NEW SPECIES OF *BATHYSIPHON* (FORAMINIFERIDA: TEXTULARIINA) FROM FRANCISCAN FLYSCH DEPOSITS, NORTHERNMOST CALIFORNIA

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Macroscopic invertebrate fossils are exceedingly rare in sedimentary rock units of the Franciscan Complex. A few occurrences of *Buchia* bivalves and ammonoid cephalopods have been reported (Bailey *et al.*, 1964, p. 115-124), but these could be transported faunal elements. Microfossils are fairly common, although they occur in isolated localities within a tectonically scrambled terrain of sedimentary units, greenstone blocks, and melange (Blake and Jones, 1974). The only unequivocally indigenous macrofaunal remains preserved in Franciscan sedimentary sequences are trace fossils, represented by locally diverse and abundant assemblages of previously unreported *Nereites* Ichnofacies forms (Miller, 1986).

In the course of a field search for examples of these newly discovered Franciscan trace fossils at Point Saint George, Del Norte County (Fig. 1), several specimens of the large, benthic foraminiferid, *Bathysiphon*, were collected. They occur at the bases of turbidite beds that feature Bouma T_{cde} and T_{de} divisions. These beds probably were deposited by intermittent turbidity currents on the distal, lower lobe of a submarine fan (see Walker and Mutti, 1973). Like the majority of the previous finds of Franciscan macrofossils, the specimens of *Bathysiphon* are, in all likelihood, transported. The geologic context of the fossil locality at Point Saint George has been described by Aalto and Murphy (1984). All specimens are deposited in the U. S. National Museum of Natural History (USNM), Washington, D. C.

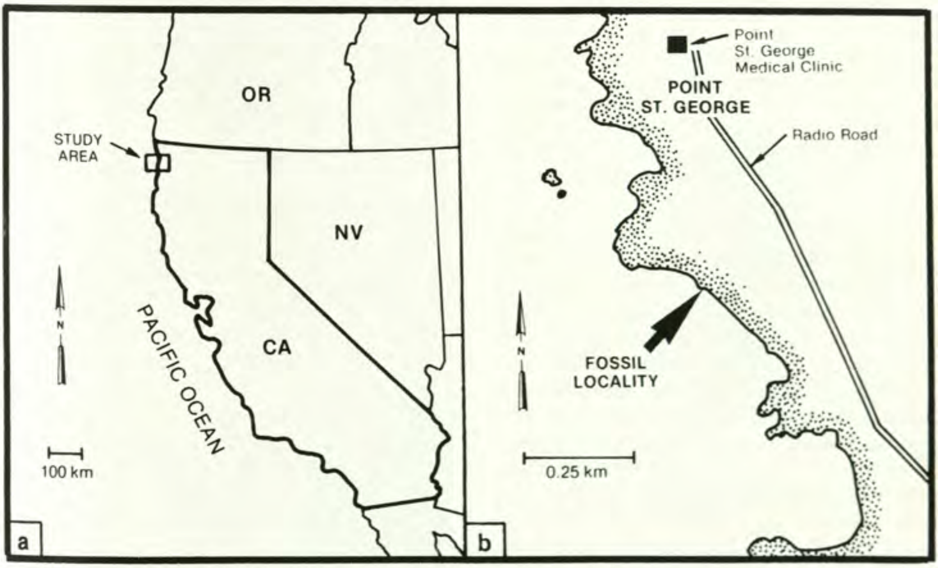

Figure 1. a) Index map showing general location of collecting area in northernmost California; b) Detail of the area near Point Saint George, coastal Del Norte County.

Order FORAMINIFERIDA
Eichwald, 1830
Suborder TEXTULARIINA Delage and
Hérouard, 1896
Superfamily AMMODISCACEA
Reuss, 1862
Family ASTRORHIZIDAE Brady, 1881
Subfamily RHIZAMMININAE
Rhumbler, 1895
Genus BATHYSIPHON M. Sars
in G. O. Sars, 1872
BATHYSIPHON AALTOI W. Miller, III, n. sp.
Figs. 2, 3

Description: Test free, large, elongate, and elliptical in cross-section; wall thick, siliceous, apparently composed of sponge spicules aligned subparallel to one another on the exterior surface in an overall axial orientation; cross-sections through wall showing either a weakly developed arrangement of radial silica fibers or structureless, translucent silica; test with weak annular constrictions, and an axial crease accentuated in collapsed test segments, forming a strong axial fold in deformed specimens.

Greatest outer diameter observed: 4.5 mm; average outer diameter (N = 5): 3.3 mm; greatest exposed segment length: 9 mm; thickness of walls: 0.5-1.0 mm.

Syntypes: USNM 399552 (Fig. 2a); USNM 399553 (Fig. 2b); USNM 399554 (Fig. 2c, B_1); USNM 399555 (Fig. 2c, B_2); USNM 399556 (Fig. 2c, B_3).

Type locality: Franciscan Complex, Late Mesozoic Central Belt; in ocean cliff exposing interbedded dark gray shale and olive sandstone, 0.5 km south of private medical clinic (old U. S. Coast Guard station) on Point Saint George, in area mapped as "Faulted Facies D" by Aalto and Murphy (1984, Fig. 3); west side of Radio Road, Del Norte County, California (Fig. 1b).

Figure 2. a) Specimen of *Bathysiphon aaltoi* (USNM 399552) on sole of turbidite bed (note broken section through siliceous test, and position of segment at oblique angle to bedding that is parallel to plane of the photograph); b) Specimen of *B. aaltoi* (B in photograph, USNM 399553) on the sole of a turbidite bed, with associated sleeve of argillaceous sediment (s) and a post-depositional burrow (b); c) Cluster of three *B. aaltoi* test segments (B_1, USNM 399554; B_2, USNM 399555; B_3, USNM 399556) associated with flute or tool mark on the sole of a turbidite bed (note axial crease in the two upper specimens). All bar scales represent 5 mm.

Discussion: The specimens of *B. aaltoi* are similar to *B. carapitanus* Hedberg, 1937, from the Tertiary Carapita Formation of Venezuela, and especially to *B. sakuensis* Asano, 1950, described from the Cretaceous Saku Sandstone, Hokkaido Island, Japan. They differ, however, in certain key respects: (1) both *B. aaltoi* and *B. carapitanus* have tests with annular constrictions and an axial furrow, but *B. carapitanus* features annulations that are much more strongly developed, and the test is smaller in size with finely arenaceous walls; (2) *B. aaltoi* is much closer in general appearance and size to *B. sakuensis*, but the latter also constructs its wall from fine sand or structureless siliceous material. *Bathysiphon aaltoi* appears to be unique among contemporary species of its genus in having an external wall with discontinuous, parallel, microscopic ridges arranged in an axial orientation (probably incorporated sponge spicules), and in having internal wall microstructure that in some instances comprises radial fibers of silica. The large test size, tubular shape, axial crease, annular constrictions, and light gray siliceous wall material would make *B. aaltoi* especially distinctive in field identifications.

This new foraminiferid is named in honor of Dr. Kenneth R. Aalto (pronounced *ȯl'-tō*), expert on the structure, sedimentary petrology, and geologic history of the Franciscan Complex in northern California, and Associate Professor in the Department of Geology, Humboldt State University.

Occurrence and significance: All specimens were collected from the bases of turbidite sandstone or siltstone beds within a sequence of Facies D flysch deposits (terminology of Walker and Mutti, 1973, p. 132). These sediments accumulated in overbank, lower suprafan lobe, or perhaps even adjacent deep-ocean basin floor depositional environments. All specimens were segmented and folded lengthwise to a greater or lesser degree. All occurred embedded at oblique angles to bedding (Fig. 2), and one cluster of three test segments was associated with what seemed to be tool or flute casts (Fig. 2c). These characteristics indicate that *B. aaltoi* was transported to the deep-water flysch environment of an active submarine fan. Whether transportation was from a proximal, upslope area within the fan complex, or from a distal, continental margin source, is not known.

Knowledge of the fossil record of Franciscan sedimentary units is very poor, so that any new report of macroscopic fossil remains, indigenous or exotic, is of special interest. The distribution of *B. aaltoi* is currently unknown, but its biostratigraphic potential as a zonal guide fossil should be carefully evaluated through further collecting. If the segments of *B. aaltoi* have been transported from benthic communities on the fan lobes, they provide a glimpse of the indigenous Franciscan deep-water fauna, which is represented for the most part by *Nereites* Ichnofacies trace fossils. One important aspect of finding *B. aaltoi* is to dispel the widely held notion that Franciscan rocks are unfossiliferous. Although these tectonically dismembered sedimentary blocks are never rich in shelly fossil beds, they do contain a localized, unique fauna and ichnofauna that indicate special conditions of life, death, and preservation on the deep-sea floor. Fossils such as *B. aaltoi* have potential as paleoenvironmental and biostratigraphic guides in a lithodemic unit in which the fossil record has been largely overlooked.

Figure 3. Reconstruction of a typical segment of *Bathysiphon aaltoi*.

I thank Dr. Kenneth R. Aalto for showing me the fossil locality at Point Saint George and for many stimulating conversations on Franciscan rocks, Dr. Emily H. Vokes for adroit editorship, and Ms. Sandi Potter for preparing the locality map.

LITERATURE CITED

AALTO, K. R., and J. M. MURPHY, 1984, Franciscan Complex geology of the Crescent City area, northern California, *in* M. C. BLAKE, JR. (ed.), Franciscan Geology of Northern California: Soc. Econ. Paleont. Min., Pacific Section, v. 43, p. 185-201.

BAILEY, E. H., W. P. IRWIN, and D. L. JONES, 1964, Franciscan and related rocks, and their significance in the geology of western California: California Div. Mines Geol. Bull. 183, 177 p.

BLAKE, M. C., JR., and D. L. JONES, 1974, Origin of Franciscan melanges in northern California, *in* R. H. DOTT, JR., and R. H. SHAVER (eds.), Modern and Ancient Geosynclinal Sedimentation: Soc. Econ. Paleont. Min., Spec. Publ. 19, p. 345-357.

MILLER, W., III, 1986, Discovery of trace fossils in Franciscan turbidites: Geology, v. 14, p. 343-345.

WALKER, R. G., and E. MUTTI, 1973, Turbidite facies and facies associations, *in* G. V. MIDDLETON and A. H. BOUMA (co-chairmen), Turbidites and Deep-Water Sedimentation: Soc. Econ. Paleont. Min., Pacific Section, Short Course Notes, p. 119-150.

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REVIEW

THE UTILITY OF REGIONAL GRAVITY AND MAGNETIC ANOMALY MAPS, edited by William J. Hinze. Published by the Society of Exploration Geophysicists, Tulsa, Oklahoma, 1985, xiv + 454 pp., 8 1/2 x 11 1/4 inches, illus. (some in color), index, $75.00

Making maps of the Earth's gravity and magnetic fields has a long and distinguished history as part of the study of structural and petrological variations within the lithosphere. Technological advances following World War II made efficient and precise gravity and magnetic mapping of extensive regions feasible. However, much of the vast amounts of gravity- and magnetic-anomaly data collected by industrial firms in mineral-resource exploration and other non-governmental agencies generally have not been available to the public. In the United States, publicly available data recently have been composited into new and improved country-wide gravity- and magnetic-anomaly maps. In 1975, the Society of Exploration Geophysicists and the United States Geological Survey jointly organized gravity- and magnetic-anomaly map committees to prepare anomaly maps of the United States. In late 1982, a revised Gravity Anomaly Map of the United States was published by the SEG, and the Composite Magnetic Anomaly Map of the Conterminous United States and the Magnetic Anomaly Map of Alaska were released by the USGS.

Small-scale versions of these maps are reproduced in color in the present volume together with the most recently published gravity- and magnetic-anomaly maps of Canada. In recognition of the publication of these national maps, and to illustrate the many uses of such maps, a series of special technical sessions was held at the 52nd Annual International Meeting of the SEG in Dallas, Texas, in fall 1982. Of the fifty-three papers presented in these sessions, thirty-three were prepared for publication and are published in this volume. Digital two-dimensional filtering can be employed to produce maps of selected attributes of the anomaly fields such as gradients, wavelength ranges, and strike directions. The importance of digital filtering in data analysis is demonstrated by the contents of this symposium, as most of the papers use some form of digital processing. These papers illustrate the wide use of digital data sets, ranging from broad crustal structure investigations to exploration for mineral resources. The editors envision the content of this work as a "benchmark from which we can expand the understanding of our Earth by improved regional anomaly maps and data sets, additional processing of regional digital-data sets by filtering and inversion, and enhanced integration of the anomaly data with available geological and collateral geophysical data." This book is well-designed and handsomely produced and should serve well the purposes for which it was prepared.

—H.C.S.