

Zeitschrift: Eclogae Geologicae Helvetiae
Herausgeber: Schweizerische Geologische Gesellschaft
Band: 22 (1929)
Heft: 1

Artikel: Permian Fusulindae found in Greece
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DOI: <https://doi.org/10.5169/seals-158833>

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Permian Fusulinidae found in Greece.

By Y. OZAWA (Tokyo) and A. TOBLER (Basle).

With 1 plate (V).

Thanks to the kindness of Professor C. RENZ, the very active explorer of the geology of Greece, the Museum of Natural History at Basle received a collection of Fusulina limestone, collected on the Egean Islands of Hydra (in the South of the peninsula Argolis in the Pelopones) and Katakupho (between Naxos and Amorgós). Professor RENZ is dealing with the occurrence of this limestone in both places in the note: Beiträge zur Geologie der Ägäischen Inseln; Praktika de l'Académie d'Athènes, 2, 1927.

At Hydra Prof. RENZ found the Fusulines in blackish limestone associated with numerous Neoschwagerina between Kalami and Soieri and in gray limestone, containing numerous Neoschwagerina and Verbeekina and laying on uppercarbonic Fusulina limestone between Hagios Konstantinos - Lehusis and Panagia-kai-Christos (see loc. cit. p. 237, footnote).

At Katakupho the Fusulina limestone was found as pebbles and blocks in conglomerate laying between a yellowish marblelike limestone at the westcap and the Neogene of the eastern part of the island and extending from the bay of Pesulia at the South straight up to the northern shore.

After RENZ the Fusulina limestone there contains Fusulina, Verbeekina, Schwagerina, Bigenerina respect. Climacammina and quite occasionally also corals (see loc. cit. p. 365).

RENZ found beside the Fusulina limestone as components of the mentioned conglomerate abundantly pebbles of limestone containing Foraminifera belonging to the earlier Tertiary. Mentioned are big Nummulites, Lepidocyclina, Alveolina, Operculina, Heterostegina, Spiroclypeus. Following the suggestion of RENZ this limestone has to be placed partly into the Lutétien, partly into the Oligocene.

Some of Professor RENZ's samples of tertiary limestone have also been given to the Museum of Basle. We could them only recognize as belonging to the Lutétien. They contain *Alveolina*

elongata d'ORB., *Orbitolites complanata* LAMCK (5 cm diameter), *Nummulites perforatus* MONTF. and different species of *Discocyclusina*.

* * *

The Fusulina limestones from Hydra and Katakupho are of much interest because of their content of some advanced forms of Fusulinidae such as *Verbeekina*, *Neoschwagerina* and *Sumatrina* which, excepting *Neoschwagerina* recorded by SCHUBERT from Velebit, are restricted in their known distribution to Asia.

The limestone from Hydra is crowded with *Staffella deprati* scarcely associated with *Neoschwagerina*. It is generally found in the Permian limestone in Asia with *Verbeekina verbeeki*, *Neoschwagerina* and *Sumatrina*.

The Fusulina limestone from Pesulia contains the following species of Fusulinidae:

Fusulinella sp.
Fusulina cf. *elongata* SHUMARD.
Depratella sp.
Verbeekina verbeeki GEINITZ
Neoschwagerina craticulifera SCHWAGER
Neoschwagerina cf. *margaritae* DEPRAT
Sumatrina pesuliensis n. sp.

Of the above species, *Fusulina elongata* SHUMARD is recorded from the Permian limestone in Asia and North America, and *Neoschwagerina craticulifera*, *Neoschwagerina margaritae* and *Verbeekina verbeeki* are the common Permian Fusulinidae in Asia. An occurrence of *Sumatrina pesuliensis* is of special interest because of its highly specialized structure, and there is no doubt of its Permian age.

Considered from the faunal content these limestones are certainly of Middle Permian age and although they are widely separated from each other, they occupy almost the same stratigraphic horizon. In the following is given the description of Fusulinidae as determined by us.

Genus *Staffella* OZAWA.

Staffella deprati (YABE).

Pl. V, fig. 1a, b.

Fusulinella deprati YABE, in YABE and HAYASAKA's Atlas of Fossils in Geographical Research of China. 1920.

Fusulinella inflata COLANI: Nouvelle contribution à l'étude des Fusulinidés, Mémoires du Service géologique de l'Indochine, p. 77, pl. 15, figs. 3, 4, 5, 7, 8, 9, 10, 13 et 15. 1924.

Staffella deprati OZAWA: A Brief Critical Revision of the Fusulina Species, etc., Journal of Geological Society, Tokyo, Vol. 32, No. 380, p. 20. 1925.

It is very abundant in the black limestone from Hydra. The specimens are not so large as *Fusulinella inflata* described by COLANI, and they have an equatorial diameter of not more than 3 mm. The number of whorls is generally more than ten. The associated fossils are *Endothyra* sp., *Depratella* sp. and *Neoschwagerina* sp.

Loc.: Between Kalami and Soieri, Island of Hydra.

Staffella sp.

Pl. V, fig. 2.

A good longitudinal section, the equatorial diameter of which is about 1.5 mm., is found in a slide containing many *Staffella deprati*. It is comparable with *Staffella bradyi* MÖLLER.

Loc.: Between Kalami and Soieri, Island of Hydra.

Genus **Fusulinella** MÖLLER.

Fusulinella sp.

Pl. V, fig. 3.

A random section of *Fusulinella* illustrated in the plate is obtained in a slide containing *Neoschwagerina margaritae* DEPRAT.

Loc.: Pesulia, Island of Katakupho.

Genus **Fusulina** FISCHER v. WALDHEIM.

Fusulina cf. *elongata* SHUMARD.

Pl. V, figs. 4a, b.

Fusulina elongata SHUMARD, Girty: Guadalupian Fauna, U. S. Geol. Survey, Professional Paper 58, p. 62, pl. 5, figs. 1-5, pl. 17, figs. 1-8, pl. 22, figs. 7-9, pl. 27, figs. 1, 2. 1907.

Fusulina elongata HAYDEN: Fusulinidae from Afghanistan, Rec. Geol. Surv. India, vol. 38, p. 247, pl. 17, figs. 3-5, pl. 20, figs. 1-12. 1909.

Fusulina elongata DIENER: Anthracolithic Fossils of the Shan States, Pal. Indica, new Series, vol. 3, Mem. 4, p. 44, fig. 5. 1911.

Fusulina extensa SCHELLW. Mscr. var. *californica* STAFF: Monographie der Fusuliniden, Teil 3, Palaeontographica Bd. 59, p. 183, fig. 12. 1912.

Fusulina elongata is a very characteristic species belonging to the group of *Fusulina tenuissima* SCHELLWIEN, and is common in the Permian limestone of North America. It is also reported from the Shan States and Afghanistan. Our sections are not sufficient enough to identify them definitely with *Fusulina elongata*, but the random sections show peculiarities of *Fusulina elongata*.

It is rather common in the limestone from Katakupho, but no good sections were obtained.

Loc.: Pesulia, Island of Katakupho.

Genus **Verbeekina** STAFF.*Verbeekina verbeeki* (GEINITZ).

Pl. V, fig. 5.

Only a fragment of *Verbeekina* is obtained and illustrated. It is undoubtedly a part of *Verbeekina verbeeki*.

Loc.: Pesulia, Island of Katakupho.

Genus **Depratella** OZAWA.*Depratella* sp.

Pl. V, fig. 9b.

One random section which is evidently that of *Depratella* is found together with *Sumatrina pesuliensis*.

Loc.: Pesulia, Island of Katakupho.

Genus **Neoschwagerina** YABE.*Neoschwagerina craticulifera* (SCHWAGER).

Pl. V, fig. 6.

One good transverse section shown in the plate.

Loc.: Pesulia, Island of Katakupho.

Neoschwagerina cf. *margaritae* DEPRAT.

Pl. V, fig. 7.

Many random sections of *Neoschwagerina* having more than two auxiliary meridional septa between a pair of primary septa are found in the limestone from Katakupho. They may be *Neoschwagerina margaritae*.

Loc.: Pesulia, Island of Katakupho.

Genus **Sumatrina** VOLZ.*Sumatrina pesuliensis* n. sp.

Pl. V, figs. 8a, b, c, d, 9b.

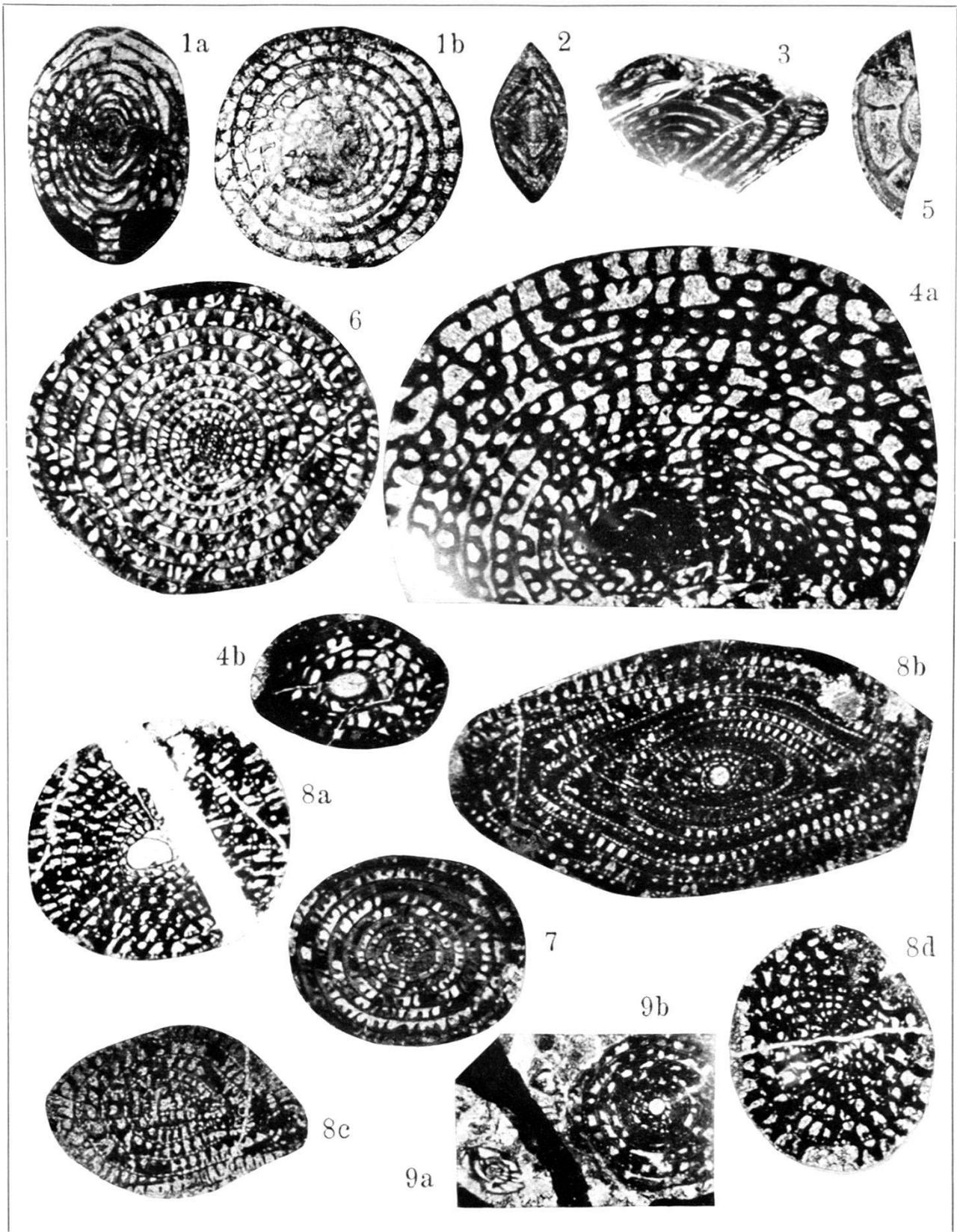
Shell fusiform, twice as long as broad; initial chamber rather large, more than 0.3 mm in diameter; volutions more than 10; shell wall thin, lamella rather thick and distinct, mesh structure slightly developed, but indistinct; 2—4 auxiliary meridional and 1—2 auxiliary equatorial septa intercalated between a pair of primary septa.

The present species is an intermediate form between *Neoschwagerina multiseptata* and *Sumatrina annae*. The shape is quite like that of the former, but the mesh structure of the shell wall and septa

is not well developed and indistinct in the earlier stage and almost disappeared in the later whorls. It is very abundant in the limestone from Katakupho, associated with *Neoschwagerina* and *Verbeekina*.

Loc.: Pesulia, Island of Katakupho.

Manuscript received January 16, 1929.



Cliché u. Druck Birkhäuser.

- 1a, b. *Staffella deprati* (YABE). Between Kalami and Soieri, Island of Hydra.
- 2. *Staffella* sp. Between Kalami and Soieri, Island of Hydra.
- 3. *Fusulinella* sp. Pesulia, Island of Katakupho.
- 4a, b. *Fusulina* cf. *elongata* FISCHER VON WALDHEIM. Pesulia, Island of Katakupho.
- 5. *Verbeekina Verbeeki* (GEINITZ). Pesulia, Island of Katakupho.
- 6. *Neoschwagerina craticulifera* (SCHWAGER). Pesulia, Island of Katakupho.
- 7. *Neoschwagerina* cf. *margaritae* DEPRAT. Pesulia, Island of Katakupho.
- 8a—d; 9b. *Sumatrina pesuliensis* n. sp. Pesulia, Island of Katakupho.
- 9a. *Depratella* sp. Pesulia, Island of Katakupho.

All figures enlarged about 10 ×.