tion. The zonation of the pyrite probably indicates outward diffusion of H_2S from buried centers of microbial activity; in any case, it shows that the pyrite is authigenic rather than detrital. The fact that some, if not all, of the fossil microorganisms apparently belong to the Actinomycetales, which are found chiefly in nonmarine habitats, is consistent with the theory that the argillites were laid down as lake muds, and possibly suggests the existence of soil and a soil microflora on middle Precambrian land surfaces. Contemporary actinomycetes are abundant in lake waters, recent lake sediments, and soil, and they include anaerobic as well as aerobic forms (*5*).

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Ostracod "Living Fossils": New Finds in the Pacific

Abstract. *New ostracod "living fossils" have been discovered in samples of Recent marine sediment collected from several Pacific islands. The finds include a male anatomy having several primitive features which, in conjunction with primitive features in the shell, necessitate reconsideration of current opinions on the phylogeny of freshwater ostracods.*

In 1963 "floats" were obtained (*1*) of 58 Recent samples collected (*2*) during 1949 from Saipan, Mariana Islands; and 55 Recent and fossil samples collected (*2*) in 1951 from Onotoa atoll, Gilbert Islands, were later floated (Fig. 1). The Saipan material contained only four specimens, compared with 13 (one fossil) from the Onotoa samples, of a new ostracod genus that both anatomically and in carapace features qualifies as a "living fossil." Close relatives of the new genus belong with it in the dominantly Paleozoic superfamily Healdiacea, which is often a characteristic element in Devonian-Pennsylvanian faunules (*3, 4*).

Subsequent skimming through the literature revealed that in 1890 G. S. Brady recorded from Samoa a Recent species, *Cytherella* (?) *tumida*, evidently belonging to this new genus. Unfortunately Brady's only specimen was destroyed during an attempt at dissection; consequently the species does not appear in his collections (*5*). The species from Onotoa, however, accords with Brady's illustrations and description so closely that I consider it identical with his taxon (*6*).

Distinguishing primitive features include a clustered adductor-muscle scar pattern, poorly developed marginal areas, a five-jointed endopodite of the second antenna, a jointed clasping-type palp on the male fifth limb, setiferous ventral segments on the sixth and seventh limbs, a furca intermediate between Myodocopida and Podocopida types, and probable segmentation in the posterior part of the body (*7*). The carapace is small (in adults, about 0.5 mm in length), often brown but sometimes pallid, smooth, and elongate-ovate in dorsal view; it is further characterized by strong left-valve overlap and a distinct merodont hingement.

In general, the anatomy is Podocopida-like and in some significant details resembles that of Darwinulidae and Cyprididae. For example, the distal mandible endopodite joint is elongate and bears six slender terminal spines, and the seventh limb is a subsidiary walking leg (as in Darwinulidae), while the second antenna exopodite is a small bristle-bearing plate and the furca is well developed as in most Cyprididae. Darwinulidae are predominantly freshwater; Cyprididae are predominantly freshwater except for some primitive genera which are marine or polyhaline.

The warranted inference, that these freshwater groups evolved from marine animals having an aggregate adductor-muscle scar pattern, requires reappraisal of current systems of ostracod classification, although the relation of Darwinulidae to Healdiacea has been suggested on paleontological grounds (*4, 8*).

As yet only a male anatomy has been found among the 17 specimens obtained from Saipan and Onotoa, but I hope that this report will stimulate further collecting or a check of earlier Pacific

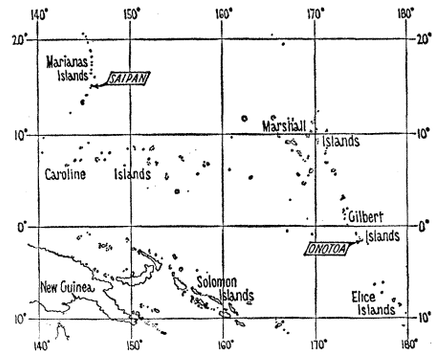

Fig. 1. Pertinent area of the southwest Pacific.

collections, or both. We already know that other ostracod living fosils (Punciidae) occur at its southwestern margin, off northern New Zealand, although only empty valves have yet been found (*9*). Such material is invaluable for the development of a natural classification, which is the principal object of a currently active committee of workers with ostracods (*10*). A more rigorous classification will enhance the already-considerable usefulness of these animals in such diverse economic spheres as oil exploration and development of fisheries.

From another point of view, since ostracods range from Lower Cambrian to Recent, detailed studies of the anatomy and shell of their "living fossils" will provide useful guidelines for any consideration of "protostracans," which were among the pioneer groups of complexly organized animals.

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