Journal of Micropalaeontology, **16**: 131–135. 0262-821X/97 $10.00

A new species of *Somalina* (*Somalina hottingeri*) with partially vacuolate lateral walls from the Middle Eocene of Oman

M. R. WHITE
Mines and Energy, South Australia, 191 Greenhill Road, Parkside, South Australia 5063, Australia.

ABSTRACT – *Somalina hottingeri*, a new species with partially vacuolate lateral walls is described from the Middle Eocene of Oman. It is distinguished from the only previously recorded species with this wall structure (*S. transitorius* (Hottinger)) by having equatorial chambers that are relatively low throughout the test. On the basis of this character, it is suggested that *S. hottingeri* evolved from the *Opertorbitolites douvillei* Group (redefined here) and that it gave rise to the true somalines. *S. transitorius* is regarded as arising from *O. latimarginalis* (ex. *O. latimarginalis* Group, introduced in this study) but not to have given rise to any other species.

Since forms of *Somalina* with only partially vacuolate walls appear to be confined to the late Early Eocene to early Middle Eocene, it is concluded that the presence of this wall structure provides a useful stratigraphic marker. *J. Micropalaeontol.* **16**(2): 131–135, October 1997.

INTRODUCTION

The type species of *Somalina* (*S. stefaninii* Silvestri, 1939; Pl. 1, fig. 1) is distinguished from that of *Opertorbitolites* (*O. douvillei* Nuttall, 1925; Pl. 1, fig. 2) in having vacuolate rather than non-vacuolate lateral lamellar walls. Morphologically intermediate individuals in which the lateral walls are partially vacuolate, however, also exist (Pl. 1, figs 3–5; Pl. 2, figs 1–3).

Opertorbitolites sensu stricto first appeared in the Late Palaeocene (*Alveolina cucumiformis* Zone, see *Opertorbitolites gracilis* (Lehmann), in Lehmann, 1961) and *Somalina sensu stricto* is not known from rocks older than the Early Eocene (probably late *Alveolina violae* Zone). Since the oldest known occurrence of individuals with an intermediate morphology is also Early Eocene (*A. trempina* Zone; Hottinger & Krusat, 1972), they undoubtedly represent a transitional evolutionary stage.

Hottinger (in Hottinger & Krusat, 1972) assigned the only previously recorded species with partially vacuolate lateral walls to *Opertorbitolites transitorius* (Pl. 2, fig. 3). However, vacuolate lateral walls are characteristic of *Somalina*, to which genus these transitional forms are here assigned.

S. hottingeri (Pl. 1, figs 3–5, Pl. 2, figs 1–2), also with partially vacuolate lateral walls, is described below and its likely evolutionary relationships with the *Opertorbitolites douvillei* and *O. latimarginalis* groups, *S. transitorius* and *Somalina sensu stricto* are discussed.

SYSTEMATIC DESCRIPTION

The classification of Loeblich & Tappan (1987) is followed and localities mentioned in the text are shown on Fig. 1. Range charts for each of these localities are given in White (1994), to which the reader is referred for more stratigraphical information. All specimens examined are deposited in the palaeontological collections of the Natural History Museum, London.

Suborder ***Miliolina*** Delage and Herouard, 1896
Superfamily ***Soritacea*** Ehrenberg, 1839
Family ***Soritidae***, Ehrenberg, 1839
Genus ***Somalina*** Silvestri, 1939
Somalina hottingeri n. sp.
(Pl. 1, figs 3–5, Pl., 2, figs 1–2)

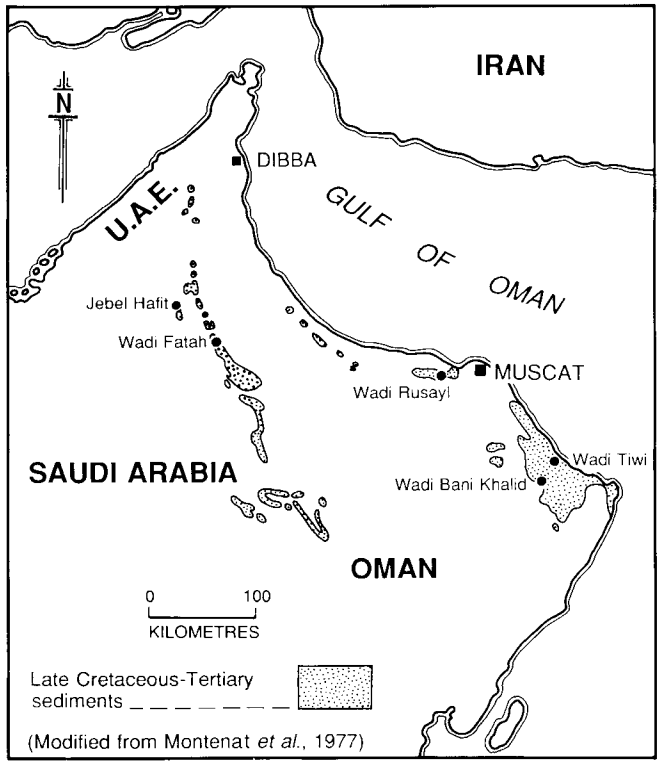


Fig. 1. Localities from which *S. hottingeri* has been recorded in Oman.

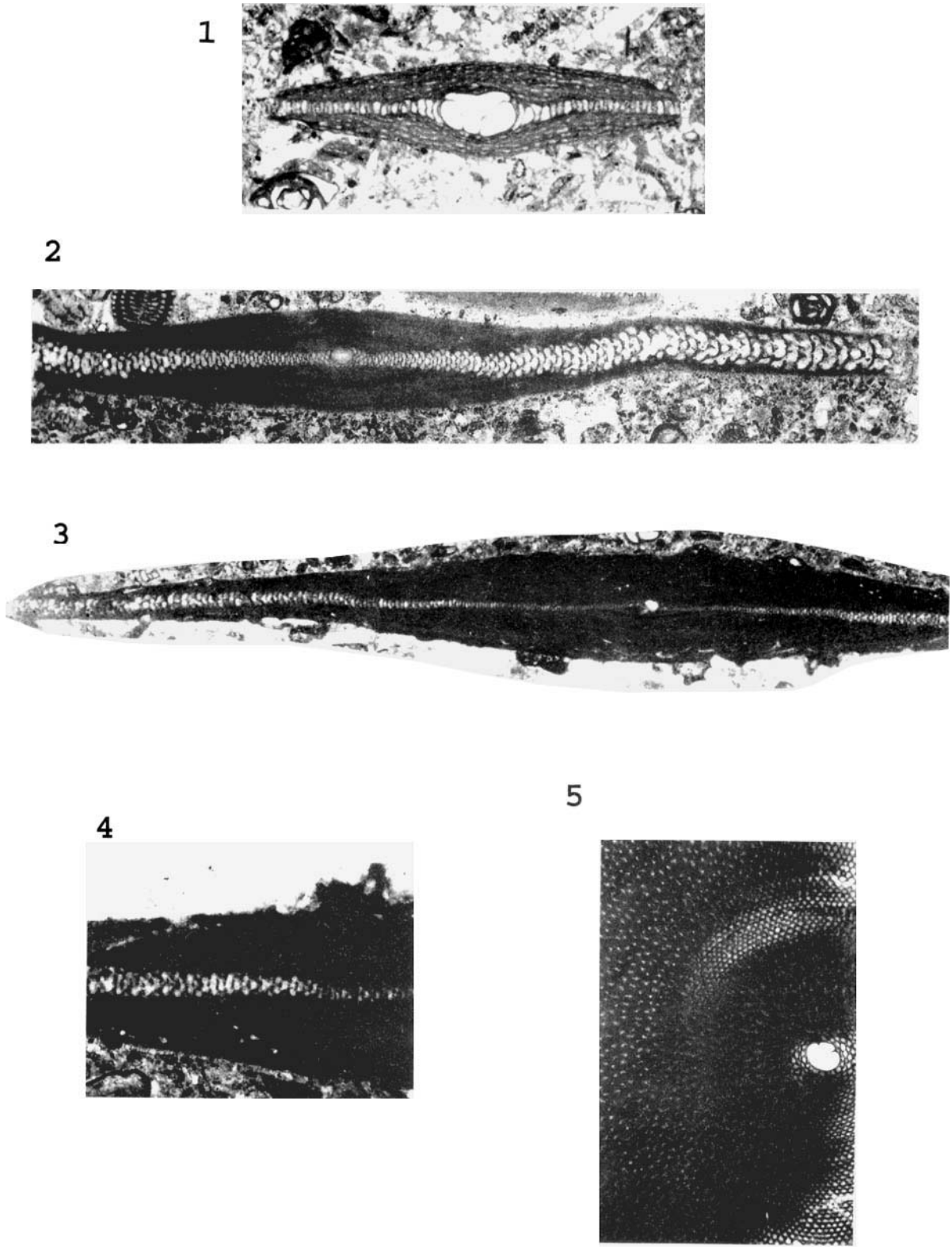
1994 *Somalina* n. sp.; White: figs 7, 9, 11, 12 & 15 (range charts).

Derivation of name. After Prof. L. Hottinger (Basle University), who first recorded partially vacuolate lateral lamellar walls seen in this species.

Diagnosis. Characterized by partially vacuolate lateral lamellar walls and low equatorial chambers throughout the test.

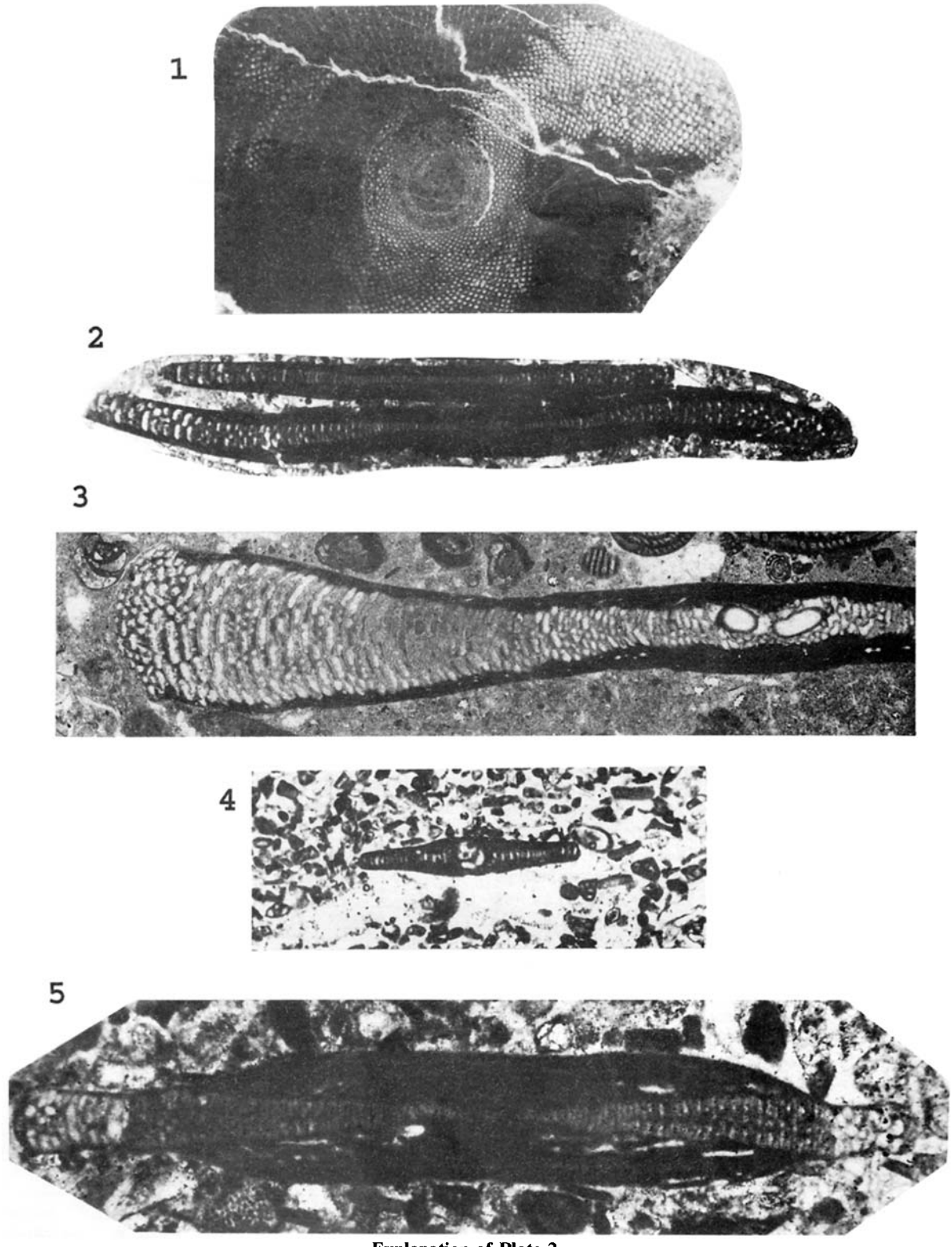
Holotype. P 52861. Pl. 1, figs 3 & 4.

Paratypes. Two oriented equatorial thin sections (P 52862 and P 52863, Pl. 1, fig 5 and Pl. 2, fig. 1, respectively) and abundant specimens in random thin sections (e.g. P 52864, Pl. 2, fig. 2).



Explanation of Plate 1

Fig. 1. *Somalina stephaninii* Silvestri. Vertical section of a megalospheric form. Wadi Bani Khalid, WBK 10. P 52860. ×20. **fig. 2.** *Opertorbitolites douvillei* Nuttall. Holotype. Vertical section of a megalospheric form. Locality 151. Parri Nala, West of Bibi Nani, Bolan Pass, Baluchistan. Figured by Nuttall (1925), Pl. 27, figs 4 & 5. Sedgwick Collection C 2516. ×15. **figs 3–5.** *Somalina hottingeri* n. sp: **3**. Holotype. Vertical section of a megalospheric form. Wadi Fatah, F 17. P 52861, ×15; **4**. Holotype. Enlargement of part of fig. 3. ×30. **5**. Paratype. Equatorial section of a microspheric form. Wadi Rusayl, WR 33a. P 52862. ×15.



Explanation of Plate 2

Figs 1–2. *Somalina hottingeri* n. sp. paratypes; 1. Equatorial section of a megalospheric form. Wadi Fatah, F 17. P 52863. ×15; **2.** Vertical section of a probable microspheric form. Wadi Rusayl, WR 33a. P 52864. ×25. **fig. 3.** *Somalina transitorius* (Hottinger). Paratype. Vertical section of a megalospheric form. Ager Valley, west of Agullo, Lerida Province, Spain. Figured by Hottinger in Hottinger & Krusat (1972), Pl. 8, fig. 2. Naturhistorisches Museum Basel, C 29774. ×20. **fig. 4.** *Opertorbitolites* sp. cf. *O. gracilis* Lehmann. Vertical section through a megalospheric form. Wadi Rusayl, WR 33a. P 52865. ×20. Note relatively unthickened lateral walls and lenticular shape. **fig. 5.** *Opertorbitolites* sp. cf. *O. douvillei* Nuttall. Vertical section of a probable microspheric form. Wadi Rusayl, WR 8. P 52866. ×30. Note relatively thickened lateral walls without the test being lenticular (see text for discussion).

Type locality. Wadi Rusayl (approximately 56°16′ E, 23°75′ N), northeastern Oman.

Type level. Middle Eocene (early *Alveolina stipes* Zone).

Occurrence. Wadi Fatah (F 12, 16, 17, 18, 19, 20); Jebel Hafit (HN 1157, 1155, 1154); Wadi Bani Khalid (WB 9, WBK 2, 4, 5, 10); Wadi Rusayl (WR 33a, 46, 49a, 51, 52, 56, 59, 60) and Wadi Tiwi (HN 1189, 1188).

Type description. Megalospheric test medium to large, lenticular, occasionally slightly to strongly undulate. Surface smooth. Embryonic apparatus comprising a small proloculus and a flexostyle. Post embryonic chambers arcuate, not increasing in height significantly from the centre to the periphery of the test. The lateral walls attain a thickness of up to 0.8 mm over the umbo and are partially vacuolate.

Microspheric test of medium size with partially vacuolate lateral walls (see Remarks below).

Dimensions of holotype. (mm)

Diameter	21
Height at centre	1.83
Height at periphery	0.41

Dimensions of megalospheric paratypes.

	No. of specimens	Max.	Min.	Mean
Diameter (mm)	3	11.60	5.76	10.15
Height at centre (mm)	2	1.36	0.80	1.08
Height at periphery (mm)	2	0.40	0.20	0.30
Max. internal diameter of proloculus (μm)*	2	400	360	380

*measured in equatorial section

Dimensions of microspheric paratypes.

	No. of specimens	Max.	Min.	Mean
Diameter (mm)	3	8.4	8.00	8.26

Remarks. The only specimen in which a microspheric embryonic apparatus has been seen (Sample WR 33a; Pl. 2, fig. 1), occurs together with specimens that also appear to belong to this generation (e.g. Pl. 2, fig. 2). These have smooth surfaces and post embryonic chambers that do not increase significantly in height from the centre to the periphery of the test. Microspheric and megalospheric forms have not been recorded together. However, the vacuolate nature of the lateral wall, and the low chambers apparently present in both generations leaves little doubt that they belong to the same species.

Although *S. hottingeri* is characterized by having partially vacuolate walls, this feature is best seen in tangential or near equatorial sections (e.g. Pl. 1, fig. 5; Pl. 2, fig. 1). *S. hottingeri* differs from *S. transitorius* in having low equatorial chambers throughout the test, and from all other species of this genus by its partially vacuolate lateral lamellar walls.

Faunal association. *Nummulites* sp. *Alveolina drobneae* White, *A. elliptica nuttalli* Davies, *A. frumentiformis* Schwager, *A. lukasi* White, *A.* cf. *rugosa* Hottinger, *A.* cf. *schwageri* Checchia-Rispoli, *A. stercus muris* Mayer-Eymer, *A.* cf. *subpyrenaica flosculina* Silvestri, *Assilina*, *Dictyoconoides cooki* (Carter), *Linderina rajasthanensis* Singh, *Lockhartia hunti* Ovey, *Opertorbitolites* cf. *gracilis* (Lehmann), *Somalina stefaninii*.

Stratigraphic range. Early to Middle Eocene (probably late *Alveolina violae* Zone to early *Alveolina stipes* Zone; see White, 1994, figs 14.7, 14.9, 14.11, 14.12 and 14.15).

DISCUSSION

Lehmann (1961) distinguished two groups of *Opertorbitolites* with relatively low equatorial chambers throughout the test, and separated *O. latimarginalis* (Lehmann), in which the equatorial chambers increase significantly in height towards the periphery. He regarded biplanar forms with only slightly thickened lateral walls as belonging to his *biplanus* Group and placed those with lenticular tests and strongly thickened lateral walls in that of *O. douvillei*. Forms with relatively unthickened lateral walls, however, may also be lenticular (e.g. *O.* sp. cf. *O. gracilis* Lehmann, Pl. 2, fig. 4), and those with thick lateral walls are not always so (e.g. *O.* sp. cf. *O. douvillei*, Pl. 2, fig. 5). Consequently, the present author does not recognize the distinction between these two groups. Instead, the *O. douvillei* Group of Lehmann is redefined here to comprise species (including those originally placed by Lehmann in his *douvillei* and *biplanus* groups) characterized by relatively low equatorial chambers. The *O. latimarginalis* Group is introduced for those species with equatorial chambers that increase significantly in height towards the periphery of the test.

The low equatorial chambers in *S. hottingeri*, combined with its partially vacuolate lateral walls and its first appearence in the late Early Eocene strongly suggest that it evolved from the *O. douvillei* Group, probably *O. douvillei* itself which is known from the Laki Series (Early Eocene) in Pakistan (Nuttall, 1925). In contrast, the relatively rapid increase in height of the equatorial chambers in *S. transitorius* implies that this arose from *O. latimarginalis* (*Alveolina trempina* Zone, see Lehmann, 1961), the only known species belonging to the *O. latimarginalis* Group.

From the above, it seems certain that *S. hottingeri* and *S. transitorius* belong to separate lineages (Fig. 2). Of these, the *latimarginalis–transitorius* line does not appear to have evolved

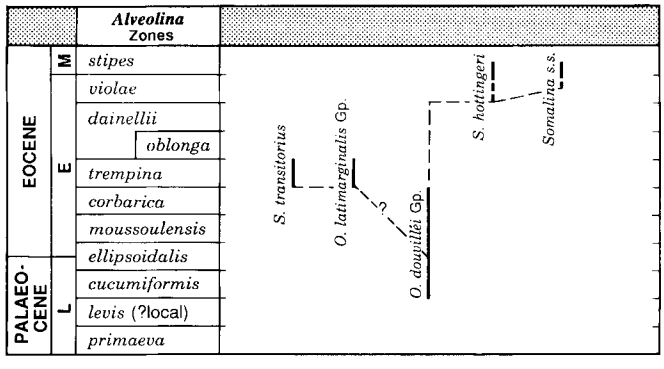


Fig. 2. Suggested evolutionary relationships between the *Opertorbitolites douvillei* Group, the *O. latimarginalis* Group, *Somalina transitorius*, *S. hottingeri* and *Somalina sensu stricto*. Vertical solid and dashed lines denote definite and inferred ranges, respectively. Both *S. hottingeri* and *Somalina s.s.* are known from the Early Eocene. Although the zone has not been identified, they must at least range into that of *Alveolina violae*. The *A. corbarica* occurrence of the *O. douvillei* Group is that of *O. biplanus*, recorded by Lehmann (1961). The range of *S. transitorius* is taken from Hottinger & Krusat (1972), while that of the *O. latimarginalis* Group (i.e. *O. latimarginalis*) is from Lehmann (1961).

further. On the other hand, the close similarity between *S. hottingeri* and *Somalina sensu stricto* (particularly their low equatorial chambers) leaves little doubt that they belong to a single evolutionary lineage. The later appearance of *O. latimarginalis* compared with the *O. douvillei* Group is tentatively interpreted as the former having evolved from the latter. It is of course possible that the two *Opertorbitolites* groups have separate origins.

The relatively short combined stratigraphical range of *S. transitorius* and *S. hottingeri* (i.e. *Alveolina trempina* -- early *Alveolina stipes* zones) makes their characteristic wall structure a useful age indicator even when the species cannot be identified (e.g. from fragments in thin section).

ACKNOWLEDGEMENTS

Thanks are extended to J. E. Whittaker, British Museum (Natural History) for organizing the photography of *Opertorbitolites douvillei* and *Somalina transitorius*, and for commenting on the text. Thanks also to Lyn Broadbridge, Mines and Energy, South Australia, for printing the other illustrated specimens. A special thank you is extended to the late C. G. Adams for his support during research that led to this paper.

Manuscript received March 1995
Manuscript accepted April 1995

REFERENCES

Hottinger, L. & Krusat, G. 1972. Un foraminifère nouveau intermédiaire entre Opertorbitolites et *Somalina* de l'Ilerdien Pyrénéen. *Revista Española de Micropaleont*ologia, num. ext, 249–271, pls 1–8.

Lehmann, R. 1961. Plusieurs types morphologiques distincts d'*Orbitolites* de l'Ilerdien Pyreneen. ***Bulletin de la Société géologique de France***, Ser 7, **4:** 357–361, pls 9–10.

Loeblich, A. R. & Tappan, H. 1987. *Foraminiferal Genera and their Classification*. Vol. 1, i–x, 1–970; Vol. 2, i–viii, 1–212, pls 1–847. Van Nostrand Reinhold, New York, USA.

Nuttall, W. L. F. 1925. The stratigraphy of the Laki Series (Lower Eocene) of parts of Sind and Baluchistan (India); with a description of the larger foraminifera contained in those beds. *Quarterly Journal of the Geological Society, London*, **81:** 417–452, pls 23–27.

Silvestri, A. 1939. Foraminiferi dell' Eocene della Somalia. *Palaeontographica italica*, **32:** 1–102, pls 1–12.

White, M. R. 1994. *In* Simmons, M. D. (Ed.) *Micropalaeontology and Hydrocarbon Exploration in the Middle East*. British Micropalaeontological Society Publication Series,. 309–341, pls 14.1–14.4. Chapman & Hall, London.