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By
PAUL S. CONGER
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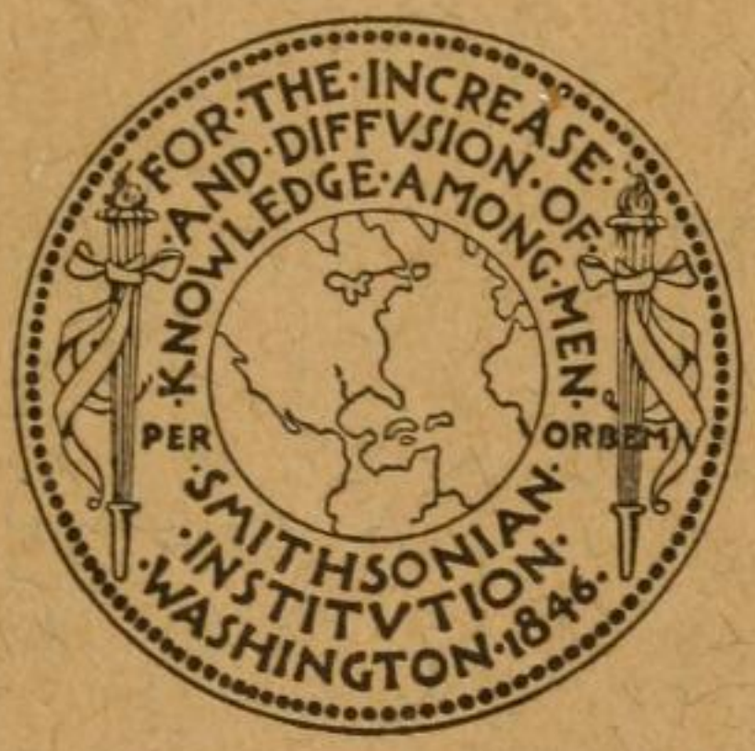

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(With One Plate)

A rather distinctive and interesting marine benthic epiphytic diatom from the bottom of Honolulu Harbor, Hawaii, was collected by Dr. R. E. Johannes of the Department of Zoology, University of Hawaii, and isolated and cultured by him for use in investigations on phosphorus metabolism, and as a source of food for amphipods which were being used experimentally. He submitted it to me for identification, and I am indebted to him for bringing it to my attention. I am also indebted to Dr. David L. Correll, of the Division of Radiation and Organisms of the Smithsonian Institution, for carrying the diatom in culture for a few weeks. I required access to adequate fresh supplies for this study, because the diatom proved too delicate to allow satisfactory permanent preparations to be made.

The diatom cultures well, multiplies rapidly, and is very hardy in artificial seawater culture medium. For these reasons it should be a very good species for investigational purposes and a good experimental form for wider use. Whether it will continue to thrive and can be maintained indefinitely away from supplies of fresh seawater remains to be seen. For all their hardiness under good conditions, these forms are very sensitive and demanding.

It would also be desirable to make electron micrographic studies of it to determine its more intricate and finer structure, but I have not been in a position to do this. Because of the very great delicacy of the shell, the structure is not readily seen with the optical microscope. For this reason the electron micrographic studies would be helpful in its identification.

Although it is not a particularly diminutive form in general dimensions, it is one of the most delicate ones I have had occasion to study. I have given it the name *subhyalina* to indicate its extremely tenuous and gossamer character.

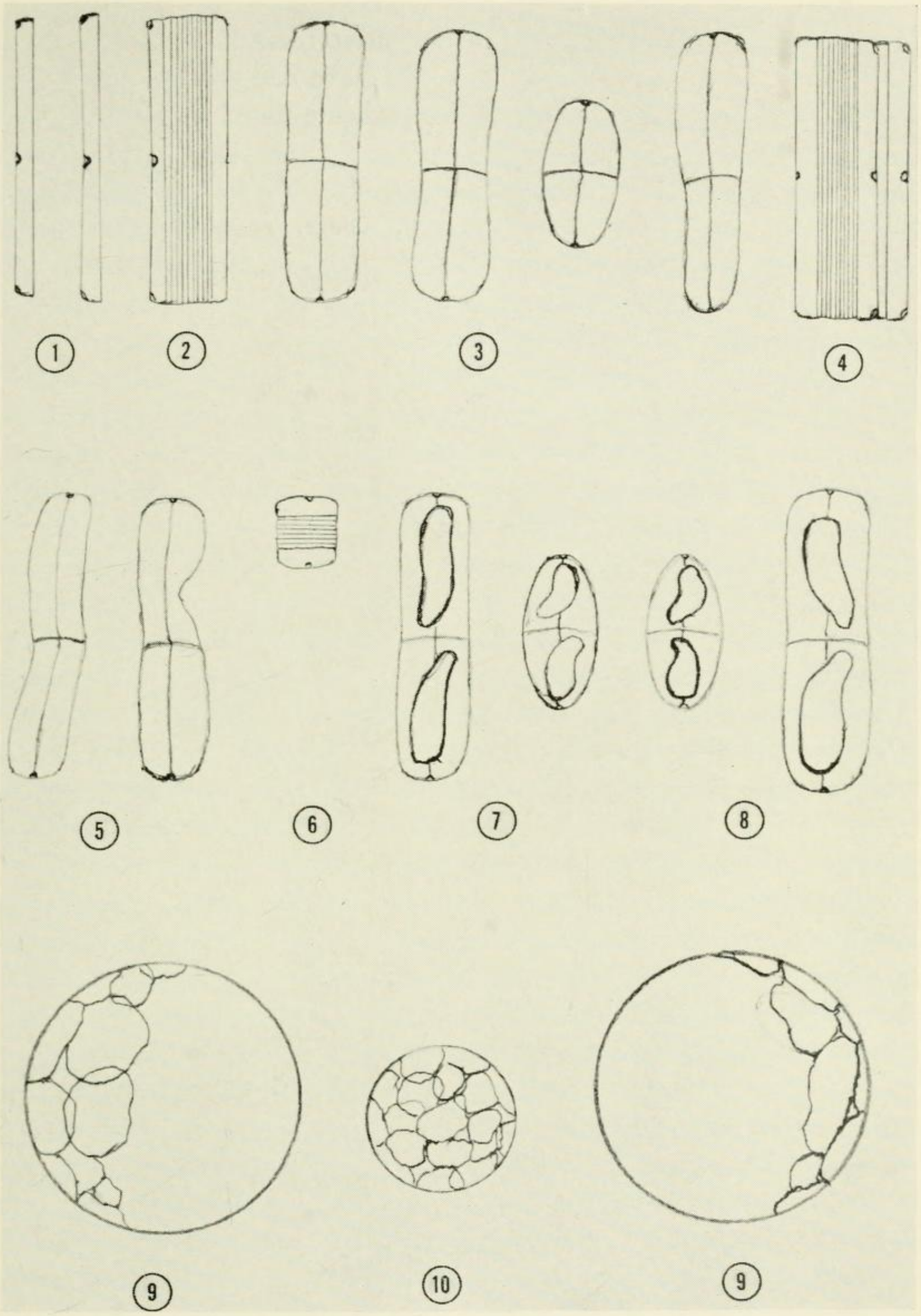
ACHNANTHES SUBHYALINA Conger, sp. nov.

Plantae unicellulares; valvae breves breviter oblongae vel linearioblongae, interdum paullo apice constrictis, 5-10μ longae, 3-4μ latae, apice late rotundatae; valva superior cum pseudoraphe angustissima, recta, mediam valvae occupante, cum linea mediana transversa angustissima, nodulis terminalibus et nodulo centrali indeterminato, tota superficie valvae hyalina; valva inferior similis; chromatophori brunnei, pyriformes, alterni vel oppositi.

Habitat: In seawater of Honolulu Harbor, Hawaii, originally collected by R. E. Johannes.

Frustules short- to linear-oblong, or long-rectangular with rounded ends, the latter type sometimes slightly, almost imperceptibly, constricted in face (valve) view; girdle view rectangular with rather sharp (or scarcely rounded) corners; valve surface flat and straight apically, sometimes slightly depressed in the center; valve mantle narrow, girdle zone two to six times as wide as valve mantle, with a lined appearance as if comprised of intercalary bands; end view of frustule square-rectangular with rounded corners; valve surface mildly convex transapically, with rounded margins; raphe a straight narrow line; valve with a median, narrow, transapical groove crossing it at right angles to raphe, in girdle aspect the groove, due to focal-depth refraction, with the appearance of a triangular or cone-shaped bright spot resembling a central nodule (believed a false optical effect); the slightly thickened corners of the valve end with the impression of terminal nodules in girdle view; valve surface markings cannot be resolved with the optical microscope. Valves 5-10μ long, 3-4μ wide.

Chromatophores in young, actively growing cells are bright orange-brown, more or less "tear-" or "pear-shaped," with truncate ends, one in each end of the cell, with narrow ends toward the cell center, characteristically alternate, much less frequently opposed (that is, on the same side), occupying (estimated) one-third to one-half the cell volume, the alternate arrangement giving frequently a twisting, sigmoid, scolio, or amphiproroid effect (actually not present). In older cells, the chromatin material is either duller, darker brown, or paler, and occupies more of the cell volume in a somewhat irregular pattern, but



Achnanthes subhyalina, sp. nov.

(*1*) Single valves (girdle view); (*2*) complete frustule (girdle view); (*3*) valves (face view); (*4*) frustule (girdle view) with extra attached valve, sometimes seen; (*5*) abnormal valves; (*6*) end view of one frustule; (*7*) frustules (valve view) with chromatophores alternately arranged; (*8*) same, with chromatophores oppositely arranged; (*9*) spherical "resting" spore bodies with peripheral chromatin masses; (*10*) same completely filled by chromatin masses.

always leaves a central (transapical) stauros-like area, in both valve and girdle aspect.

The shells are exceedingly delicate and gossamer-like and are not amenable to conventional microscopic preparation; they disappear completely in strong acid but withstand dilute hydrochloric and sulfuric acids, which turn the chromatin material green but do not digest it. The cells are very slightly silicified and are destroyed by incineration. No mounting is possible by conventional methods.

The vegetative cell population contains occasional spherical, transparent bodies, peripherally pigmented with dense, essentially round, but more or less irregular, pigment masses over a quarter or less of the periphery of the sphere; the remainder of the cell is clear. The diameters of these spherical bodies range in size from about the length of the frustules to up to twice this length. Occasionally the whole sphere is filled with peripheral pigment bodies, obviously chromatin material similar to that of the diatoms, although no "shell" forms are distinguishable, or if present are collapsed. These pigment masses appear to be either residues of former cells or perhaps parts of potential ones. They become quite numerous in old, stagnant, decadent cultures. (Whether they are "auxospores," or some reproductive phase, or a protective or degradational resting body in senile and decadent cultures I am unprepared to conclude.)

The cells are actively motile in new and healthy cultures, moving in a mostly linear course, with few reversals; the movement in a reversed direction is short (usually less than a cell length) before forward motion is again resumed. The rate of movement is about five to eight times the cell length in a minute. The cells in aging cultures, even though they may appear otherwise healthy, are slower, moving little or but a cell's length in a longer time.

The cells are very strongly adhesive to the substrate in an Erlenmeyer flask culture, making an even brown coating on the bottom of the flask, and require somewhat violent shaking to loosen them; in contrast, for instance, with *Phaeodactylum tricornutum,* which is either nonadhesive or readily stirred. Once detached from the substrate, they quickly form in dark brownish, free-floating aggregates or clumps that never adhere again to the bottom, but adhere strongly to one another.

This diatom is probably one that migrates in its natural benthic environment in response to diurnal illumination, although there is no observational evidence of this.

In young, healthy cultures among large populations there are no

empty, "dead" cells (unpigmented frustules), which is the only condition in which they could be examined morphologically at all adequately. In quite old cultures, empty frustules, and occasionally separate valves, become more frequent. Empty frustules or valves are dim-whitish in appearance and almost invisible in water. This "whitish" appearance of the diatom in water under ordinary full-field illumination suggests the advantage of "dark-field" illumination and, indeed, the latter (or "phase-contrast") is a good way to bring out more prominently the obscure cell features. The diatoms are most readily located by the much greater visibility, in girdle view, of the false "central nodule" which can be picked up as a bright triangular spot, from which the rest of the cell outline can then be followed. Were it not for this the shells would not be easy to make out or would be overlooked completely. In valve aspect the raphe and transapical groove are the more easily seen features, appearing as moderately bright white lines.

Although this diatom is necessarily described on fewer structural features than usual, it is felt that it should be readily identifiable from these features, and by the very characteristic "tear-" or "pear-shaped," alternately arranged chromatophores, which afford it a rather conspicuous and distinctive character. I have not been able to secure a separate view of the inferior valve, and so that has been hypothecated from the girdle view of the whole frustule.

There is difficulty and uncertainty in making out even the generic status, although the diatom character is immediately evident and not at all to be questioned. The prevalence, range, and frequency of *Achnanthes subhyalina* are not likely soon to be determined. Its small size, frailty, and general obscurity make it a form not likely to be found by the conventional methods of examination of natural materials that account for the discovery of most species of diatoms. It is unlikely to be found except when in quantity in isolated cultures, which suggests that there may well be many other such diminutive forms that have escaped notice due to the limitations of conventional procedures. On the other hand, the readiness and rapidity with which it grows and its evident hardiness suggest that it may be a widely distributed and abundant species. Because of its frailty and low degree of silicification, the shells are not likely to persist after death in the natural environment or to be recognized if they do persist. It must be observed in the living state for determination or recognized from dead shells in culture material. By present methods no permanent preserved "type" preparations, such as microscope slides, have

been possible. Material preserved in formalin, alcohol, or other liquid preservative is of uncertain and doubtful value. The living culture may best serve as confirmatory or "type" material.

In the active, healthy cultures there is some range in the size and shape of the cells, and the size, shape, and arrangement of the chromatophores, but this is well within the limits of expectation. In the large numbers of specimens observed the growth pattern is very consistent and typical, and the incidence of distorted or otherwise abnormal forms is exceedingly low. The generally healthy vigor of the species implies that it thrives under cultural conditions and adapts readily to them. The adaptability suggests it as a dependable and useful culture organism for many experimental purposes. The discovery of *Achnanthes subhyalina* suggests the importance of widespread "culturing" as a valuable exploratory method, as yet meagerly employed, for the recognition of many minute, obscure, and transient forms which have so far eluded detection and may continue to do so in the future without this method. It is more and more recognized that these watery, next to invisible, transitory forms may comprise a substantial, functionally important constituent of the micropopulation of the ocean. Hitherto they were a "blindspot" in our studies, which cannot afford to be overlooked any longer. They will be, at best, a tedious, difficult, and special study.