

## THE AGE OF THE AGIOS KONSTANTINOS LIMESTONE AT LAVRION, SOUTHEASTERN ATTICA, GREECE

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**Abstract:** The age of the Agios Konstantinos limestone is determined on the basis of the foraminiferal fauna recorded in the beds. The assemblages examined showed that the lower part of the limestone was deposited during the Middle Cenomanian and the upper part during the Campanian continuing into the Maastrichtian. The middle part on the other hand (the ferrogeneous beds) lacks fossils.

**Key words:** Middle Cretaceous platform limestone, Southern Attica, Greece, benthic foraminifera.

### Introduction

The age of the limestone beds which are exposed NW and N of the village of Agios Konstantinos in Lavrion, SE Attica, is (according to paleontological data hitherto presented) still unknown. Since the beds are strongly recrystallized, the fossils, thus, being difficult to recognize. Only in rare cases and then mainly at the base and the top of the sequence are the limestone beds not metamorphosed and slightly recrystallized. In these beds it is sometimes possible to identify fossils.

It was the high degree of recrystallization of the Agios Konstantinos limestone that made it difficult for previous workers (Lepsius 1893, Negris 1915, Leleu and Neumann 1969) to determined the time of deposition of the beds.

Recently, Katsiavrias (1990) presented the stratigraphic development and the exact tectonic position of the Agios Konstantinos limestone, and characterized the limestones beds as the Cretaceous deposits of a new isopic zone of the eastern Hellenids.

The aim of this paper is to present a micropaleontological study in which the age of the limestone beds at Agios Konstantinos as described by Katsiavrias (1990) is determined on the basis of foraminiferal fauna found in the beds.

### Previous works

As it appears from the literature the discussion on the age and designation of the Agios Konstantinos limestone beds is confused. Lepsius (1893), who was the first to observe that the limestone beds exposed southwest and south of the village Agios Konstantinos at Lavrion, believed that they belong to

the Athenian limestone beds, a view which was later adopted by Marinou and Petraschek (1956).

However, Negris (1915) found rudist fragments and foraminifera assemblages (*Miliolidae*) within the Cretaceous limestone beds close to Nychtochori and in the Lavrion workshop.

Leleu and Neumann (1969), on the other hand noted that the Agios Konstantinos limestone beds are probably of Cenomanian age and should be placed with the Plaka shales.

Subsequently, Katsikatos (1977) accepted that the Agios Konstantinos limestone beds have been deposited during the Albian–Aptian interval discordantly above the phyllitic system, while Papademas (1987) found Upper Cretaceous limestones above the Athenian shales in the Lavrion area. Finally, Katsiavrias (1990) considered that the above Cretaceous limestone beds represent a younger part of a new isopic zone of the eastern Hellenids. They have been deposited discordantly above the ophiolites. They occur either alone or with the ophiolites and radiolarites above the Triassic limestones and shales of the autochthonous system.

### The outcrop at Agios Konstantinos

About 1.6 km SWS from the village Agios Konstantinos, Lavrion, and on the left side of the road that leads to the Leggrena (Fig. 1), appear the Agios Konstantinos limestone beds (Fig. 2). These beds discordantly overlie the ophiolites which are tectonized and in part lubricated (Fig. 3) and which together with the underlying radiolarites occur above Triassic shales of the autochthonous system.

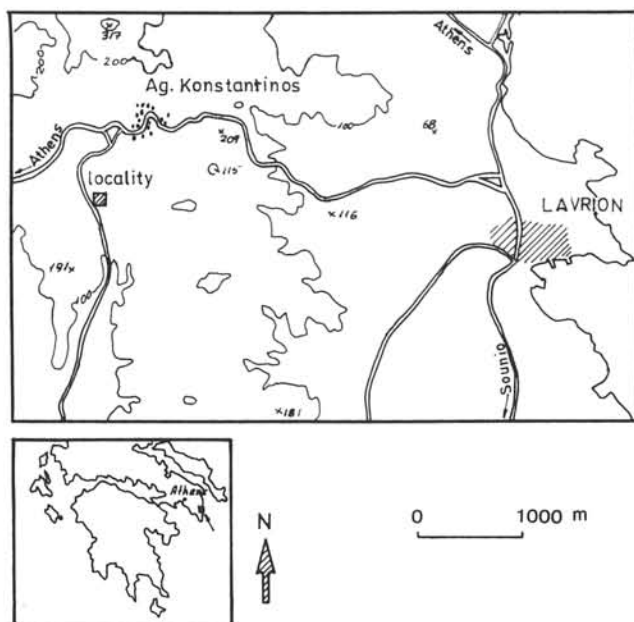


Fig. 1. Topographic map showing the location of the Agios Konstantinos outcrop.

In the basal parts of the limestone outcrop (Fig. 2), the beds are yellowish thin-bedded marly and intercalate with ash-like, thin-bedded or saccaroid and brecciated beds. They are characterized by having dense and chaotic patterns of calcite veins and fissures filled with yellowish to brownish oxides. In the middle part the limestone are yellowish-brown, recrystallized and ferrogeneous (Lepsius 1893) which Marinov and Petraschek (1956) named ankerites. This limestone passed into coloured, folded and somewhat recrystallized limestone beds (Fig. 2), with lenses of cherts and dendrites of oxides crossed by chaotic patterns of calcite and oxides.

### The foraminiferal assemblages

The foraminiferal fauna examined occurs in the basal and top parts of the outcrop (Fig. 2). The fauna which is composed of benthic and planktonic foraminiferal assemblages is poor and badly preserved because of the deformation of the rocks and of their strong recrystallization.

In the basal beds of the outcrop (samples K-13 to A-17) only benthic foraminiferal assemblages appear from which the following species were recognized: *Broeckina* (*Pastrikel-*

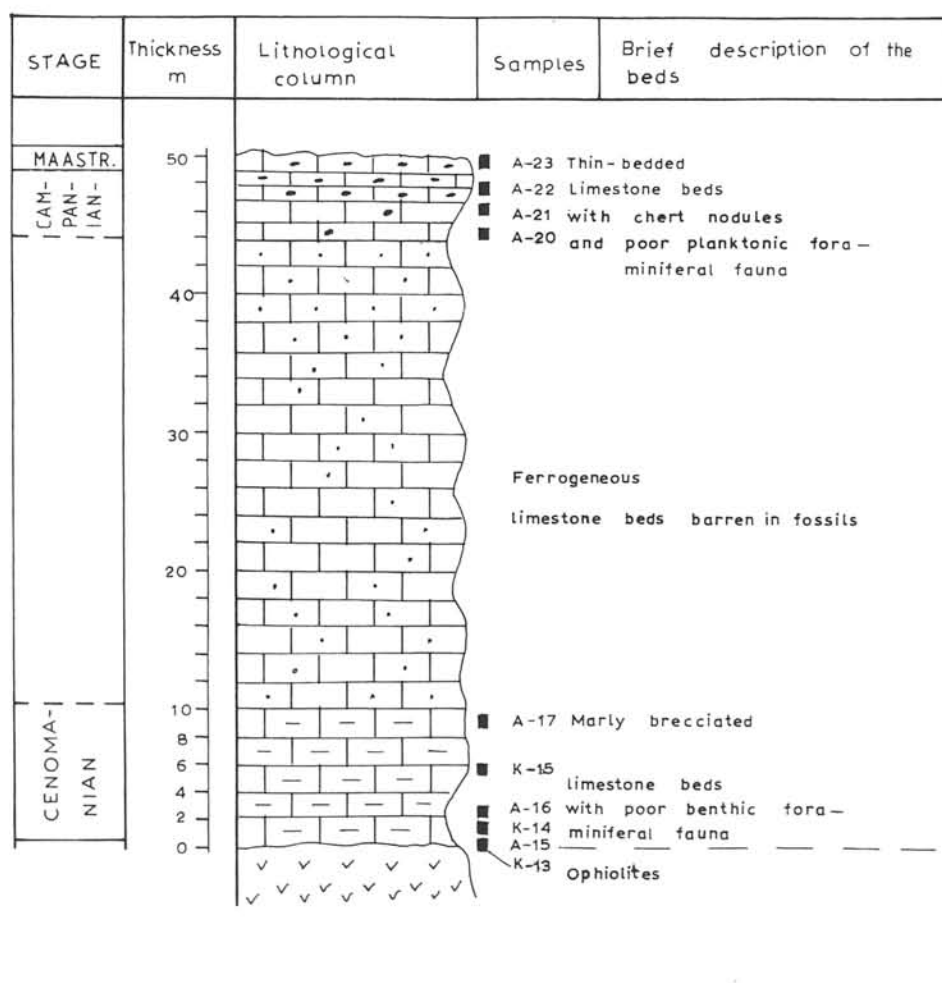


Fig. 2. Diagram showing the lithology and the age of the Agios Konstantinos limestone beds.

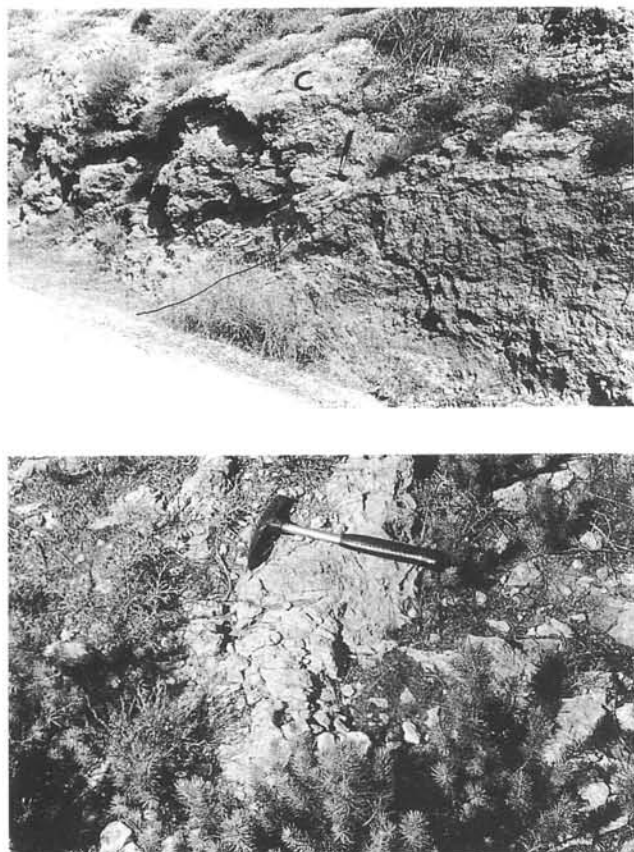


Fig. 3. The outcrop at Agios Konstantinos.

Above – The Middle Cenomanian limestone beds (C) overlying to ophiolites (O). Below – Folded, thin-bedded limestones beds of Campanian–Early Maastrichtian age.

*la*) cf. *balcanica* Cherchi, Radoicic and Schroeder 1976 (= *Dicyclina schlumbergeri* Munier-Chalmas), *Cyclammina* aff. *cretacea* d'Orbigny, *Montcharmontia appenninica* (De Castro), *Hemicyclammina sigali* Maync, *Chrysalina gradata* d'Orbigny, *Charentia cuvillieri* Neumann 1965, *Pseudonummuloculina* sp., *Orbitolina* (*Conicorbitolina*) *conica* (d'Archiac), *Pseudolituonella reicheli* Marie 1954. The above species indicate a Middle Cenomanian age.

The species described were restricted to the inner platform (from supra-intertidal to infralittoral). They occur at the most to the circalittoral zone to the outer platform and not far from the barrier zone.

In the upper part of the outcrop planktonic and benthic foraminifers as well as ostracods are present. In the lower beds of this part of the outcrop (A-20 and A-21), which is

composed of a limestone deposited in pelagic marine conditions, the planktonic foraminiferal species, *Pseudotextularia elegans* (Rzehak), *Globotruncana arca* (Cushman) and *Contusotruncana* cf. *forficata* (Plummer), *Globotruncanites elevata* (Brotzen), specimens of the group *Globotruncanites subspinosus* (Pessagno), *Radotruncana calcarata* (Cushman), *Falsomarginotruncana linneiana* (d'Orbigny) and specimens which probably belong to the *Globotruncanites elevata* – *Globotruncanites stuartiformis* group were identified. The presence of members of *Globotruncanites elevata* and *Globotruncanites subspinosus* – *Radotruncana calcarata* in the same sample although *Globotruncanites elevata* disappeared in the Campanian before *Globotruncanites subspinosus* – *Radotruncana calcarata* made its appearance in the upper part of the Campanian interval (Robaszynski et al. 1984) may indicate a condensation and reworking of the strata. Following the outcrop upwars (sample A-22) the conditions in the water changed and a neritic facies made its appearance. In this neritic limestone a few ostracods and benthic foraminifers appear. The neritic facies was later replaced by a pelagic facies as is shown by the limestone beds and the fauna which is included at the top bed of the outcrop (A-23). However, the fauna is badly preserved and heavily deformed, a fact which made the identification of the species difficult. From this fauna we could identify *Globotruncana* sp. and *Archaeoglobotruncana kefiana* (Salaj and Maamouri). This evidence indicates that the top bed of the outcrop was probably deposited during the Early Maastrichtian.

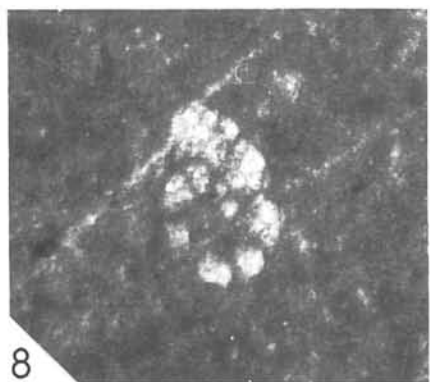
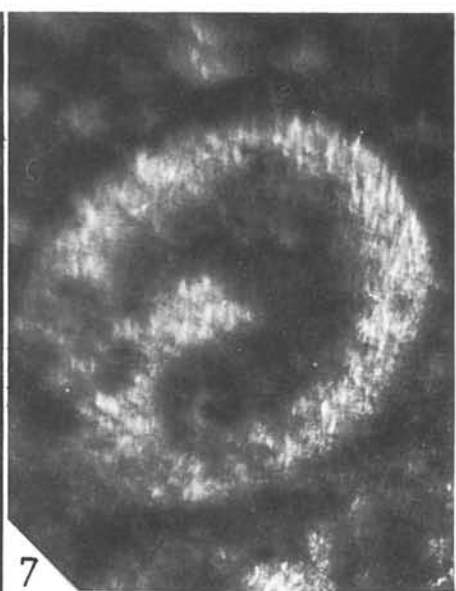
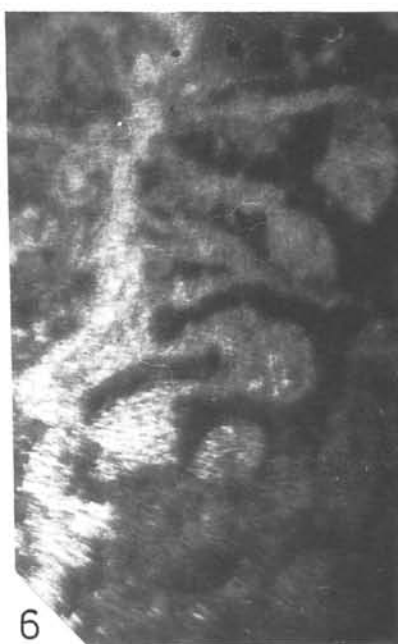
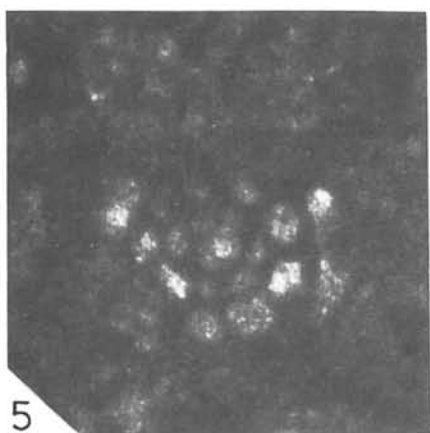
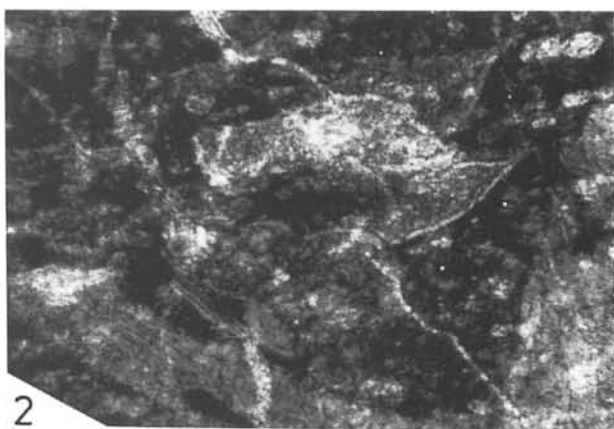
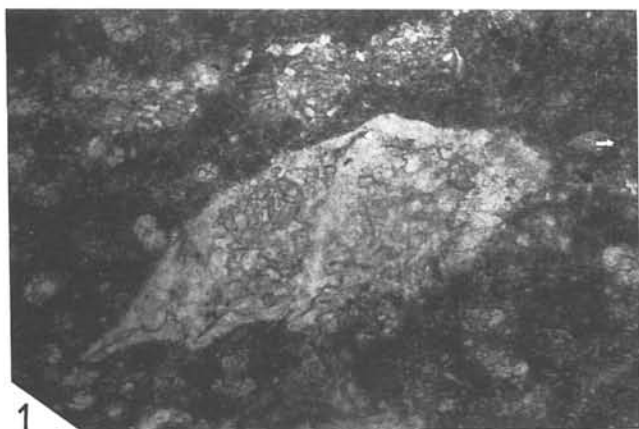
The above foraminiferal assemblages prove that this part of the Agios Konstantinos limestone was deposited during the Campanian continued into the Early Maastrichtian interval.

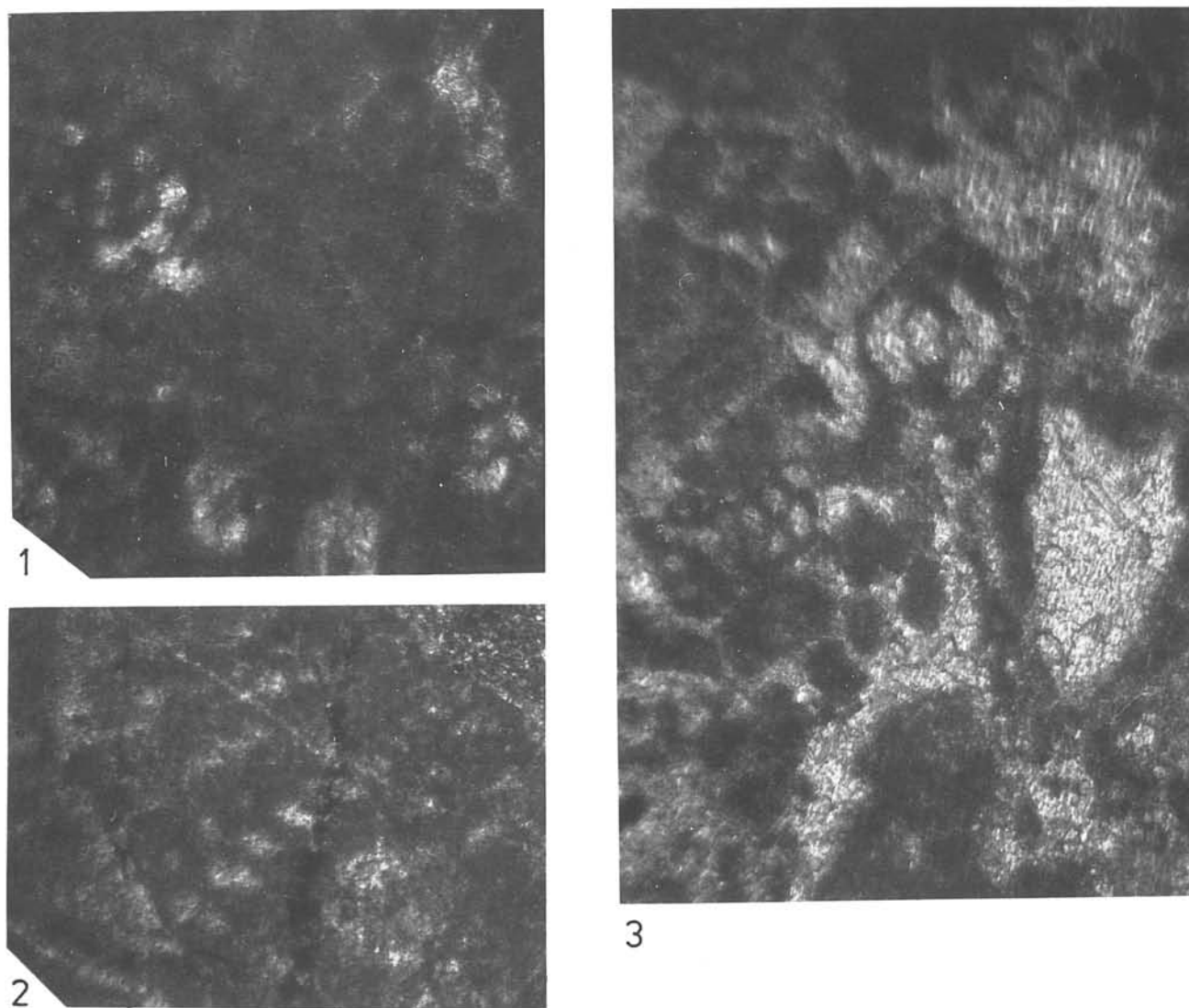
### Summary

The foraminiferal assemblage examined from the outcrop at Agios Konstantinos in Lavrion, show that the lower part of the Agios Konstantinos limestone beds were deposited during the Middle Cenomanian in a shallow sea.

The deposition of the beds of the upper part of the limestone took place during the Campanian and probably during the Early Maastrichtian interval in a pelagic facies, except for a short interval where a neritic facies appeared. The ferrogeneous limestone beds that occur between the Cenomanian and Campanian beds of the outcrop lack fossils and it is, thus, difficult to speculate about their age. They could, however, have been deposited during the interval between the Cenomanian and Campanian.

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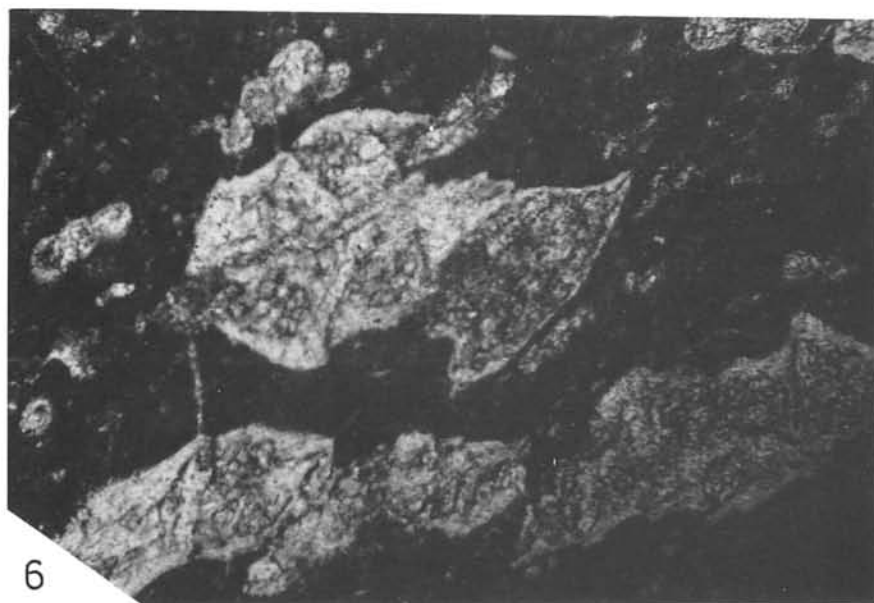
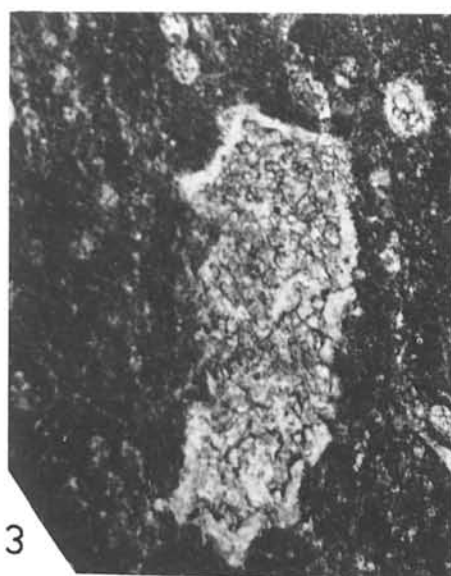
**Plate 2:** Fig. 1 – *Charentia cuvillieri* Neumann. Sample K-15,  $\times 50$ ; Fig. 2 – *Textularia* sp. Sample K-15,  $\times 50$ ; Fig. 3 – *Montcharmontia appenninica* (De Castro). Embryonal part. Sample K-15,  $\times 50$ .

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**Plate 1:** Fig. 1 – A representative of the group *Globotruncanita subspinoso* (Pessagno) – *Radotruncana calcarata* (Cushman). Note the presence of spines in the periphery of the chambers. Sample A-21,  $\times 100$ ; Fig. 2 – Specimen which probably belong to the *Globotruncanita elevata* (Brotzen). Sample A-21,  $\times 50$ ; Fig. 3 – *Globotruncana arca* (Cushman). Sample A-21,  $\times 128$ ; Fig. 4 – *Pseudonummoloculina* sp. Sample K-14,  $\times 50$ ; Fig. 5 – *Montcharmontia appenninica* (De Castro). Sample K-14,  $\times 50$ ; Figs. 6–7: *Chrysalina gradata* D'Orbigny. Sample K-15,  $\times 50$ . Fig. 8 – *Hemicyclammina sigali* Maync. Sample K-14,  $\times 50$ .

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**Plate 3:** Figs. 1–2: *Pseudotextularia elegans* (Rzehak). Sample A-21, Fig. 1  $\times 85$ , Fig. 2  $\times 150$ ; Fig. 3 – *Falsomarginotruncana linneiana* (D'Orbigny). Sample A-21,  $\times 150$ ; Fig. 4 – Specimens which probably belong to *Globotruncanita elevata* (Brotzen). Sample A-21,  $\times 100$ ; Fig. 5 – *Archaeoglobotruncana kefiana* (Salaj et Maamouri) Sample A-23,  $\times 100$ ; Fig. 6 – *Globotruncanita elevata* (Brotzen). Sample A-21,  $\times 78$ ; Fig. 7 – *Globotruncana arca* (Cushman). Sample A-21,  $\times 71$ .



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