A NOTE ON THE FIRST OCCURRENCE OF *HELICOSPHAERA CARTERI* IN THE EARLY OLIGOCENE (NP23, *SPHENOLITHUS PREDISTENTUS* ZONE)

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Abstract: Until now, *Helicosphaera carteri* (Wallich) Kamptner has been widely accepted by nannopalaeontologists as a Miocene-Recent species. My investigation in the Ionian Zone of Albania indicates an older first occurrence for this species, in the Early Oligocene. In different sections and wells within the Ionian Zone, *H. carteri* was recorded in the *Sphenolithus predistentus* Nannofossil Zone (NP23). Absent in the Late Oligocene, this species reappears in the Early Miocene, very close to the end of the *Cyclicargolithus abisectus* acme, just before the first occurrence of the planktonic foraminifera, *Globoquadrina dehiscens*.

Introduction

During analysis of a core from Well Sqepuri (Sq.1) in 1987, an unusual assemblage of calcareous nannofossils was recorded. Among the species characterising NP24 (the *Sphenolithus distentus* Zone), such as *Sphenolithus predistentus*, *Sphenolithus distentus* and *Sphenolithus ciperoensis*, a species of *Helicosphaera*, consistent with the morphology of *Helicosphaera carteri*, was recorded. In order to be sure that its occurrence was not a question of contamination, further smear slides were prepared. This species was recorded in all of them. Taking into consideration that *H. carteri* has never been reliably documented in deposits older than Miocene, it was initially regarded as *H.* cf. *H. carteri*. With the intention of clarifying the unusual occurrence of this species, a detailed study was undertaken.

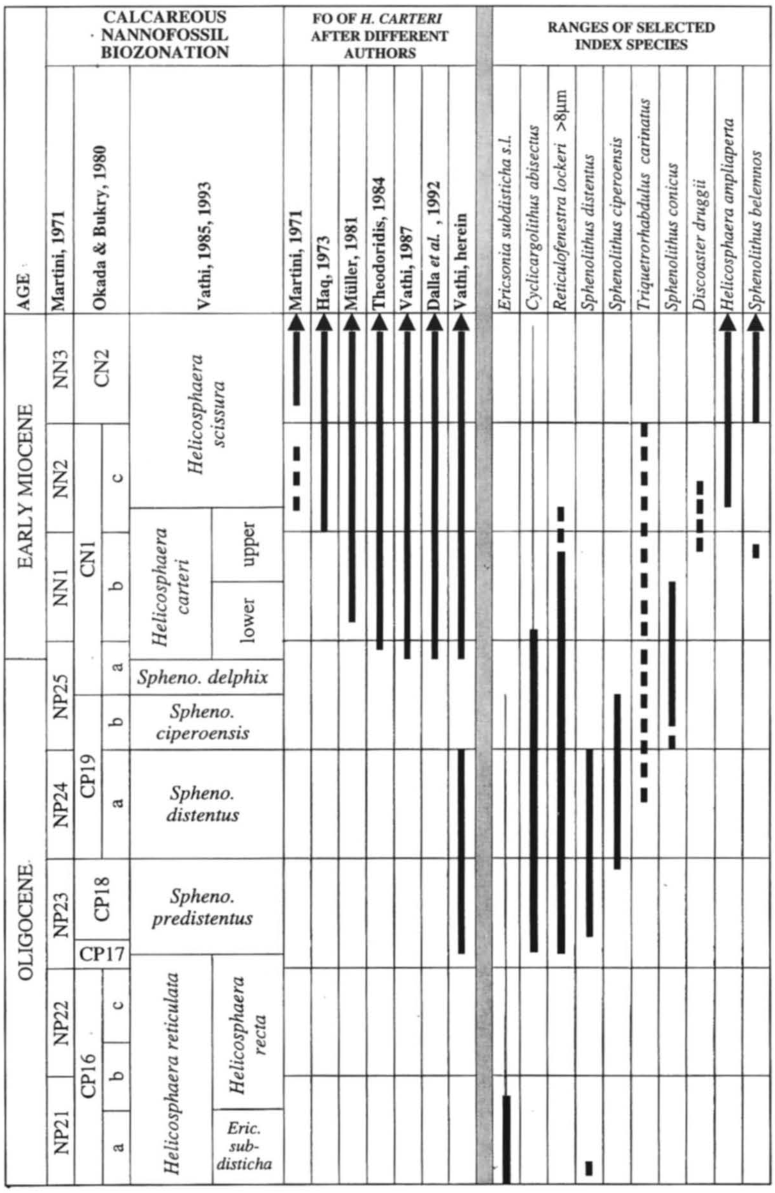

Figure 1: FO of *H. carteri* after different authors, and the ranges of selected index species in Albanian sections.

Historical background

Originally, *H. carteri* was described as *Coccosphaera carteri* by Wallich (1877) from the Present Day oceans. Since then this species has been found in many different areas (land sections as well as DSDP and ODP sites) from the Miocene to the Recent. In Figure 1, the first occurrence (FO) of *H. carteri* is shown, according to a selection of authors. Martini (1971) gives its FO as within zone NN2. Haq (1973), in his work concerned with the genus *Helicopontosphaera* (*Helicosphaera*) puts it at the base of zone NN2. Later, Müller (1981) gave it an earlier FO, towards the base of zone NN1. Theodoridis (1984) distinguished three varieties of *H. carteri* (*H. carteri* var. *carteri*, *H. carteri* var. *burkei* and *H. carteri* var. *wallichii*), and noted that all of them ranged from his *Eodiscoaster deflandrei* Subzone (= CN1b of Okada & Bukry, 1980) to the Recent.

Vathi (1987), working on Late Oligocene-Early Miocene deposits of the Ionian Zone in Albania, used the FO of *H. carteri* as a marker for defining the Oligocene/Miocene boundary, and consequently the Paleogene/Neogene boundary. It was noted that this event preceded the FO of the planktonic foraminifera, *Globoquadrina dehiscens*. Studying Italian sections, Dalla *et al.* (1992) arrived at the same conclusion, placing the FO of *H. carteri* between the last occurrence (LO) of *S. ciperoensis* and the LO of *Helicosphaera recta*. Its FO was also recorded here as being before the FO of *G. dehiscens*.

Material studied

The closest land section to Well Sq.1 is Osmanzeza-1 (see Figure 2). This includes deposits through the interval including the *S. predistentus* to *S. ciperoensis* Zones (NP23-24). The study of this section (Vathi & Budri, 1990) showed the presence of *H.* cf. *H. carteri* in the *S. predistentus* and *S. distentus* Zones but not in the *S. ciperoensis* Zone (NP25, Late Oligocene).

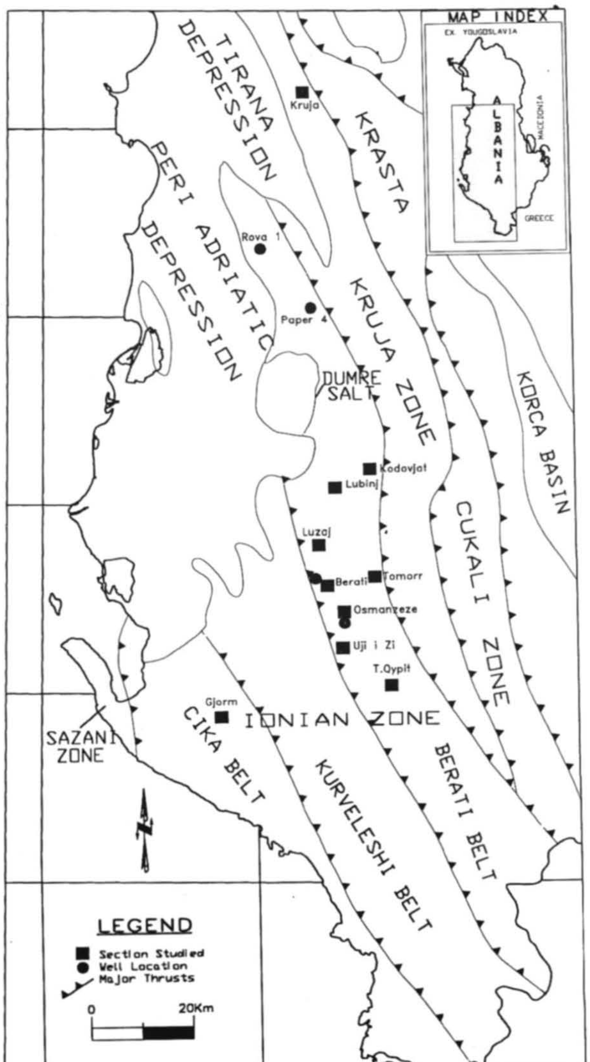

Figure 2: Location of studied sections and wells.

Berat and Luzaj (Figure 2), two more-complete sections (including NP21-NP25) not far from Well Sq.1, were studied (Myftari *et al.*, 1989). In both sections, *H. carteri* is also present in the *S. predistentus* and *S. distentus* Zones.

More recently, the species has been recorded in other sections (see Figure 2 for locations) such as Kruja and Kodovjat (*S. predistentus* Zone), Tomorr (*S. predistentus* and *S. distentus* Zones), Lubinjë and Tënda e Qypit (*S. distentus* Zone), and also in cores from Wells Paper-4, Bistrovic-2 and Rova-1. It should be noted that none of these sections include deposits younger than Late Oligocene.

Recently, the Gjorm section has been studied (unpublished data), including deposits of Early Oligocene-Early Burdigalian age. Once again, *H. carteri* was recorded from the *S. predistentus* and *S. distentus* Zones, and in the Early Miocene.

Discussion

When new data such as this is introduced, there is inevitably some doubt associated with it. However, two points can be clarified here:

Reworking/caving: To discount this explanation, a detailed analysis of (a) the assemblages of the different fossil groups, and (b) the dynamic evolution of the region and its structure, was demanded.

(a) In order to obtain the maximum possible biostratigraphic data, calcareous nannofossil, planktonic, smaller benthic and larger foraminifera, as well as palynological studies were undertaken. The same sample material was used for each study to ensure direct correlation between the respective biozonations. Figure 3 shows the local biozonations recognised in Albania and the stratigraphic positions of the studied sections. These sections cover the Early Oligocene-Burdigalian interval.

Generally, the nannofossil assemblages are rich and well-preserved. In all of the sections, the well-known FO and LO bioevents were recorded (see Figure 1). A few reworked Cretaceous-Eocene taxa are present throughout the Oligocene. However, no Miocene species were observed, except for *H. carteri* in the *S. predistentus* and *S. distentus* Zones. Planktonic and larger foraminifera and palynomorph assemblages prove a successive sedimentation from the Late Eocene until the Late Oligocene and, towards the west, Early-Middle Miocene (Jançe, 1980; Sadushi, 1987; Prillo, 1987).

The time interval of interest here (*S. predistentus* to *S. distentus* Zones) approximately corresponds to the total range of *Globorotalia opima opima*. The studied deposits contain especially rich assemblages of planktonic foraminifera, spores, pollen and dinocysts. Neither herein, nor in previous studies, have any Miocene species been recorded from this interval. The Gjorm section, which shows successive sedimentation from the Late Eocene to the Early Miocene as proved by all palaeontological methods, represents an incontestable case indicating that the deposits of the *S. predistentus*-*S. distentus* Zones are *in situ*. The co-existence of *S. predistentus*, *S. distentus* and *S. ciperoensis* with *H. carteri* in this case would be attributable to contamination. However, excluding *H. carteri*, no other Neogene species have been observed.

(b) Regarding the dynamic evolution and structure of the region, at least for the eastern part of the Ionian Zone, reworking of *S. predistentus*, *S. distentus* and *S. ciperoensis* in the Miocene can be excluded. It is well-documented that, in the Late Eocene, the Krasta-Cukali Zone (= Pindos Zone) was a basin receiving terrigenous sediment (flysch), the Kruja Zone (= Gavrovo Zone) was a carbonate platform, and the Ionian Zone was a basin where pelagic carbonates were accumulating (Aubouin & Ndojaj, 1964; Gjata & Skela, 1972). At the end of the Late Eocene, the Krasta-Cukali Zone emerged and overthrust the Kruja Platform. Under these conditions, the sedimentation in the Ionian Zone underwent a great change, the instigation of

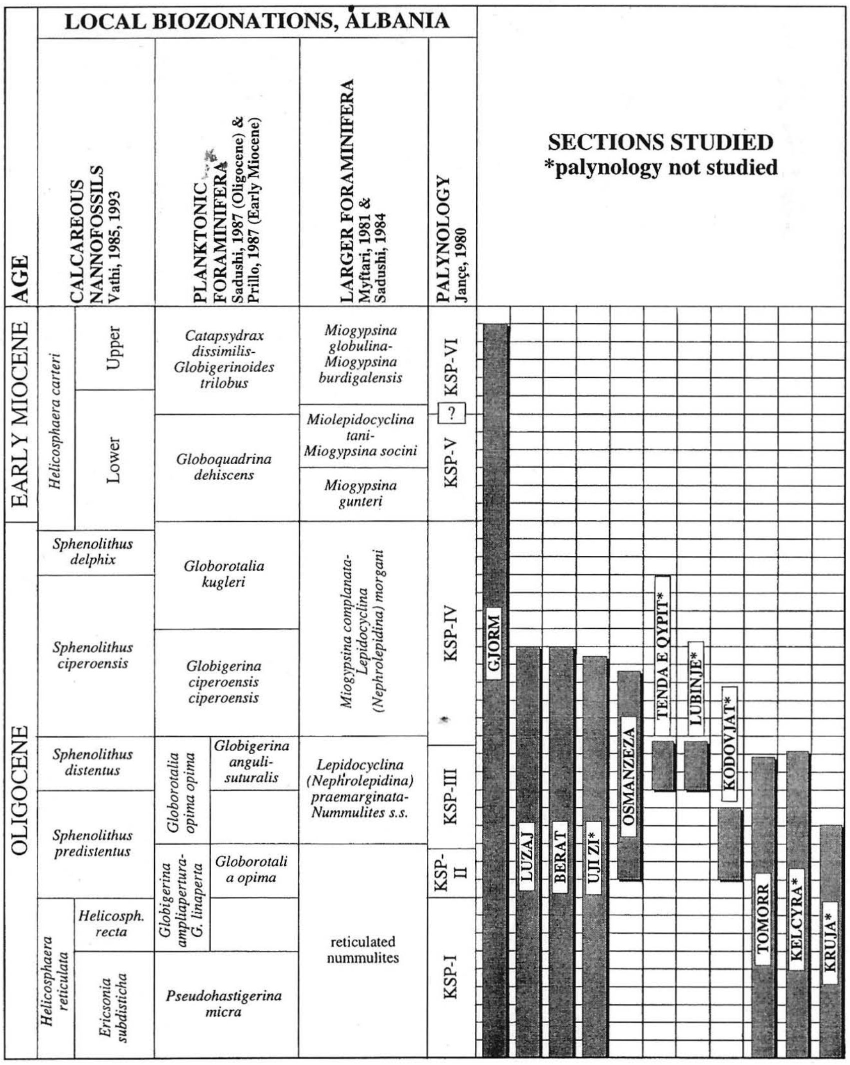

Figure 3: Stratigraphic position of the studied sections.

The FO of *H. carteri* is accompanied by the FO of *C. abisectus* and *Reticulofenestra lockeri* >8µm.

The Oligocene specimens of *H. carteri* are generally well-developed, showing a central area with two openings (*H. carteri* var. *carteri*), or a simple suture (*H. carteri* var. *burkei*). The first *H. carteri* specimens at the base of the Early Miocene are generally smaller.

terrigenous sedimentation corresponding with the Eocene/Oligocene boundary (Vathi, 1985; Sadushi, 1987). During the Early Oligocene (NP21-NP24), the eastern part of the Ionian Zone (Kelcyra and Tomorr sections) subsided the most, preserving ~3km of flysch deposits. By the end of the Early Oligocene (*S. distentus* Zone), this part of the Ionian Zone emerged and the subsidence migrated towards the west (Vathi, 1985, 1989).

Contamination: Careful sampling and sample preparation in the laboratory were carried out. Furthermore, not one but several samples throughout the *S. predistentus* and *S. distentus* Zones, in different sections in the Ionian Zone, contained *H. carteri*.

Results

The acquired data from the study of the above-mentioned samples (land sections and wells) from the Ionian Zone in Albania leads to the conclusions summarised in Figure 1. For the first time, the FO of *H. carteri* has been observed in the Early Oligocene *S. predistentus* Zone (NP23). This species occurs in the *S. predistentus* and *S. distentus* Zones. *H. carteri* has not been observed in the Late Oligocene but reappears in the Early Miocene, after the LO of *S. ciperoensis*, and close to the end of the *C. abisectus* acme.

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References

Aubouin, J. & Ndojaj, I. 1964. Regard sur la géologie de l'Albanie et sa place dans la géologie des Dinarides. *Bull. Soc. Géol. France*, **4**(7): 593-625.

Dalla, S., Rossi, M., Orlanda, M., Visentin, C., Gelati, R., Gnoccolini, M., Papani, G., Belli, A., Biffi, U. & Catrullo, D. 1992. Late Eocene-Tortonian tectono-sedimentary evolution in the western part of the Padan basin (northern Italy). *Paleontologia i Evolucio*, **24/25**: 341- 362.

Gjata, T. & Skela, V. 1972. Structural situation of the Krasta-Cukali, Kruja, Ionian and Sazani Zones. *Përmbledhje Studimesh*, **1**: 127-138. (In Albanian, résumé in French)

Haq, B.U. 1973. Evolutionary trends in the Cenozoic coccolithophore genus *Helicopontosphaera*. *Micropaleontology*, **19**(1): 32-52.

Jançe, L. 1980. Palynological characteristics of the terrigenous deposits of the Oligocene and Aquitainian (Ionian Zone) based on spore and pollen analyses. Internal report, Oil & Gas Institute, Fier, Albania. (In Albanian)

Martini, E. 1971. Standard Tertiary and Quaternary calcareous nannoplankton zonation. *In*: A. Farinacci (Ed.). *Proc. II Conf., Roma, 1970*, **2**: 739-785.

Müller, C. 1981. Calcareous nannoplankton and silicoflagellates. *In*: F. Cati (Ed.). *In search of the Paleogene-Neogene boundary. Giornale di Geologia*, **44**: 33-38.

Myftari, S. 1981. Larger foraminifera of Chattian-Burdigalian deposits in the southern part of the Ionian Zone. *Buletini Nafta dhe Gazi*, **1**: 63-95. (In Albanian, summary in English)

Myftari, S., Shehu, D., Jançe, L., Roqi, R., Vathi, K. & Budri, E. 1989. Micropaleontological complex study of Oligocene deposits of the Berat-Paper region. *Buletini Nafti dhe Gazi*, **2**: 115-140. (In Albanian, summary in English)

Okada, H. & Bukry, D. 1980. Supplementary modification and introduction of code numbers to the low-latitude coccolith biostratigraphic zonation (Bukry, 1973, 1975). *Marine Micropaleontology*, 5(3): 321-325.

Prillo, S. 1987. *Foraminifera: biostratigraphy and paleoecology of Aquitanian-"Helvetian" deposits in the Ionian Zone*. PhD thesis, Oil & Gas Institute, Fier, Albania. (In Albanian)

Sadushi, P. 1984. Biostratigraphy of Oligocene terrigenous deposits in the Ionian Zone. *Buletini Nafta dhe Gazi*, **1**: 65-84. (In Albanian, summary in English)

Sadushi, P. 1987. New data on the microfacies of terrigenous deposits and their role in stratigraphy. *Nafta dhe Gazi*, **2**: 37-42. (In Albanian)

Theodoridis, S. 1984. Calcareous nannofossil biozonation of the Miocene and revision of the helicoliths and discoasters. *Utrecht Micropaleontological Bulletins*, **32**: 271pp..

Vathi, K. 1985. Les nannofossiles calcaires de la zone ionienne d'Albanie. *Mém. Sci. Terre Univ. Curie, Paris*, **1985**: 178pp..

Vathi, K. 1987. The Paleogene-Neogene boundary in south-western Albania (Ionian Zone) based on calcareous nannofossil data. *Buletini Nafta dhe Gazi*, **2**: 87-95. (In Albanian, summary in English)

Vathi, K. 1989. Calcareous nannofossil zonation of the Ionian Zone flysch. *Buletini Nafta dhe Gazi*, **1**: 57-70. (In Albanian, summary in English)

Vathi, K. 1993. Calcareous nannofossil biostratigraphy of Late Oligocene-Early Miocene deposits in the Ionian Zone. *Nafta Shqiptare*, **4**: 51-71. (In Albanian, summary in English)

Vathi, K. & Budri, E. 1990. Calcareous nannofossil biostratigraphy of the Osmanzeza section. *Nafta dhe Gazi*, **4**: 31-36. (In Albanian)

Wallich, G.C. 1877. Observations on the coccosphere. *Ann. Mag. Nat. Hist., series 4*, **19**: 342-350.

PLATE 1

Illustrations of *Helicosphaera carteri* (Wallich) Kamptner
Photomicrographs 1-11 x2000; 12-19 x1650
TL = transmitted light, XPL = crossed polars, PC = phase contrast

Figs 1-3, 5-11: Berat section, *S. predistentus* Zone. **1-3** same specimen: **1** - TL, **2** - XPL, **3** - PC. **5-7** same specimen: **5** - TL, **6 & 7** - PC (different focusing depths). **8-9** same specimen: PC (different focusing depths). **10-11** same specimen: XPL (different angles).

Figs 4, 14: Luzaj section, *S. predistentus* Zone. Both: XPL.

Fig.12: Tínda e Qypit section, *S. distentus* Zone. XPL.

Fig.13: Kodovjat section, *S. distentus* Zone. XPL.

Figs 15-16: Luzaj section, *S. distentus* Zone. Same specimen: **15** - TL, **16** - PC.

Figs 17-18: Berat section, *S. distentus* Zone. Same specimen: XPL (different angles).

Fig.19: *H. carteri* (left), *Zygrhablithus bijugatus* (Deflandre) Deflandre (middle), *Helicosphaera bramlettei* (Müller) Jafar & Martini (right).

PLATE 1