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COMMENTS ON THE GENUS
VIRGULINELLA CUSHMAN, 1932
(FORAMINIFERIDA)

DREW HAMAN*
CHEVRON U.S.A., INC., NEW ORLEANS

Cushman and Ponton (1931) described *Virgulina miocenica* from the Miocene of Florida and Maryland. The specimens were recorded from the Shoal River, Choctawhatchee (?) and Oak Grove formations of Florida, and from the Choptank Formation, Chesapeake Beach, Maryland. The relationship of this species to *Virgulina pertusa* Reuss and *V. gunteri* Cushman was discussed in the same article. In 1932 Cushman erected the subgenus *Virgulinella* and selected *V. pertusa* Reuss as the subgenotype, stating (1932, p. 9), with reference to the subgenus, that "as far as known the species are limited to the Miocene." Reuss (1861) had, however, recorded *V. pertusa* from the "Miocene and Pliocene of western Europe," as noted by Cushman (1931, p. 32). The European Pliocene occurrence must have been regarded as suspect by Cushman considering his subsequent statement (1937, p. 31) that "the European species has been recorded from the Pliocene of Belgium, but there seems to be some question as to the validity of this record." The Miocene restriction of this subgenus was reiterated. However, in the same year Yabe and Asano (1937) recorded *V. lunata* as common in a sandstone of Pliocene age at Tjilegong, Bantam, West Java, unquestionably establishing a stratigraphic range extension of the subgenus into the Pliocene.

The taxon *Virgulinella* was accepted for decades as being a form of Miocene-Pliocene age, as is evidenced by Loeblich and Tappan (1964, p. C734) in their diagnosis of this taxon, which they regarded as a distinct genus. These authors indicated that the genus had a geographic extent of Europe (Germany, Netherlands) to North America and Indonesia.

Prior to the significant work of Loeblich and Tappan (1964) a report appeared that apparently has been overlooked by many authors in their analysis of this genus. In this work (Orlov, 1959) the taxon *Virgulinella* was accepted as a genus, and the species *V. pertusa* was recorded from the upper Maikop series (lower Miocene) of the Azerbaijan region, south Russia. A specimen of this species, from the collection of Z. V. Kuznetsova, was illustrated in this 1959 publication.

As this genus was originally described from the Gulf Coast province and as it has been utilized stratigraphically by many workers in this region (for example, Ellisor, 1940) the appearance of two recent papers on the taxon has prompted this short note. Two papers were published in 1976, both of which recorded *Virgulinella* from Recent sediments in the Indo-Pacific area. It is hoped that this article will emphasize the fact that the genus is not restricted to the Miocene and Pliocene on a world wide basis, and will make the record more complete by the inclusion of the Russian data. Ecologic

*Research Associate, Dept. of Geology, Tulane University, New Orleans.

data from these papers may be of assistance in paleoecologic interpretations of faunas containing this genus when such faunas are encountered in the Gulf Coast region.

Bhatia and Kumer (1976) described the Recent benthic foraminiferal fauna from 17 stations situated around Anjidiv Island, off Binge, west coast of India. These authors recorded *Virgulinea* sp. from two stations (no. 4 and no. 16) where the taxon comprised 0.19% and 0.25% respectively of the total foraminiferal fauna retrieved from these stations. The authors were unable to determine whether the specimens were alive or dead at the time of collection. In their discussion (1976, p. 244) of these occurrences, they make no mention of the possibility of the taxon having been reworked into the Recent sediments and analysis of their faunal lists indicates that there are no other taxa present to support a reworking theory. Consequently these occurrences reported as being Recent must be accepted. Environmental parameters were presented for all stations (*ibid.*, p. 241, table 1), some of which are selected here, as follows: Station 4: 13 meters water depth; 88.53% silt substrate; 29.4° C temperature; 9.5 pH; 34.56‰ salinity; 4.48 ml/l dissolved oxygen. Station 16: 10.5 meters water depth; 95.74% silt substrate; 29.5° C temperature; 10.8 pH; 34.49‰ salinity; 4.52 ml/l dissolved oxygen. The authors could not speculate their form but they state "there is no doubt that we have in our material specimens of this Mio-Pliocene genus" and that "there are apparently hitherto no records from the present-day seas." This latter statement would indicate that these authors believe that the taxon is indigenous in the Recent sediments they examined.

Grindell and Collen (1976) recorded *Virgulinea fragilis* from Wellington Harbour, New Zealand. They reported empty (dead) tests at 15 stations in the harbour. The water depths at these stations range from 16-31 meters. They further recorded living specimens (as determined by the rose Bengal method of Walton, 1952) at three stations, which ranged in depth from 16-20

meters. Individual station ecologic parameters were not presented, but a summary of the habitat of *V. fragilis* was given (*ibid.*, pp. 274, 277). In general, the harbour substrate is composed of silty to sandy muds. The area undergoes a 11°-18° C seasonal temperature fluctuation. The salinity ranges from 33.5-34.5‰, and there is no serious oxygen depletion in the turbid, efficiently mixed harbour waters. Two areas of pollution were defined in the harbour based on bacterial abundance. These areas were tentatively related to the samples that contained live specimens of this genus. The authors (*ibid.*, p. 278) noted that the tests they recovered were very fragile, and while test dimorphism could not be demonstrated, they felt that both microspheric and megaspheric generations were present. The same authors state: "Published data suggest evolution of the genus in North America or Europe in the Miocene, migration to Southeast Asia during the Pliocene, and further spread from there to New Zealand." Grindell and Collen make no reference to the Maikopian occurrence as noted by Orlov (1959), although this occurrence does not negate their dispersal hypothesis. The report of Bhatia and Kumer (1976), does not preclude the theory of Grindell and Collen (1976), although it would suggest that the post-Pliocene pattern is more complex than suggested.

In summary, the India and New Zealand occurrences of *Virgulinea* necessitate a range extension of this form from the Miocene to the Recent, although to date, no Pleistocene occurrences have been documented. The Recent occurrences of this taxon suggest that *Virgulinea* prefers a temperate to warm, shallow water habitat, (10.5-31 meters), with normal salinities, and a silty to sandy mud substrate.

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REVIEWS

FOSSILS, PALEONTOLOGY, AND EVOLUTION, by David L. Clark. Published by Wm. C. Brown Company, Dubuque, Iowa, 1976, second edition, x + 121 pp., illus., paperbound.

This book includes a brief history of paleontology and the origin of life, as well as a survey of the evolution of major groups of organisms that have left a fossil record. Four chapters deal with fossils as tools in the interpretation of Earth history, including consideration of Evolution and Biostratigraphy, Paleoecology, and Paleogeophysics. A final chapter provides a brief discussion of the possibility of extraterrestrial life, and whether, if such life should exist, it would resemble life as known on Earth.

LIFE THROUGH TIME, by Harold L. Levin. Published by Wm. C. Brown Company, Dubuque, Iowa, 1975, xi + 217 pp., illus., paperbound.

In this volume, the pageant of prehistoric life as revealed by the fossil record over the last three billion years is reviewed. The content is designed for the non-geologist undergraduate student who for aesthetic reasons desires an understanding of evolution and prehistoric life on Earth. The book is comprehensive, yet clear and readable. Included are a glossary and an index which are quite useful.

GRIT AND CLAY, by M. D. Picard. Published by Elsevier Scientific Publishing Company, Amsterdam, Oxford, and New York, 1975, xiii + 258 pp., paperbound.

How does a reviewer review a book of and about book reviews? This book is an amusing compilation of the author's published reviews interspersed with classic quotes and anecdotes. It should prove to be a pleasant experience for the reader.

--H.C.S.