

CHILOGUEMBELINA CUBENSIS (PALMER) AND *C. OTOTARA* (FINLAY), IN NEW ZEALAND

N. DE B. HORNIBROOK

New Zealand Geological Survey, P.O. Box 30368, Lower Hutt, New Zealand

ABSTRACT

Chiloguembelina cubensis (lower Oligocene to lower Miocene) and *C. ototara* (upper Eocene to lower Oligocene) are different species with different rates of expansion during growth and different surface ornament. The extinction of *C. cubensis* may not be a reliable bioevent to mark the base of the Chattian Stage in the New Zealand region.

TAXONOMY

Palmer (1934) described the tiny biserial form, *Guembelina cubensis*, now referred to the genus *Chiloguembelina*, from the lower Oligocene of Cuba and this species has since been recorded widely in upper Eocene and Oligocene strata.

Most of the illustrations of *C. cubensis* published since the introduction of the scanning electron microscope (SEM) show an elongate, slowly expanding form with minute surface tubercules aligned in vertical rows and tending to fuse together as costae. Other illustrations, however, show surfaces with minute, randomly distributed tubercules. Poore and Gosnell (1985) have already drawn attention to these features. The resolving power of the average low power stereoscopic microscope is barely sufficient to distinguish these two different types of surface, although they are well shown by SEM stereoscan pictures.

Finlay (1940, p. 453, pl. 63, figs. 50–52) described *Guembelina ototara* from the Oamaru Diatomite of latest Eocene age (Runangan Stage) in the South Island of New Zealand, without reference to *C. cubensis*. His photographic illustrations are of a rapidly expanding triangular shaped species with eleven chambers in the test, but are inadequate to show surface detail.

In 1964, D.G. Jenkins, then working at New Zealand Geological Survey, sent topotypes of *G. ototara* to the late R. Cifelli at the Smithsonian Institution, Washington D.C., for comparison with the types of *C. cubensis*. In those pre-SEM days, Cifelli considered the two taxa to be identical and Jenkins (1971, p. 66–67, pl. 1, figs. 3–5) figured three topotypes of *C. ototara* as junior synonyms of *C. cubensis*.

In 1985, I examined Cushman Collection topotypes of *C. cubensis* from Palmer's Station 1163, a water well

0.5 km SW of Huseo Poey, Cuba, through the courtesy of M. Buzas. The specimens were compared with primary types and topotypes of *C. ototara* and one or two were stereoscanned before being returned to the Cushman Collection. The two populations clearly belong in different species. Whereas *C. cubensis* has a distinctly costate or semi-costate surface, with pores aligned between the costae (Pl. 1, Figs. 1–11), *Chiloguembelina ototara* has minute tubercules and fine pores, randomly distributed (Pl. 1, Figs. 12–16).

Furthermore, the two species differ in their rates of expansion with growth (Fig. 1). The topotype population of *C. ototara* consists mostly of rapidly expanding individuals that are triangular in outline with 11 to 12 chambers and occasionally up to 15 chambers in the test. By contrast, the topotype population of *C. cubensis* is comprised predominantly of elongate individuals with a relatively slow rate of expansion. Most individuals consist of 14 to 16 chambers and occasional specimens have up to 22 chambers. Additionally, these two species have different ranges in New Zealand.

STRATIGRAPHIC RANGES

Chiloguembelina ototara ranges from upper middle Eocene to lower Oligocene (uppermost Bortonian, Kaiatan, Runangan and lower Whaingaroan stages). The species figured as *Chiloguembelina cubensis* by Jenkins and Srinivasan (1986, pl. 1, fig. 2) from the *Globigerina linaperta* Zone in DSDP mid Tasman Site 592 (upper Eocene), is non-costate and appears to be identical with *C. ototara*.

Chiloguembelina cubensis is found in the lower and upper Oligocene (lower Whaingaroan to Duntroonian stages). Although both species occur in the *Globigerina angiporoides* Zone I have not found them occurring together and their ranges appear not to overlap (Fig. 2). The extinction level of *C. cubensis* seems to be widely accepted as coinciding with the base of the Chattian at about 30 Ma (Berggren and others, 1985; Berggren and Miller, 1988).

In the Oligocene–lower Miocene sequence in the Waitaki Valley, Oamaru district, South Island (Table 1), the ranges of heterohellicids have been closely

PLATE 1

1–11 *Chiloguembelina cubensis*. 1–3, 9 Topotypes from Palmer's Station 1163, lower Oligocene, Cuba. 1 $\times 300$. 2 $\times 225$. 3 $\times 300$. 9 $\times 1000$. 4 From Chatham Rise, lower Oligocene, *Globigerina angiporoides* Zone sample SE43179/f2, NZOE Station H926 $\times 20$. 5, 10 From lower Kokoamu Greensand, upper Oligocene, Otekaike River, Waitaki Valley, sample 140/f9711. 5 $\times 270$. 10 $\times 1350$. 6 From Taoroa Limestone, lower Miocene, Chatham Island, sample CH/f495 $\times 500$. 7, 11 From lower Kokoamu Greensand, upper Oligocene, The Earthquakes, Waitaki Valley, sample I41/f7703. 7 $\times 240$. 11 $\times 2175$. 8 From Earthquakes Marl, lower Oligocene, *Globigerina angiporoides* Zone, Otekaike River,



sample I40/f9399 $\times 260$. 12–16 *Chiloguembelina ototara*, topotypes from the Oamaru Diatomite, 'Jacksons Paddock,' upper Eocene, Oamaru, sample J41/f8817. 12 $\times 260$. 13 $\times 300$. 14 $\times 225$. 15 $\times 240$. 16 $\times 190$.

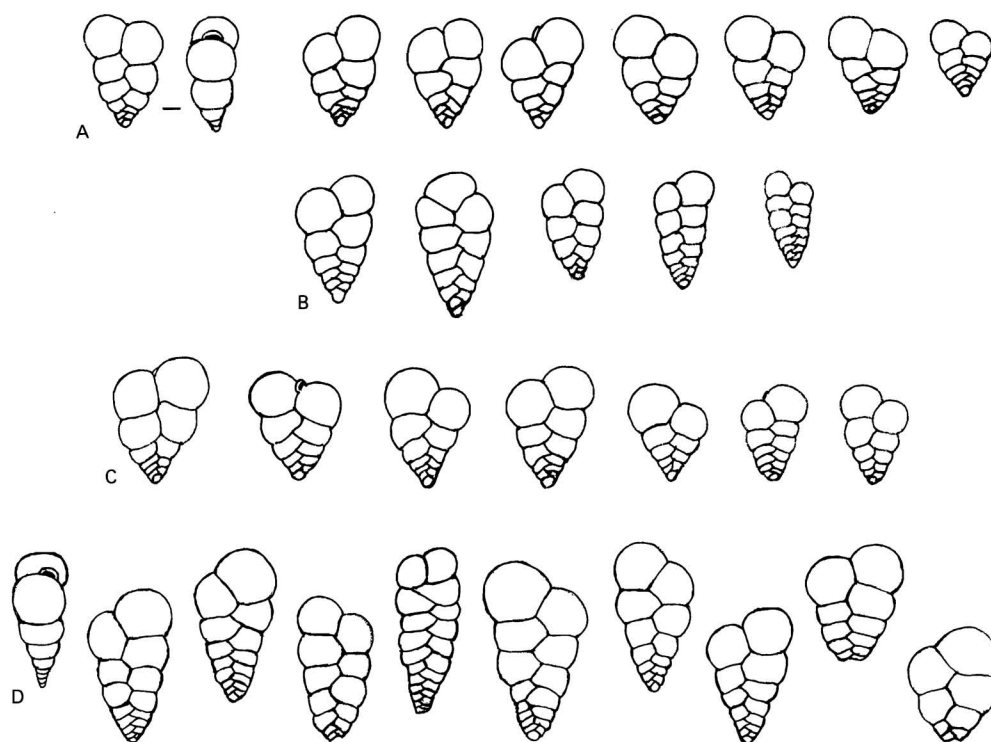


FIGURE 1. Camera lucida outline drawings of topotypes of *Chiloguembelina ototara* and *C. cubensis* $\times 75$. A–C *C. ototara*: A, B from Oamaru Diatomite, upper Eocene, 'Jacksons Paddock,' Oamaru, NZ, sample F5182, J41/8817, original collection. The first two figures of A are two views of the holotype; C from recollection. D *C. cubensis* from lower Oligocene, Cuba, Palmer's Station 1163.

checked (Hornibrook, 1985). The highest occurring *Chiloguembelina cubensis* (costate) accompanied by *Guembelitra triseriata samwelli* and *Streptochilus pristinus* is in the upper Kokoamu Greensand (lower Duntroonian) and rare specimens of a smooth *Chiloguembelina*-like species occur with *Streptochilus* higher in the Otekaike Limestone. *Globorotalia* cf. *opima*, present in the Kokoamu, continues up into the basal part of the limestone. This association is consistent with an early Chattian age for the Kokoamu according to the ranges of *C. cubensis* and *G. opima* given by Berggren and others, 1985, and Berggren and Miller, 1988.

However, the Oligocene was a time of maximum marine transgression over New Zealand when carbonate facies covered broad shallow shelf areas. The tiny heterohelicids are difficult to find in this lithology and the few records of the highest occurrences of *Guembelitra* and *Streptochilus* in the *Globoquadrina dehiscens* Zone are possibly incomplete records of their total ranges in the area. *Guembelitra* fluctuates in abundance in the Oligocene of South Australia and is an indicator of cool conditions according to McGowran and Beccroft (1985).

Furthermore, an excellent microfauna from a small patch of a lens of Taoroa Limestone on Chatham Island 800 km east of New Zealand, contains typically costate *Chiloguembelina cubensis* (pl. 1, fig. 6) together with *Globoquadrina dehiscens*, *Globigerina euapertura* and *G. woodi*, which would place it in the *Globigerina woodi woodi* Zone of Jenkins (1966) within the Waitakian Stage (lower Miocene). Also present is *Rectuvigerina rerensis*, not found below the Waitakian in New Zealand. Whereas reworking of foraminifera from the Eocene into younger beds is not uncommon in the Chathams, there is only one isolated small patch of Oligocene deposits containing *C. cubensis* remaining on the islands and it is unlikely that the delicate and well preserved specimens common in the Taoroa Limestone have been reworked from older deposits.

CONCLUSIONS

Chiloguembelina ototara (Finlay) and *C. cubensis* (Palmer) are separate and valid species and have different stratigraphic ranges in New Zealand. The last recorded mainland New Zealand occurrence of *C. cu-*

TABLE 1. Oligocene–lower Miocene sequence in the Waitaki Valley.

Formation	Zone (Jenkins, 1966)	NZ Stage
Otekaike Limestone	<i>G. euapertura</i> , <i>Glbq. dehiscens</i> , <i>Glbq. woodi</i>	Waitakian to upper Duntroonian
Kokoamu Greensand	<i>Globigerina euapertura</i>	Lower Duntroonian to upper Whaingaroan
Unconformity	part <i>G. angiporoides</i> , part <i>G. euapertura</i> ? missing	
Earthquakes Marl	<i>Globigerina angiporoides</i>	Lower Whaingaroan

AGE	NEW ZEALAND STAGES	ZONE	OCCURRENCE NEW ZEALAND	CHAT-HAMS
E. MIO.	WAITAKIAN	<i>Globigerina woodi</i>		
		<i>Globoquadrina dehiscens</i>		
OLIGOCENE	DUNTROONIAN	<i>Globigerina</i>		
		<i>euapertura</i>		
	UPPER WHAINGAROAN			
	LOWER WHAINGAROAN	<i>Globigerina angiporoides</i>		
EOCENE		<i>Globigerina brevis</i>		
	RUNANGAN	<i>Globigerina linaperta</i>		
	KAIATAN	<i>Globorotalia</i>		
	BORTONIAN	<i>inconspicua</i>		

FIGURE 2. Observed ranges of *Chiloguembelina ototara* and *C. cubensis* in New Zealand and Chatham Island.

bensis s.s. in the upper Oligocene, is below the first appearance of *Globoquadrina dehiscens* at the base of the Waitakian Stage. However *C. cubensis* occurs with *G. dehiscens* in the basal Miocene in the Chatham Islands, which does not support the wide acceptance of the last appearance datum of *C. cubensis* (costate) as a universally valid datum level to mark the base of the Chattian Stage at 30 Ma.

Internal toothplates described by Poore and Gosnell (1985) in early stages of *C. cubensis*, reclassified by them as *Streptochilus*, were not observed in the topotypes, possibly due to their poor preservation.

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