

**FORAMINIFERA FROM THE UPPER CRETACEOUS OF SOUTH-LIMBURG, NETHERLANDS
LXXXV**

Siderolites calcitrapoides Lamarck

and

Siderolites laevigata Reuss

in the Tuff Chalk of Maastricht, especially in the type-section, Section I.

by J. HOFKER

Siderolites calcitrapoides has been analysed by the present author on several occasions (1926, *Natuurhist. Maandblad*, vol. 15, pp. 14-17; 1959, *Inst. Roy. Sci. Nat. Belgique*, Mém 112, pp. 26-40). In the last mentioned paper the author showed that the proloculus diameter differs greatly in the different generations. These generations may be distinguished externally by the number of spines. In the museum-samples then at hand, the author proved that the average diameter of the proloculus decreases with the increase of the number of spines; in the microspheric generations this number always is very large. In the Lower Md *S. calcitrapoides* occurs together with specimens of *S. laevigata*, whereas in the Upper Md *S. calcitrapoides* becomes rare and the species *S. laevigata* more and more abundant.

A. J. Cosijn (*Leidsche geol. Mededeel.*, vol. 8, 1942, p. 140-171) analysed the diameters of proloculi and deutoconchs of *S. calcitrapoides* from two levels in the quarry Burgerwacht, both obviously from Lower Md, and stated that the average of proloculi and deutoconchs diameters increases with time. Since only two levels were analysed, it seems adequate to restudy the problem. Since we now know that such a study can be done best with one single generation, I chose the A₂-generation, with four spines.

Siderolites calcitrapoides occurs in the beds of Mb to Upper Md, and most frequently in Mc and Lower Md. In the section I, quarry ENCI, below the Lichtenberg, the species is found in most samples from 13.25 m upward, always in small specimens up to 21.75 m, where the base of the Md is found. In the Mb specimens mostly have the diameter less than 1 mm; in the Mc they fluctuate around 1 mm, but in the Lower Md the specimens rapidly increase in size till at 24.25 m they reach the diameter

of 5 mm. From 24.75 m to 25.75 m there is a gradual decrease in size with at 27 m the smallest specimens with a diameter of below 1 mm, whereas a sudden increase starts again till at 28.25 m once again the diameter of 5 mm is reached. At 30 m a decrease of diameter, beginning at 28.25 m, finds its end with once again a diameter of 1 mm, and from 30.25 till 33 m the average diameter is about 3 mm; here the section ends. When we do not account for the sudden leaps at 24.25 m and 28.25 m, which may be due to other circumstances than environment (accidental amounts of large specimens due to selection by streams in the water), there is an average increase of the total diameter of all specimens found from 0.4 mm in the Mb to 3.5 mm in the Upper Md. In these measurements only the specimens with four spines were considered; it is remarkable that the increase of diameter coincides with the total number of species of Foraminifera found in the levels, whereas a distinct decrease of size of *S. calcitrapoides* unvariably coincides with a decrease of the number of species found.

Large possible quantities of individuals with four spines were sectioned horizontally to study the inner diameter of the proloculus; the sections were so thick that the real inner diameter could be found in a clarifier.

The analysis of these measurements in average are:

<i>Siderolites calcitrapoides</i>		
ENCI, Lichtenberg, Section I	lithologic beds	diameter of proloculus
29 m	upper Md	50 μ
27 m	base upper Md	50 μ
27 m	lower Md	55 μ
23.75 m	lower Md	70 μ
23 m	lower Md	64 μ
21.50 m	boundary Md/Mc	58 μ
18.75 m	boundary Mc/Md	50 μ
13.75 m	Mc	48 μ
6 m	Mb	26 μ
<i>Siderolites laevigata</i>		
33.50 m	upper Md	64 μ
31.25 m	upper Md	66 μ
28 m	base upper Md	73 μ
quarry		
Curfs	lower Md	70 μ

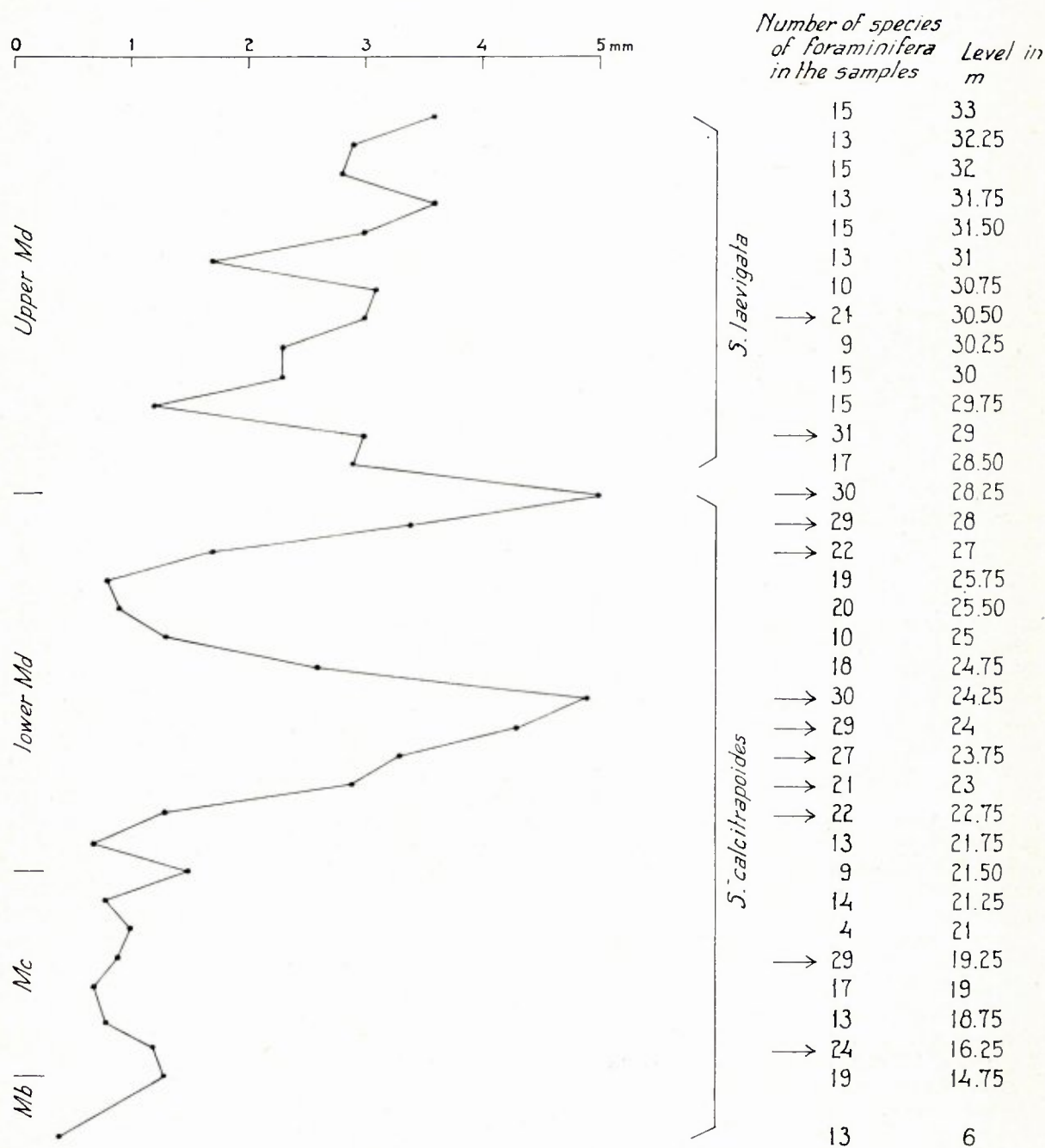


Fig. 1. Diameters of the average of the largest specimens in fauna of *Siderolites calcitrapoides* with four spines, in the ENCI quarry, Lichtenberg, Section I, in mm, compared with the number of other species also found in these levels.

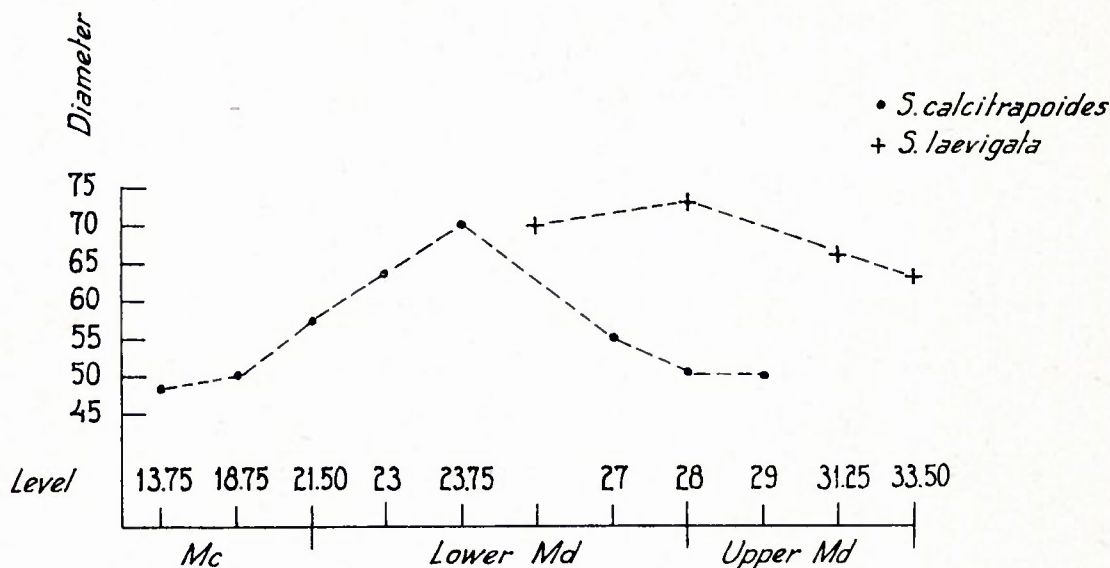


Fig. 2. Diameters of proloculi of *Siderolites* specimens with four spines (A2-generation, averages in μ).

These measurements show that during Mb and Mc, in which the specimens are small, the proloculi increase with time from 26 to 58 μ ; in the lower Md, with large tests, this increase continues up to about 63 μ , in *S. calcitrapoides*; then, suddenly, at the boundary Lower/upper Md, just before *S. laevigata* is found for the first time, the average diameter decreases to 55 μ .

In *S. laevigata* this species starts with 70 μ diameter, attains a diameter of 76 μ ; then, in the upper Md the species once again shows a decrease of the size of the proloculi from 66 to even 64 μ .

These statements may involve that there is a general increase of the diameter of megalospheric proloculi, but that at the end of an evolution, there is the tendency to decrease this size rather abruptly. Moreover, when each species does so (and this continuous increase of diameter of the megalospheric proloculi already has been stated in several other species of Foraminifera), it will be obvious that, whereas *S. calcitrapoides* shows a whole evolution in the Maastricht Tuff Chalk, *S. laevigata* only shows the very end of its evolution. The latter species seems not have been developed from

S. calcitrapoides, at least not in the Maastricht Tuff Chalk, but has been migrated into these regions from elsewhere in that period in which the circumstances became favorable for this species.

The increase of size of the megalospheric proloculus is, as mentioned, a common fact among Foraminifera; the sudden decrease of it at the end of the evolution of a species also was stated by Cosijn (1938, p. 55) when he says: „The foraminiferal proloculum goes through a development that is characterized by a gradual increase of the average volume, on which follows, after a maximum has been reached, a period wherein the reversed evolutionary picture is passed through, during which the average volume is gradually reduced”.

Hofker jr made it clear, at least in *Orbitolina* (Leidsche geol. Meded., vol. 29, 1963, pp. 181-254) that this decrease as end stage of the evolution may be caused by a change in the reproduction pattern. It is remarkable that in the samples of the upper Md, where this decrease in size of the proloculi is found in *S. calcitrapoides*, the B-generation as well as the A₁-generation become rare or absent.