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Somalina praestefaninii n. sp., a New Species of Large Foraminifera from the Dammam Formation (Lutetian) of Gebel Hafit, United Arab Emirates

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Key words: *Somalina*, Taxonomy, Eocene, United Arab Emirates.

Abstract

The nodular limestones exposed at the basal part of the Gebel Hafit (United Arab Emirates) represent a truncation surface, between the Rus and the Middle Eocene Dammam Formation (*Mibazara Member*). *Somalina praestefaninii* n. sp. is a new large foraminiferal species separated from the Mibazara member. It is believed that *Somalina praestefaninii* n. sp. is the ancestral form of *Somalina stefaninii* SILVESTRI as it is smaller and has a more simple protoconch. Here, it is believed that the taxon *Somalina* (Lutetian) could possibly be derived from *Opertorbitolites* NUTTALL, 1925 (the taxon characteristic for the Ypresian).

1. INTRODUCTION

The stratigraphic succession exposed in the Gebel Hafit area of the United Arab Emirates (Fig. 1) ranges from Eocene to Miocene in age (HUNTING, 1979; CHERIF & EL DEEB, 1984; HAMDAN & BAHR, 1992; ANAN et al., 1992; ANAN, 1996). Basically, the Lower Eocene is represented by a relatively thin sequence of limestones, with marl intercalations in its upper part (Rus Formation), while the Middle and Upper Eocene are represented by thick sequences of limestones with marl and shale intercalations (Dammam Formation). Both formations have a wide aerial extent in the Emirates, Qatar, and Saudi Arabia (BOUKHARY & AL SHARHAN, 1998).

2. STRATIGRAPHY

The stratigraphic section measured along Wadi Tarabat at the core of the Hafit domal structure (Fig. 2) is represented by two formations, an older Rus Formation and younger Wadi Al Nahayan Formation.

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2.1. Rus Formation, Late Ypresian

The Rus Formation (THRALLS & HASSON, 1956) is composed of 40 m of white, medium to coarse grained, thickly bedded limestone, with gray chert nodules in the lower part and marl intercalations in the upper part. Two members are distinguished within the Rus Formation, the Sulaimi and Doha Members.

2.1.1. Sulaimi Member

The Sulaimi Member (BOUKHARY & AL SHARHAN, 1998) is exposed in the lower part of Gebel Hafit and is composed of about 25 m of thick-bedded white or cream-weathering medium to coarse-grained limestone. The upper part is composed of thinly-bedded cream to light-brown argillaceous limestone. The base of this unit is not exposed. Based on foraminifera *Acarinina bullbrooki* BOLLI, *Globigerina turgida* FINLAY, and *Morozovella aragonensis* (NUTTALL), the unit is assigned to the level of the late Early Eocene. The middle part is either barren or with poorly preserved foraminifera, such as *Acarinina bullbrooki* BOLLI, *A. pentacamerata* SUBBOTINA, *Globigerina turgida* FINLAY, *Morozovella aragonensis* (NUTTALL), and is characterized by a Nummulitic horizon with *Nummulites subramondi* DE LA HARPE, besides *Orbitolites*, *Alveolina* and algal Nummulitic limestones. This unit is correlated with the middle part of the Hili Member of the Rus Formation according to HAMDAN & BAHR (1992). The upper part is conformable with the overlying Doha Member.

2.1.2. Doha Member

The Doha Member (BOUKHARY & AL SHARHAN, 1998) is defined from the Lower Eocene outcrops of Qatar. It is unconformably overlain by the Dammam Formation (as defined from Qatar). The unit is composed of well-bedded grey to cream, fine–medium-grained nodular limestones with chert nodules and marl intercalations (15 m). Marls are rich in planktonic foraminifera, including *Subbotina inaequispira* (SUBBOTINA), *Globigerina turgida* FINLAY, *Morozovella aragonensis* (NUTTALL), *M. lensiformis* SUBBOTINA, *M. quetra* BOLLI, *Acarinina broedermanni* CUSHMAN & BERMUDEZ, *A. bullbrooki* BOLLI, *A. pentacamerata* SUBBOTINA, *A. pseudotopilensis* (SUBBOTINA), *A. triplex* SUBBOTINA, *A. solda-*

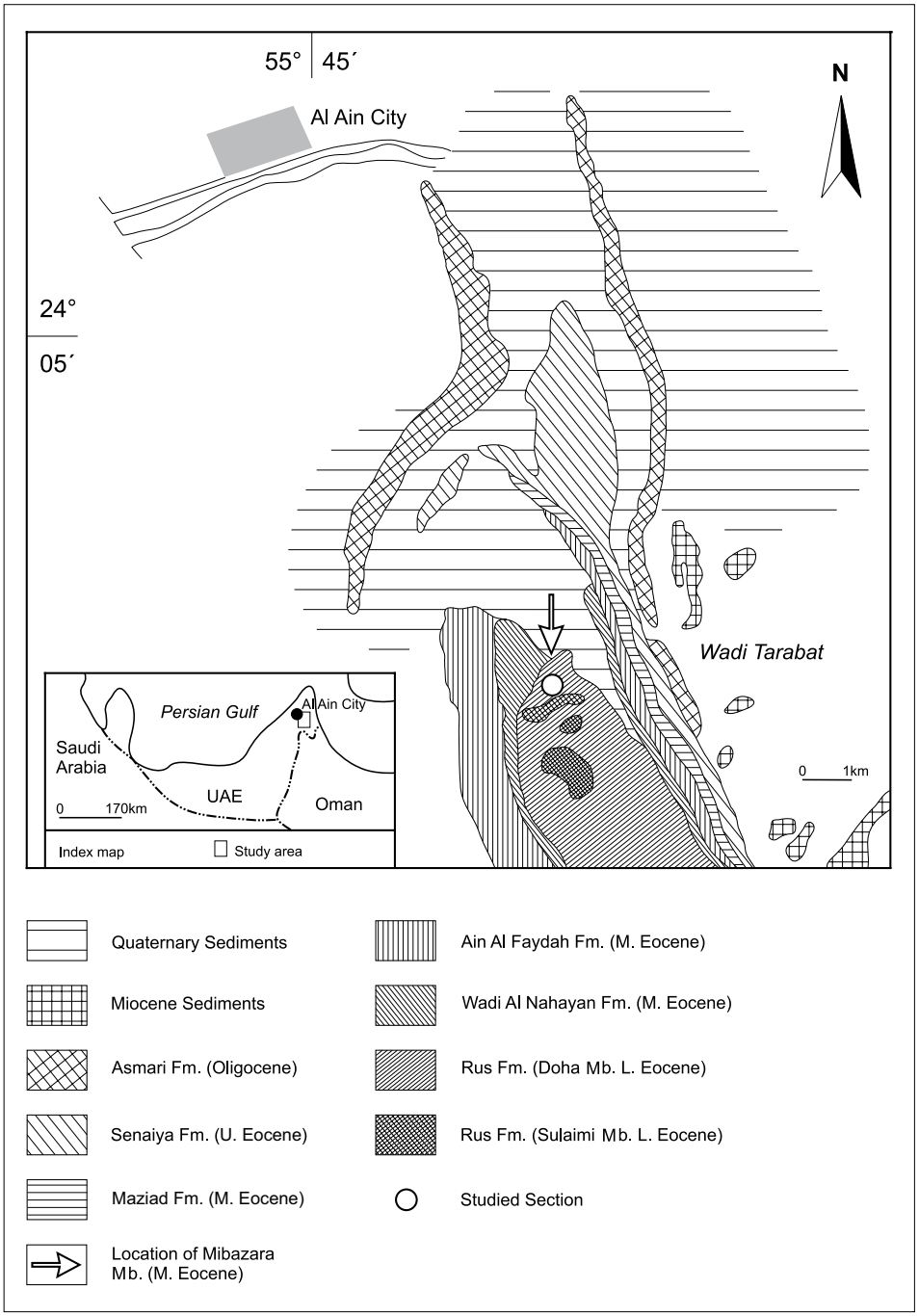

Fig. 1 Location map of the Gebel Hafit area (after CHERIF & EL DEEB, 1984).

doensis SUBBOTINA, *A. spinuloinflata* BANDY, and *Pseudohastigerina micra* (COLE). Some horizons are rich in large foraminifera, e.g. *Nummulites bassiounii* BOUKHARY & BLONDEAU. According to the foraminiferal associations this unit is dated as late Early Eocene (BOUKHARY & BLONDEAU, 1991). The unit is correlated with the upper part of the Hili Member of HAMDAN & BAHR (1992).

2.2. Wadi Al Nahayan Formation, Early/Middle Lutetian

The Wadi Al Nahayan Formation (HAMDAN & BAHR, 1992) forms the basal part of the El Dammam Group. It is composed of tan to light brown limestone with shale interbeds. The Dammam Group (720 m thick) is separated into four formations from base to top: Wadi Al Nahayan, Ain Al Faydah, Maziad, and Senaiya Formations. The Wadi Al Nahayan Formation is separated from the underlying Rus Formation by a 6 m thick conglomeratic layer, the Mibazara Member (BOUKHARY et al., 2006). This unit is composed of highly compacted and unoriented limestones pebbles and cobbles. The clasts are highly cemented by a fine reddish matrix of marly Nummulitic carbonates rich in large benthic foraminifera, including *Assilina spira abrardi* SCHAUB, *Somalina praestefaninii* n. sp., and *Nummulites perplexus* SCHAUB, similar to the basal

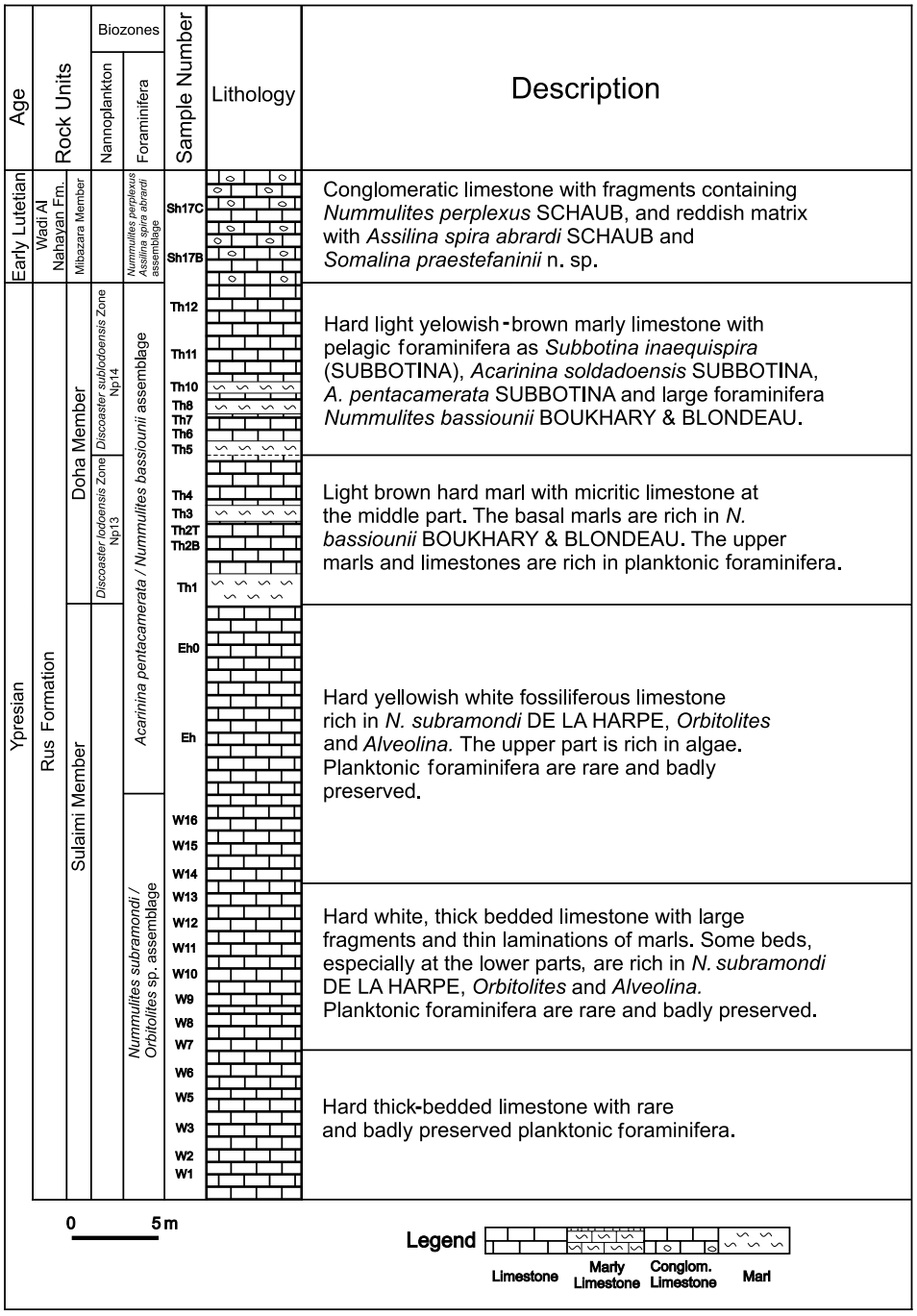

Fig. 2 Stratigraphy of the Early–Middle Eocene outcrop section in the Hafit area.

Lutetian assemblage of Italy (SCHAUB, 1981, p. 132). The unit is exposed on both limbs of the Hafit anticline with a variable thickness (3–6 m). These conglomerates represent a sudden shallow shift in sedimentation related to an uplift of the Arabia platform during the Early to Middle Lutetian. Also, this uplift seems to be responsible for the absence of the P10–P12 interval on the western side of Qatar (Lutetian Lacuna, BOUKHARY & AL SHARHAN, 1998).

2.3. Stratigraphic Remarks

The studied section is correlated with other countries (Qatar, Saudi Arabia and Egypt) to delineate important stratigraphic levels related to *Somalina* occurrences (Fig. 3). Consequently, *Somalina praestefaninii* n. sp. recorded from the basal part of the Dammam Fomation (Lutetian) is the ancestral form of *Somalina stefaninii* SILVESTRI, a characteristic species for the Bartonian. Also, the sequence of *Somalina praestefaninii* n. sp. could be correlated with the stratigraphic lacuna (between the Rus and Dammam formations) in Qatar, Bahrain, Kuwait, Saudi Arabia and Egypt (BOUKHARY & AL SHARHAN, 1998; BOUKHARY et al., 2006). Accordingly, the Mibazara Member corresponds to the black and red tuffs with *Nummulites perplexus* of Malo, Italy (SCHAUB, 1981), where both of the two units are characterized by conglomeratic facies.

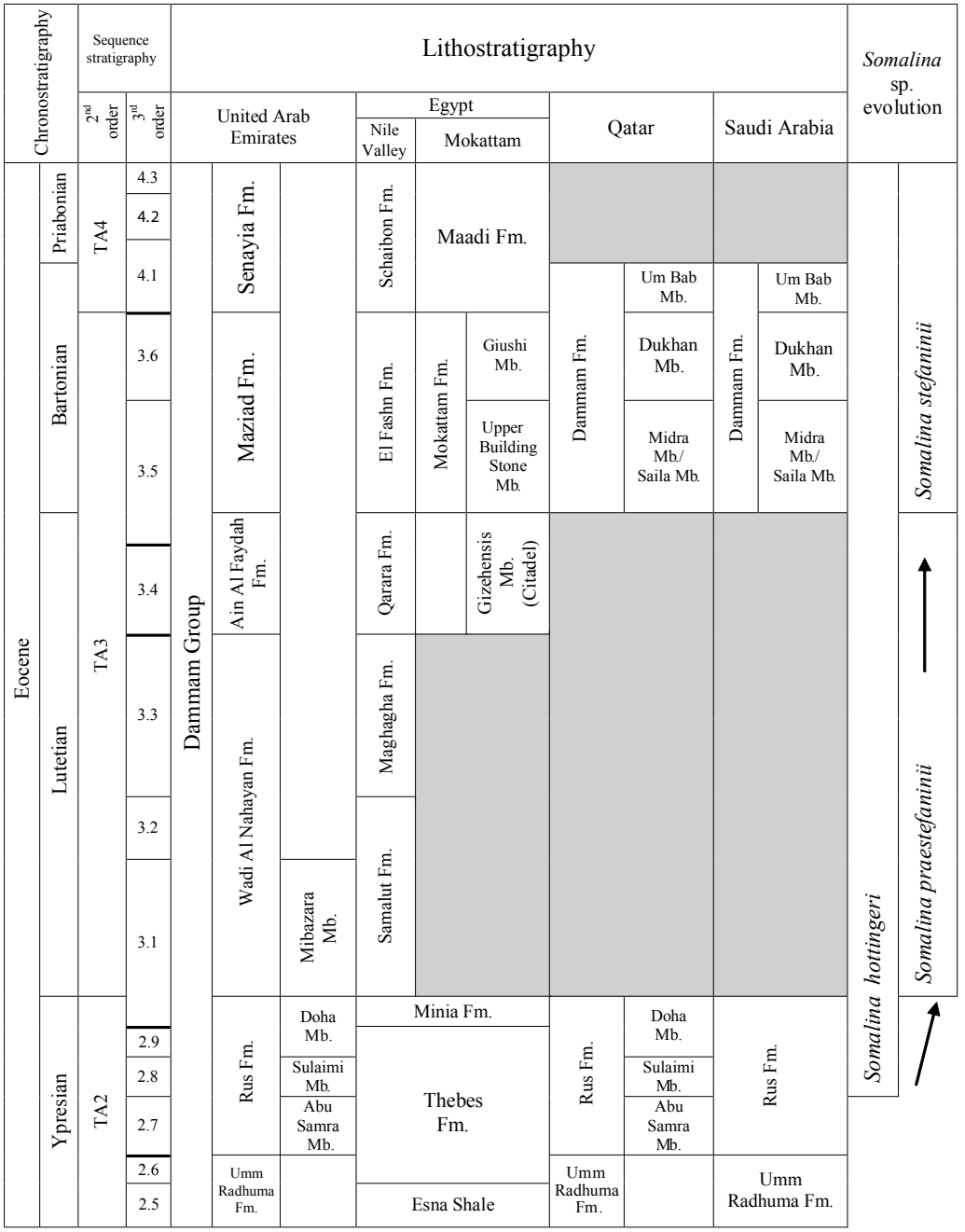

Fig. 3 A proposed stratigraphic classification and correlation of the Eocene sequences in the United Arab Emirates, and the *Somalina* evolution trend. Grey areas are unconformities.

Also, *Somalina hottingeri* WHITE may be related to *Somalina praestefaninii* n. sp. According to the known global sequences, four major (2nd order) stratigraphic sequences are recorded as follows.

1 – **Umm Er Radhuma–Rus Sequence (Ypresian, TA–2):** Umm Er Radhuma–Rus/Esna Thebes–Minia Formations.

This sequence is represented by a succession of shales and limestones and laid down under a major Tethyan transgression. The sequence ended with a major regression resulting in the absence of Early Lutetian deposits in many parts of the Arabian plate (BOUKHARY & AL SHARHAN, 1998).

2 – **Wadi Al Nahayan–Ain Al Faida Sequence (Lutetian, Early–Middle TA3):** Wadi Al Nahayan–Ain Al Faida / Samalut–Maghagha–Qarara Formations.

This sequence is represented by a succession of marls and limestones and was laid down under a major Tethyan regression accompanied by the Middle Eocene hyperthermal event (SCHMIDT & SHINDELL, 2003). This sequence is only recorded from the United Arab Emirates and Egypt. A tectonic trigger for this sequence is obvious from the Lower Egyptian basins (Mokattam).

3 – **Maziad Sequence (Bartonian, Late TA3):** Maziad / Mokattam–Fashn / Dammam Formations.

This sequence is represented by limestones deposited under a major transgression of Tethys. The sea level rise may have led to the evolution of *Somalina stefaninii* SILVESTRI across broad extents of the Arabian and African plates. The sequence has a wide distribution in the various Arabian countries.

4 – **Senaiya Sequence (Early Priabonian, TA4):** Senaiya / Schaibon Formations.

This sequence is represented by a succession of marl and limestone and was laid down under a major regression of Tethys which led to the absence of Early Priabonian sediments in many parts of the Arabian plate. Like the Wadi Al Nahian–Ain Al Faida Sequence, this sequence is only recorded from the United Arab Emirates and Egypt.

3. SYSTEMATIC PALAEONTOLOGY

Classification: following LOEBLICH & TAPPAN (1988)

Suborder: Miliolina DELAGE & HEROUARD, 1896

Superfamily: Soritacea EHRENBERG, 1839

Family: Soritidae EHRENBERG, 1839

Genus: *Somalina* SILVESTRI, 1939

The genus *Somalina*, considered as monospecific, was first figured by SILVESTRI (1938) and described by himself in 1939 from the Lower Eocene of Somalia and Egypt. In 1948, he mentioned and illustrated for the second time, new specimens provided from Egypt (Gebel Ataka, Collection of J. Cuvillier) of lower Eocene age. HENSON (1948) erected from the Lutetian of Iraq and Oman the species *S. danieli* HENSON (*S. danieli* sp. nov., p. 60, pl. 3, figs. 2–3, HENSON, 1950). Henson's illustrated thin sections are oblique sections and the only difference, given by this author, from the type species is by that it has a "smooth" or only slightly pitted surface. HENSON (1950) also mentioned from the Upper Eocene of Iraq *Somalina danieli* sp. nov. var.? (p. 61, pl. 3. figs. 4–6). The difference from the type species is "... a marked inflation of the test at the poles and an exceptionally large, irregular, multicellular, megalospheric embryo ranging in diameter from 0.3 mm to over 2 mm". Henson justified this separation mainly on the younger age of this form, because he admitted that the criteria for its separation are not particularly significant. AZZAROLI (1952) described and again illustrated *S. stefaninii* SILVESTRI from the Ledian of Somalia (in the lower part of the Carcar IV) with *Linderina buranensis* NUTTALL & BRIGHTON, *Pentellina* sp., rotalids and miliolids. RAHAGHI (1978) described *Somalina stefaninii* SILVESTRI from the Middle Eocene of Iran (region of Shiraz), the diameter of these specimens is 8 mm and their thickness is 1.6 mm. The embryonic apparatus has an internal dimension (in vertical section) of 600x400 µm. This species is associated with *Pseudolituolinella reicheli* MARIE, *Lituonella* sp., *Dictyoconus* sp., *Praerhapydionina* sp., and *Orbitolites complanatus* LAMARCK. Also, this author described two new species: *Somalina gigantea* RAHAGHI and *S. khorassanica* RAHAGHI, both from the Middle Eocene. *S. gigantea* RAHAGHI 1978 (pl. 3, figs. 1–3; pl. 4, figs. 1–3; pl. 41) has a diameter of 3.7 mm and a thickness of 0.4 mm for the forma A with a plurilocular apparatus in vertical section, with internal dimension of 1200x500 µm. For the forma B, the diameter is 33 mm for a thickness of 3 mm. The lateral layers, with vacuoles of variable dimensions, are similar to those of the type species. The new species mainly differs from the other species by its shape and size. It is associated with *Alveolina* aff. *munieri* HOTTINGER and *Alveolina* sp. Only the form A of *S. khorassanica* RAHAGHI is known (RAHAGHI, 1978, p. 41–42, pl. 2, fig. 4). The main characteristic of this form is the reduction and even the absence of the lateral layers. Its diameter is 0.7 mm and can reach 8 mm. The embryonic apparatus has an internal dimension of 300x400 µm. It is associated with *Alveolina* sp. and *Rotalia* sp. These characteristics, in our opinion, are not sufficient to nominate a new species. However, it is impossible to have a definite opinion on this matter before examining the samples. It should be, nevertheless, noticed that Rahaghi must have had an extremely rich collection, which explains the great diversity he was able to observe. He again mentions these species in his later work (RAHAGHI, 1980). BEUN (1982) mentioned *S. stefaninii* SILVESTRI from the Lower Eocene of SE Afghanistan, accompanied by *Assilina spinosa* DAVIES, and *A. placentula* DESHAYES. KAEVER (1970) recorded *Somalina stefaninii* SILVESTRI from the Middle Eocene of Afghanistan. KURESHI (1969, 1972) mentioned *S. stefaninii* SILVESTRI from the Lower Eocene of western Pakistan. FORTELEONI & RADRIZZANI (1972) recorded *S. stefaninii* SILVESTRI from the Middle Eocene of Somalia (pl. V, fig. 1) with *Lockhartia haimei* (DAVIS), *Rotalia* sp., *Dendritina* sp. and miliolidae. SAMPO (1969) mentioned *Somalina stefaninii* SILVESTRI (pl. 39 – middle Eocene and pl. 45 – "Jahrum Formation") from Iran. JAMES & WYND (1965) illustrated *Somalina* sp. from the "Jahrum Formation" of Iran (fig. 66). LEHMANN (1961) renewed the description of the species after examining specimens from Egypt and Iran. However, the author noticed that the forms from Iran are larger than those from Egypt. Stratigraphically, Lehmann considered *Somalina* as a foraminifera of the Lutetian (p. 660–663, figs. 47–49, tab. 14, figs. 4 & 5). WHITE (1997) described *Somalina hottingeri* WHITE with partially vacuolate lateral walls from Wadi Fatah, Oman, Arabian Gulf. SHAMAH & HELAL (1994) recorded *Somalina stefaninii* SILVESTRI from an Eocene hill south west Gebel El Goza El Hamra, Shabrawet area, Cairo–Suez district, Egypt.

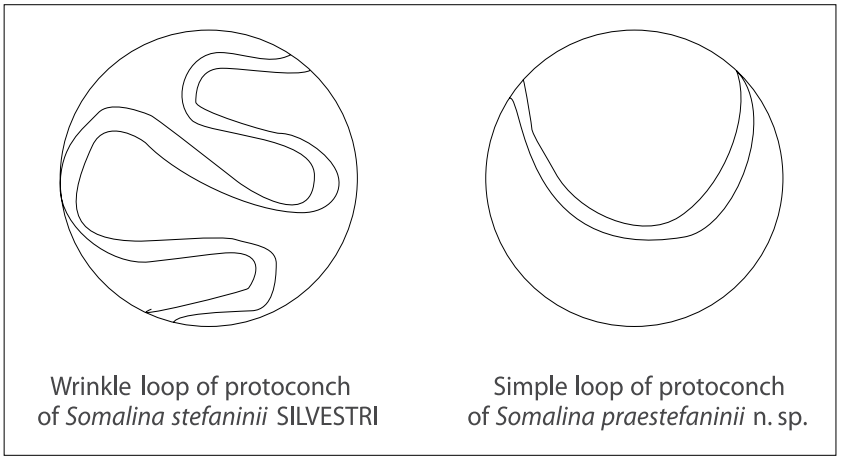

Fig. 4 Protoconch characteristics of *Somalina stefaninii* SILVESTRI and *Somalina praestefaninii* n. sp.

Depository: All types are deposited in the collection of Mohamed Boukhary, Department of Geology, Faculty of Science, Ain Shams University, Cairo, Egypt.

Somalina praestefaninii n. sp.

(Pl. 1, Figs. 1–13)

Etymology: Prior to *Somalina stefaninii* SILVESTRI in age.

Holotype: Pl. 1, Fig. 13, Sample No. sh. 17B.

Paratypes: 7 microspheric individuals and 2 megalospheric individuals in thin sections.

Locus Typicus: Gebel Hafit, Wadi Tarabat (Lat. 24°02'N and Long. 55°54'E).

Stratum typicum: Conglomeratic limestone with boulders and fragments containing *N. bassiounii* BOUKHARY & BLONDEAU and reddish matrix with *Assilina spira abrardi* SCHAUB, Early Lutetian (Wadi Al Nahayan Formation, Mibazara Member, Gebel Hafit), sample No. sh. 17B.

Diagnosis: *Somalina praestefaninii* n. sp. is believed to be the ancestral form of *Somalina stefaninii* SILVESTRI. It differs from *Somalina stefaninii* SILVESTRI by being smaller in size, with a smaller protoconch, and a less complicated embryonic chamber. Instead of having a wrinkled protoconch as in the case of *Somalina stefaninii* SILVESTRI, the protoconch of *Somalina praestefaninii* n. sp. is partially divided by a simple loop (Fig. 4).

Description

Microspheric form: Test of medium size, flat to lenticular, sometimes compressed to extremely pointed at the peripheral margin, diameter 15–20 mm, thickness 2–4 mm, the test consists of median and lateral structures, chambers in the median part of cavities and the lateral chambers are arcuate, larger near the central area and smaller in the outer margin. Cavities of the median part are elongated. Stolon is represented by a fine passage connecting the chamberlets. Aperture not possibly seen since all the material is embedded in hard limestones.

Megalospheric form: Test relatively small, diameter 3–3.5 mm with an average thickness of 500 to 750 μm. Protoconch rounded, rectangular to subrectangular, 250–500 μm. The protoconch appears to be occupied by a half circle ribbon, more simplified than that in *Somalina stefaninii* SILVESTRI, in which the protoconch is plurilocular.

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PLATE 1

Somalina praestefaninii n. sp., sample Sh17B, Mibazara Member, Wadi Al Nahayan Formation, Gebel Hafit

Figs. 1–10 Microspheric form of *Somalina praestefaninii* n. sp. (fig. 6 in BOUKHARY et al., 2006). Scale = 1 mm.
Figs. 11–13 Megalospheric form of *Somalina praestefaninii* n. sp. Scale = 1 mm.


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