RANIKOTHALIA SAHNII, N.SP. AND *R. SAVITRIAE*, N.SP.: A POSSIBLE LINK BETWEEN THE PALEOCENE FAUNAS OF THE EAST AND WEST INDIES

LT. COL. L. M. DAVIES
Grant Institute of Geology, University of Edinburgh

ABSTRACT

The author refers to his paper "*Ranikothalia* in East and West Indies" (1949), in which he cited a West African form as apparently linking the Paleocene *Ranikothalia* of the Indo-Afghan border to those of the Antilles. He now describes that form as *Ranikothalia sahnii*, and its megaspheric companion as *R. savitriae*, as a tribute to his friend the late Prof. Birbal Sahni, F.R.S., and to Mrs. Sahni.

INTRODUCTION

IT is unusual for a description of foraminifera to appear in a journal of palaeobotany; but the circumstances are exceptional, since the friends of the late Prof. Sahni have been asked to contribute papers, dealing with their several lines of research, to a commemoration volume of that journal. The author, therefore, contributes a description of an interesting West African form, naming its two generations after Professor and Mrs. Sahni.

HISTORY OF THE CASE

The author was sent this material by Monsieur G. Arnaud, the Director of Mines at Dakar in French West Africa, who asked him (letter of 22 July 1943) to give his opinion on foraminifera from the Eocene beds of Senegal and Dahomey. He agreed, so presently received considerable collections from Senegal, and one consignment (lot "26") from Toffo (2° 2′ E. : 6° 54′ N.) in Dahomey (Togoland). The latter proved specially interesting, because its contents differed from the Senegalese types and looked very like the Indian *Ranikothalia* (*Nummulites*) *nuttalli*. So he asked for more of it, and more was sent (lot "7745") from 3 metres below the surface at Toffo. The author then wrote (13 April 1944) to Monsieur Arnaud, emphasizing the resemblance of these Toffo forms to *N. nuttalli*; and a third consignment was sent to him (lot "6345") from 12 metres below the surface at Zahuc (2° 4′ E. : 6° 52′ N.), a few miles S.E. of Toffo. These also contained the same forms. The author soon afterwards (7 July 1944) told M. Arnaud that although the megaspheric representative of this type differed noticeably from *R.* (*N.*) *thalicus*, the pair could not be far removed from *N. nuttalli*/*N. thalicus*, and seemed to indicate both the existence of Paleocene beds in Dahomey and also the existence of some communication between those beds and the contemporary deposits of N.W. India.

Some time after this, M. Arnaud told the author (letter of 15 April 1946) that Monsieur J. Flandrin wished to study specimens of *N. nuttalli* from India; so the author sent some to him (30 July 1946). Apparently two other French geologists, R. Furon and N. Kouriatchy, came to the same conclusion as to the identity of the Togoland forms with *N. nuttalli*, for they soon afterwards published a note (18 December 1946) to that effect, claiming for these Dahomey deposits an age equivalent to that of the Upper Ranikot of India. What is more. F. Tessier has lately (13 June 1949, p. 229) reiterated the opinion that Paleocene beds exist in Togoland, and considers that they can be linked with the Paleocene of Trinidad. Meanwhile the author had stressed (March 1949) that the Togoland forms seem to link the *R.* (*N.*) *nuttalli* beds of N.W. India with the Paleocene beds of the Antilles.

DISTINCTION OF THE TOGOLAND FORMS

Despite the resemblance to *R.* (*N.*) *nuttalli* shown by the larger specimens from Toffo, the author now considers it safer to treat the latter as specifically distinct for the following reasons:

1. Their megaspheric companions are noticeably distinct from *R.* (*N.*) *thalicus*, as remarked from the first (7 July 1944).

2. They do not exhibit the same range of variation as appears in *R.* (*N.*) *nuttalli*, but

they seem to occupy a position between *R.* (*N.*) *nuttalli* and *R.* (*N.*) *sindensis*.

3. Although they show the degeneration of the outer layer (or " supplemental skeleton ") characterizing the *Ranikothalia*, this degeneration does not run to excess as it does in *R.* (*N.*) *nuttalli*, which merges into *Miscellanea stampi* (DAVIES, 1927, p. 272 ; PL. 21, FIGS. 1-8. 1937, pp. 40-44 ; PL. 6, FIGS. 4, 6, 9-10, 17-18).

The Togoland forms are, therefore, now described and figured as follows.

Genus Ranikothalia, Caudri 1943-4, pp. 17 ff.

RANIKOTHALIA SAHNII, n.sp.

Plate 1, Figs. 1, 4-5, 7-8

Holotype, Brit. Mus. (Nat. Hist.) Reg. No. P. 40347.

1944. *Nummulites* cf. *nuttalli* Davies : Davies (letters of 13th April and 7th July).
1946. *Nummulites nuttalli* Davies : R. Furon & N. Kouriatchy, *C.R.S.S. Soc. géol. France*, p. 347.
1949. *Nummulites* aff. *nuttalli* Davies (pars) : Davies, *Geol. Mag.*, **86**, p. 114.

As already remarked, this species seems to be intermediate between *Ranikothalia* (*Nummulites*) *nuttalli* and the very open-spired forms into which *R. nuttalli* merges, and which have been described as *Operculina*, *Nummulites*, etc., *sindensis* (*vide* DAVIES, 1927, pp. 266-271, 274-276 ; PL. 18, FIGS. 3-4 ; PL. 19, FIGS. 1-13. Also DAVIES, 1937, pp. 18-22 ; PL. 3, FIGS. 1-2, 9 ; PL. 6, FIGS. 19-20 ; PL. 4, FIG. 21).

The size of these African specimens varies from 11 mm. down to about 3 mm. diameter ; while the thickness of the test varies from 20 to 30 per cent of its diameter, the average being about 24 per cent, which is nearer to that of *R. nuttalli* (about 25 per cent) than to that of its variety *kohaticus* (about 18 per cent).

The diameters of successive whorls, and the numbers of chambers in them, were as follows in one of the largest specimens, and in a small one, respectively :

DIA., mm.	CHAMBERS	DIA., mm.	CHAMBERS
11·0	50		
6·6	32	6·0	32
3·4	24	3·0	24
1·6	18	1·4	15
0·7	13	0·6	12

The height of each chamber equals from four to five times its length. The septal partitions drop more or less vertically down on to the subjacent marginal cord, being only markedly recurved at their tops ; yet the uppermost rear portion of each chamber tends to be somewhat rounded.

The poles of the test are rather prominent, and granulated ; the septal filaments are strongly marked, and often show transverse trabecules. The incipient degeneration of the outer layer (or " supplemental skeleton ") of the test is evidenced both in equatorial and meridian sections of it ; in the former by the clear distinction of the outer layer from the inner one (or " spiral sheet "), and in the latter by the traversing of the outer layer by numerous radial fissures. It is this degeneration of the outer layer which justifies the reference of this species to *Ranikothalia*, like the type species *R. nuttalli*. The reticulation of the marginal cord, which Prof. H. Douvillé specially noted (1928) in the case of *R.* (*N.*) *nuttalli*, is one of the consequences of this degeneration, and is sometimes also seen in *R. sahnii*.

The marginal cord of *R. sahnii* is always strongly developed, as in *R. nuttalli* ; the underlying chambers being laterally " pinched in ", producing a marked " gutter " or depression between the tours of the cord, as seen from the outside. This feature is particularly marked in the more widely opening Indian *Ranikothalia* (cf. DAVIES, 1927, PL. 19, FIGS. 11-12 ; 1937, PL. 4, FIG. 21) which *R. sahnii* tends to approach. The irregularity in coiling of the test is also often most pronounced, in *R. sahnii* as in *R. nuttalli*, many specimens having very unevenly wound spires.

RANIKOTHALIA SAVITRIAE, n.sp.

Plate 1, Figs. 3, 6, 9-10

Holotype, Brit. Mus. (Nat. Hist.) Reg. No. P. 40353.

1944. *Nummulites* aff. *thalicus* Davies : Davies (letter of 7th July).
1949. *Nummulites* aff. *nuttalli* Davies (pars) : Davies, *Geol. Mag.* **86**, p. 114.

It is in the megaspheric companion of *R. sahnii* that, as stated above, one finds the chief distinction from the *R. nuttalli*/*R. thalicus* combination, for it is impossible to

separate the African megaspheric form from younger representatives of its microspheric associate by external examination alone. It is only by sectioning the form, and finding its initial apparatus, that one can definitely distinguish it from its associate. For that reason one of these sectioned forms has had to be cited as the holotype of the species.

The diameter of *R. savitriae* ranges up to over 6 mm., as compared with barely 4 mm. in the case of *R. thalicus*, while its thickness is only about 20 to 25 per cent of its diameter ; it being quite as relatively slender as its microspheric companion, instead of distinctly stouter like *R. thalicus*, whose thickness averages 50 per cent of its diameter (cf. DAVIES, 1927, p. 270).

The protoconch of *R. savitriae* is usually a little over 0·3 mm. (ranging from 0·25 to 0·4 mm.) in diameter, while the deuteroconch is from half to two-thirds the size of the protoconch. As with *R. thalicus*, the adult test contains rather more than 3 whorls, but their diameters are respectively from 1·5 to 2·0 mm., 3·0 to 4·5 mm. and 5·0 to 6·5 mm. ; while the numbers of chambers in them are respectively about 7 to 9, 17 to 20 and 34 to 37. Thus the protoconch is somewhat smaller than that of *R. thalicus*, which averages 0·4 mm. in diameter ; while the chamber formula shows a more rapid increase than that of *R. thalicus*, which has $8\frac{1}{2}$ to $10\frac{1}{2}$, 17 to 19 and 24 to 30 chambers in its three completed whorls (DAVIES, *ut supra*). The chambers are also much higher than those of *R. thalicus*, and have much less rounded tops (cf. DAVIES, 1927, PL. 20, FIG. 1).

AGE OF THE SPECIMENS

The tendency of *R. sahnii* to approach the very open-spired *R. sindensis*, which sometimes survives *R. nuttalli* and even appears in the lower levels of the succeeding Laki (Ypresian, or Lower Eocene) beds of India, suggests an uppermost Paleocene (or Sparnacian) age for these Togoland forms ; but the author could find no supporting evidence as to their exact age. Although the three lots containing *R. sahnii*/*R. savitriae* were packed with their representatives, he could find no other Nummulitinae or stratigraphically significant forms in their company. So it seems to be the case with the early Tertiary deposits of Togoland, as it is of those of Senegal (cf. FLANDRIN & JACQUET, 1936, p. 365), that they contain an abundance of individual Nummulitinae, but very few species.

The author could find, accompanying *R. sahnii*/*R. savitriae*, only certain ostracods (including *Bairdia subdeltoidea* Münster), some small echinoid spines, and a number of small coprolites. This suggests brackish water or estuarine conditions, as in the Indian Ranikot and Laki, which also contain many ostracods, including *B. subdeltoidea* (cf. LATHAM, 1936). It is, therefore, to be noted that Messrs Furon (1946) and Tessier (1949) accept the existence of Paleocene beds in Togoland.

It should also be noted, as already remarked (DAVIES, 1949, p. 114) that the presence, in Togoland, of *R. sahnii*/*R. savitriae* proves the existence of Nummulitinae further south, in West Africa, than they had previously been known to exist.

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EXPLANATION OF PLATE 1

1. *Ranikothalia sahnii*, n.sp. Holotype. From Toffo (2° 2′ E. : 6° 54′ N.). External view. × 8. Note granulated pole; coarse septal filaments, with transverse trabecules; irregular outline of test; and prominent and slightly reticulated marginal cord, with pronounced "gutter" between its tours. Brit. Mus. (Nat. Hist.) Reg. No. P. 40347.

2. Smaller specimen, same locality. Either young *R. sahnii*, or its megaspheric companion. External view. × 8. Brit. Mus. (Nat. Hist.) Reg. No. P. 40352.

3. *Ranikothalia savitriae*, n.sp. Holotype. From 12 metres below surface at Zahuc (2° 4′ E.: 6° 52′ N.). Equatorial section. × 8. Note relatively small size of its initial apparatus, with rapidly increasing diameters of its three completed whorls, and numbers of chambers in them, also relative height of those chambers and their less rounded tops, as compared with the same in *R. thalicus*. Brit. Mus. (Nat. Hist.) Reg. No. P. 40353.

4. *Ranikothalia sahnii*, n.sp. From 3 metres below surface at Toffo. Equatorial section. × 7¾. Note the distinction between inner and outer layers of the test; great height of chambers, with often vertically descending septal partitions, and somewhat rounded top posterior portions of those chambers. Brit. Mus. (Nat. Hist.) Reg. No. P. 40348.

5. *Ranikothalia sahnii*, n.sp. From 12 metres below surface at Zahuc. Meridian section. × 8½. Note incipient degeneration of walls of test, marked by many coarse radial passages through its outer layer; also lateral pinching in of sides of chambers, below marginal cord. Brit. Mus. (Nat. Hist.) Reg. No. P. 40349.

6. *Ranikothalia savitriae*, n.sp. From 12 metres below surface at Zahuc. Equatorial section. × 8. Note larger initial apparatus, with even more rapidly increasing size of spire. This indicates range of variation. Brit. Mus. (Nat. Hist.) Reg. No. P. 40354.

7. *Ranikothalia sahnii*, n.sp. From 12 metres below surface at Zahuc. Equatorial section. × 8. Note distinction between inner and outer layers of the test, and its extreme irregularity of winding. Brit. Mus. (Nat. Hist.) Reg. No. P. 40350.

8. *Ranikothalia sahnii*, n.sp. From 3 metres below surface at Toffo. Meridian section. × 8. Note incipient degeneration of outer layer of test, prominent marginal cord, and lateral pinching in of walls below the cord. Brit. Mus. (Nat. Hist.) Reg. No. P. 40351.

9. *Ranikothalia savitriae*, n.sp. From 12 metres below surface at Zahuc. Meridian section. × 8. Note relative slenderness of the test, the incipient degeneration of its outer layer, and tendency to lateral pinching in of the chamber walls below the rather prominent marginal cord. Brit. Mus. (Nat. Hist.) Reg. No. P. 40355.

10. *Ranikothalia savitriae*, n.sp. From 12 metres below surface at Zahuc. Meridian section. × 8. Note irregular winding of test, as indicated by eccentric position of protoconch. Other features as in Fig. 9, but less clearly seen. Brit. Mus. (Nat. Hist.) Reg. No. P. 40356.


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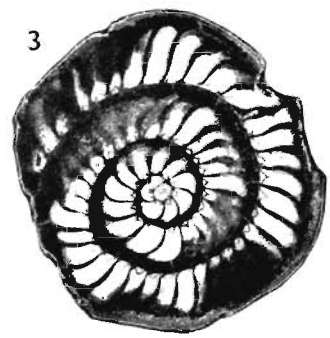
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