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Observations on Southwestern Diatoms. II. *Caloneis latiuscula* var. *reimeri* n. var., *Cyclotella pseudostelligera* f. *parva* n. f., and *Gomphonema montezumense* n. sp., New Taxa from Montezuma Well National Monument

Author(s): David B. Czarnecki and Dean W. Blinn

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**OBSERVATIONS ON SOUTHWESTERN DIATOMS.  
II. CALONEIS LATIUSCULA VAR. REIMERI N. VAR.,  
CYCLOTELLA PSEUDOSTELLIGERA F. PARVA N. F., AND  
GOMPHONEMA MONTEZUMENSE N. SP., NEW TAXA  
FROM MONTEZUMA WELL NATIONAL MONUMENT<sup>1</sup>**

DAVID B. CZARNECKI<sup>2</sup> and DEAN W. BLINN

Department of Biological Sciences, Northern Arizona University,  
Flagstaff, Arizona 86011

CZARNECKI, D. B. & BLINN, D. W. 1979. Observations on southwestern diatoms. II. *Caloneis latiuscula* var. *reimeri* n. var., *Cyclotella pseudostelligera* f. *parva* n. f., and *Gomphonema montezumense* n. sp., new taxa from Montezuma Well National Monument. *Trans. Amer. Micros. Soc.*, 98: 110–114. Morphological features are presented which describe three new diatom taxa, *Caloneis latiuscula* var. *reimeri*, *Cyclotella pseudostelligera* f. *parva*, and *Gomphonema montezumense* from Montezuma Well National Monument, a unique solution-collapse basin in north-central Arizona. Their occurrence, thus far, appears to be restricted to this environment.

Montezuma Well National Monument, Yavapai County, Arizona is a unique and stable aquatic system which has been designated as a hard carbonate, high sodium chloride thermal spring (Cole & Barry, 1973). Chemical data suggest this system is highly mineralized ( $\text{SiO}_2 = 22$  mg/l;  $\text{Ca} = 106$  mg/l;  $\text{Mg} = 43$  mg/l;  $\text{Na} = 46$  mg/l;  $\text{K} = 5.75$  mg/l;  $\text{Cl} = 37$  mg/l;  $\text{HCO}_3^- = 680$  mg/l) and of slightly acidic to circumneutral pH (6.6–6.8). These data remain relatively constant throughout the year with variation rarely exceeding 10%. Temperature ranges of 16–26 C occur on a yearly basis, although monthly increments have yet to exceed  $\pm 2$  C. Specific conductance is relatively constant at nearly 1 millimho/cm. Other limnological features have been well documented (Cole, 1963, 1965, 1968, 1975; Cole & Barry, 1973; Cole & Batchelder, 1969). Unfortunately, with the exception of the publication by Kidd & Wade (1963), little is known about the algal composition of the Well, particularly the diatom flora.

Biweekly collections of the epipellic and epilithic diatom flora obtained by the senior author for nearly two years, and additional collections extending from 1973, indicate a quite stable flora of ca. 80 taxa. Of these, three have not been previously described.

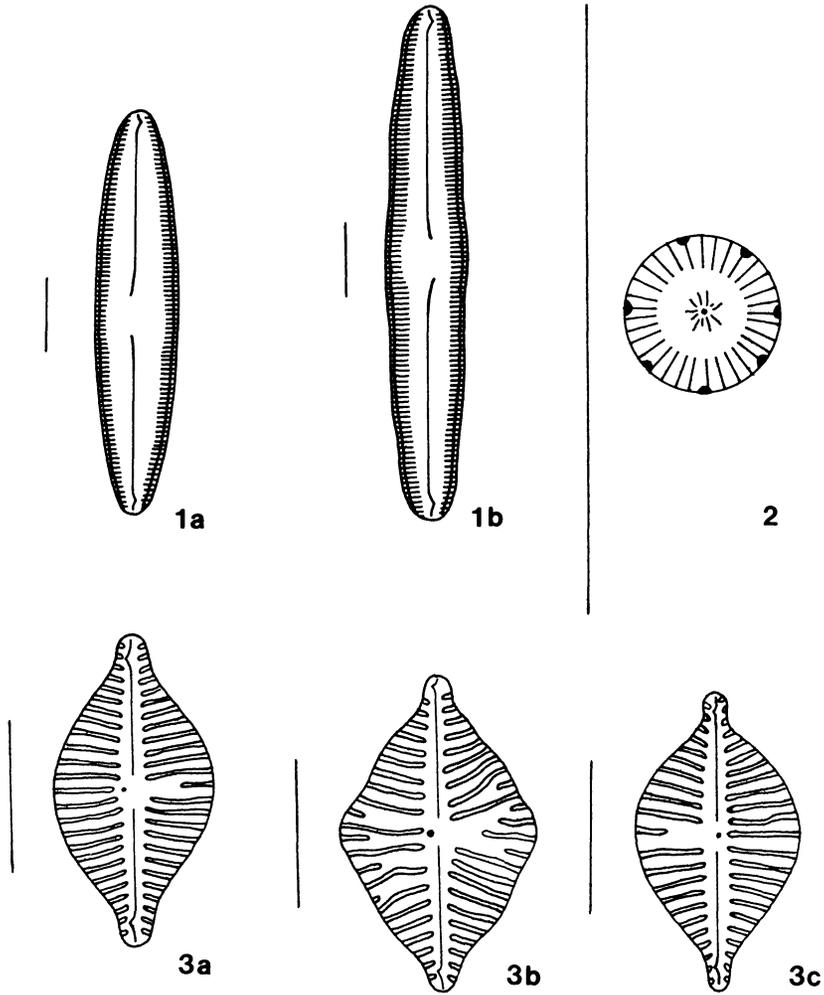
**MATERIALS AND METHODS**

Epipellic collections, obtained by suction of the uppermost sediment, and epilithic collections, obtained by scraping, were made at the so-called "Swallet" outlet of Montezuma Well. These collections were "cleaned" by peroxide-dichromate oxidation; aliquots were then mounted in Hyrax for micro-

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<sup>1</sup> We wish to thank Dr. Charles W. Reimer for comments regarding the status of these taxa. Also, special thanks are due to Dr. Hannah Croasdale for editing the Latin diagnoses and to Phyllis Czarniecki for preparing the original illustrations. The aid and encouragement of Mr. Thomas Ferrell and Mr. Jack Beckman, both National Park Rangers at Montezuma Well National Monument, was greatly appreciated. Publication costs are being met, in part, by a grant from the Darbaker Fund of the American Microscopical Society.

<sup>2</sup> Present address: Department of Botany, University of Minnesota, St. Paul, Minnesota 55108.



FIGS. 1a-b. *Caloneis latiuscula* var. *reimeri*, valve views. FIG. 2. *Cyclotella pseudostelligera* f. *parva*, valve view. FIGS. 3a-c. *Gomphonema montezumense*, valve views. All line scales are 10  $\mu$ m.

scopic observation. Taxonomic determinations were made using Zeiss phase-contrast optics at 1250  $\times$ .

SYSTEMATIC DESCRIPTIONS

*Caloneis latiuscula* var. *reimeri* n. var.

(Fig. 1)

*Valvae lineari-fusiformes, paululum triundulatae in frustulis maioribus, apicibus acute rotundatis. Area axialis fusiformis, lata, tertiae latitudinis valvae vel maior; area centralis nulla aut parva, unilateralis. Raphe simplex, extremitatibus proximis paululum inflatis, nodulum versus centralem fere unilateralem aliquantulum unilateraliter deflecta. Striae breves, punctatae*

*parallelae*, 17–19 in 10  $\mu\text{m}$ . Puncta 32 in 10  $\mu\text{m}$ . Linea longitudinalis distincta submarginalis. Longitudo 47–75  $\mu\text{m}$ . Latitudo 10–14  $\mu\text{m}$ .

Valves linear-fusiform, slightly triundulate in larger frustules, with acutely rounded apices. Axial area fusiform, broad, one-third or more the width of the valve; central area absent, or small, unilateral. Raphe simple, proximal ends slightly inflated, slightly unilaterally deflected toward the nearly unilateral central nodule. Striae short, punctate, 17–19 in 10  $\mu\text{m}$ . Puncta 32 in 10  $\mu\text{m}$ . Longitudinal line distinct, submarginal. Length 45–75  $\mu\text{m}$ . Width 10–14  $\mu\text{m}$ .

Type-locality: Montezuma Well National Monument, Yavapai County, Arizona.

Holotype: NAU 1002 (on deposit at the Academy of Natural Sciences, Philadelphia).

Isotypes: NAU 1002A; NAU 1002A2 (on deposit at the Academy of Natural Sciences, Philadelphia); NAU 1002A3 (on deposit at the British Museum). Additional isotype material may be obtained from the senior author.

*Cyclotella pseudostelligera* f. *parva* n. f.  
(Fig. 2)

*Haec forma a forma typica differt ut minor, paululum silicea, et costas paululo tenuiores habens. Costae 20–24 in 10  $\mu\text{m}$ . Diameter 2.5–5  $\mu\text{m}$ .*

This form differs from the type-species in being smaller, less siliceous, and with slightly finer costae. Costae 20–24 in 10  $\mu\text{m}$ . Diameter 2.5–5  $\mu\text{m}$ .

Type-locality: Montezuma Well National Monument, Yavapai County, Arizona.

Holotype: NAU 1003 (on deposit at the Academy of Natural Sciences, Philadelphia).

Isotypes: NAU 1003A; NAU 1003A1; NAU 1003A2 (on deposit at the Academy of Natural Sciences, Philadelphia); NAU 1003A3 (on deposit at the British Museum). Additional isotype material may be obtained from the senior author.

*Gomphonema montezumense* n. sp.  
(Fig. 3)

*Valvae ellipticae aut elliptico-lanceolatae, lateribus irregularibus et apicibus basibusque rostrato-capitatis protractis. Area axialis tenuis, linearis, area centralis parva, unilateralis, per striam medianam praecisam formata. Stria media opposita in punctum remotum desinit. Striae punctatae radiataeque, 11–14 in 10  $\mu\text{m}$ . Puncta 28 aut plura in 10  $\mu\text{m}$ . Longitudo 12–23  $\mu\text{m}$ . Latitudo 8–13  $\mu\text{m}$ .*

Valves elliptical to elliptical-lanceolate with irregular margins and protracted rostrate-capitate apices and bases. Axial area narrow, linear; central area small, unilateral, formed by a shortened median stria. The opposite median stria terminates in an isolated punctum. Striae punctate, radiate, 11–14 in 10  $\mu\text{m}$ . Puncta 28 or more in 10  $\mu\text{m}$ . Length 12–23  $\mu\text{m}$ . Width 8–13  $\mu\text{m}$ .

Type-locality: Montezuma Well National Monument, Yavapai County, Arizona.

Holotype: NAU 1001 (on deposit at the Academy of Natural Sciences, Philadelphia).

Isotypes: NAU 1001A; NAU 1001A1; NAU 1001A2 (on deposit at the Academy of Natural Sciences, Philadelphia); NAU 1001A3 (on deposit at the

British Museum). Additional isotype material may be obtained from the senior author.

#### DISCUSSION

Populations of *Caloneis latiuscula* var. *reimeri*, named after Dr. Charles Reimer of the Academy of Natural Sciences of Philadelphia, are somewhat variable in the shape of the valve and central area. Although similar in dimensions, shape at these dimensions, and number of striae, to *C. latiuscula* var. *formosaeformis* Mayer, var. *reimeri* exhibits a consistently broader axial area and shorter striae. The tendency for an increase in central tumidity with increasing valve length, along with the broad axial area and short striae, warrants the distinction of this diatom at the varietal level. According to Drs. Reimer & Patrick (personal communication), this diatom appears to be an associated part of *C. latiuscula* (Kütz.) Cl.

*Cyclotella pseudostelligera* f. *parva*, although possibly an anomaly associated with the life cycle of *C. pseudostelligera* Hust. (Dr. Charles Reimer, personal communication), maintains its feeble silicification, small size, and relatively fine costae. Our collections of this organism from Montezuma Well, encompassing nearly five years, indicate f. *parva* is quite stable in these characters as described. Lowe (1975) made no mention of these features in his ultrastructural survey of *Cyclotella*. Belcher et al. (1966) observed that populations of *C. pseudostelligera* Hust. under silica stress resembled *C. woltereckii* Hust. and had a tendency to lack central ornamentation. These feebly silicified forms when placed in media of adequate silica yielded more typical *pseudostelligera* features. However, the absence of silica limitation in Montezuma Well and the maintenance of very small individual frustules suggests the above phenomenon does not explain the occurrence of f. *parva*.

*Gomphonema montezumense* named for the ecosystem to which it is apparently restricted, resembles at times *G. carolinense* Hagelst. and *G. parvulum* Kütz. (as *G. parvulum* var. *lagenula* Freng.) in the shape of the valve. The consistent occurrence of these "abnormal" looking *Gomphonema* and the absence of any transition forms in Montezuma Well suggest specific status. Dawson (1972, 1973) and Wallace & Patrick (1950) do not include such variability in their excellent discussions of the morphological variation in *G. parvulum* Kütz. to which *G. montezumense* is probably closely related.

In terms of their ecological significance, the diatoms, both in number and diversity, far outshadow other algal groups in Montezuma Well. *Cyclotella pseudostelligera* f. *parva* dominates in number all other diatoms in the epipelagic community and is second in number only to *Rhoicosphenia curvata* (Kütz.) Grun. in the epilithic community. The high relative abundance and relative frequency of this diatom in both communities suggest that it is the single most important component of the diatom flora. *Caloneis latiuscula* var. *reimeri* and *Gomphonema montezumense*, although observed in nearly every epipelagic collection (only rarely in epilithic collections), have yet to individually exceed 1% of relative abundance estimates.

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## THE NEUROANATOMY OF *POROCEPHALUS CROTALI* HUMBOLDT, 1811 (PENTASTOMIDA)<sup>1</sup>

PATRICK D. HOLLIS

Microbiology and Infectious Diseases, Southwest Foundation for  
Research and Education, San Antonio, Texas 78284

HOLLIS, P. D. 1979. The neuroanatomy of *Porocephalus crotali* Humboldt, 1811 (Pentastomida). *Trans. Amer. Micros. Soc.*, 98: 114-122. The neuroanatomy of the North American pentastomid, *Porocephalus crotali*, is composed of a bilobed subesophageal ganglion, ganglia with associated peripheral nerves, and paired cuticular bulbous sensory papillae. The neurohistology of this species is illustrated and contrasted with similar features found in other closely related pentastomid species. Common features shared with other porocephalids of this species are: a compact subesophageal ganglion, paired major nerves, a neuropile core surrounded by a cellular rind bearing grape-like clusters of ganglion cells, and paired cuticular bulbous sensory papillae. Variation from other porocephalids was noted with respect to sensory neurons found in the sensory corpuscles. A setiferous-type sensory neuron was the most commonly observed sensor, while compact, nonsetiferous, neurohypodermal cells were observed within the cephalic papillae of *P. crotali*. Many of the sensory neurons previously described for other pentastomes were not observed in this species. Sensory corpuscles were located in five types of bulbous papillae: cephalic, hook, primary, ventral, and ventrolateral papillae.

The two pentastomid orders, Cephalobaenida and Porocephalida, differ in their neuroanatomy. The cephalobaenids possess an elongated ventral

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