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TAXONOMIC NOTE ON THE VARIABILITY OF *NEOBUCCELLA BABSAE* IN HOLOCENE SEDIMENTS OF BAJA CALIFORNIA SUR, MEXICO

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INTRODUCTION

Foraminiferal and ostracode studies at Laguna de La Paz, Baja California Sur (Segura-Vernis and Carreño, 1991) show the ubiquitous presence of one foraminiferal species, doubtfully assigned by the authors to the genus *Polystomellina*. Further study of the material allows its correct assignment to *Neobuccella babsae* (Brenner), as well as the recognition of several morphological variants.

In a paper concerning the distribution and origin of the benthic foraminifera of the Panamanian Province, Crouch and Poag (1987) noticed that *N. babsae* varies greatly in the number and distribution of sutural and apertural pustules, as well as in the height of its spire. Accordingly, and because *Neobuccella angelensis* and *Neobuccella elaborata* described by McCulloch (1977) were found together with *N. babsae* in the Gulf of California, the same authors concluded that those might be ecophenotypic variants of the last one.

During recent years, many authors have emphasized that recognition of the morphological variants of benthic foraminiferal populations, as ecophenotypes, is a valuable interpretative tool for paleoecological, biogeographic and biostratigraphic studies. On the other hand, some authors (*e. g.*, Haynes, 1992) maintain that this practice has only generated nomenclatural confusion.

Anyhow, the infraspecific distinction on benthic foraminifera plays an important role in the comprehension of the spatiotemporal evolution of the species. The main purpose of this paper is to describe the morphological variation of *N. babsae* present at Laguna de La Paz, and its significance as an element of the late Cenozoic near-shore fauna of Baja California and, therefore, of the Panamanian Province.

Details on sample position, and physical and chemical parameters are given by Segura-Vernis and Carreño (1991). All figured specimens are housed in the micropaleontological collection of the Museo de Paleontología, Instituto de Geología, UNAM.

SYSTEMATICS

Suborder Rotaliina Delage and Hérouard, 1896
Superfamily Chilostomellacea Brady, 1881
Family Trichohyalidae Saidova, 1981
Genus *Neobuccella* McCulloch, 1977
Type species *Neobuccella elaborata* McCulloch, 1977

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Neobuccella babsae (Brenner, 1962)

(Plate 1; figures 1-24)

Eponides mansfieldi Cushman. Kleinpell, 1938, p. 30, pl. 18, figs. 13-15 (not *Eponides mansfieldi* Cushman, 1930).
Buccella mansfieldi (Cushman). Bandy, 1961, p. 20, pl. 2, fig. 1 a, b.
Eponides babsae. Brenner, 1962, p. 283, pl. 40, figs. 4, 5.
Neobuccella colnettensis. McCulloch, 1977, p. 294, pl. 148, figs. 1, 2.
Neobuccella babsae (Brenner). Crouch and Poag, 1987, p. 170-171, pl. 3, figs. 2, 3.
?*Polystomellina* sp. Segura-Vernis and Carreño, 1991, p. 208, pl. 5, fig. 9a-c.

DESCRIPTION

Species with a great morphological variability in test size and outline, number of chambers, ornamentation, and final chamber face. Test trochospiral, equally biconvex, periphery strongly limbate, sometimes with a beaded carina; smooth, matte and strongly calcified wall. Some specimens show scattered pustules (Plate 1, figures 1-4, 9-11) or densely distributed throughout the dorsal (Plate 1, figures 6-8) and ventral surface (Plate 1, figures 14-16), either without any specific trend (Plate 1, figures 1, 3-4, 9-12) or slightly parallel to the sutures (Plate 1, figures 2, 5-8, 13-16). Lateral view lenticular. Dorsal side evolute with 1 1/2 - 2 visible whorls (Plate 1, figures 1-4), sometimes tightly appressed and obscured in the initial 1/3 by pustules (Plate 1, figures 5-8); 8-9 chambers in the final whorl. Ventrally involute. It includes specimens with an auricular (Plate 1, figures 1, 5, 9, 13), subrounded (Plate 1, figures 2, 6, 7, 10, 14, 15) to circular (Plate 1, figures 3, 4, 8, 11, 12, 16) test shape. Dorsal sutures prominently limbate, raised, slightly to strongly curved to form a swirl in the initial 1/3 of the whorl; curvature increases toward periphery, in grooves (Plate 1, figures 1-4), beaded (Plate 1, figures 6-8) or a combination of both (Plate 1, figure 5); ventral sutures prominently limbate, both grooved and beaded (Plate 1, figures 9-16). Apertural face vertically elevated, marginal in part, slightly asymmetrical and partially (Plate 1, figures 18, 20-24) or totally covered (Plate 1, figures 17, 19) with pustules. The aperture is a very narrow equatorial interior-marginal slit that is obscured by the pustulose coating material. No secondary or supplementary apertures were observed—openings of the sutural fissures of Loeblich and Tappan (1988).

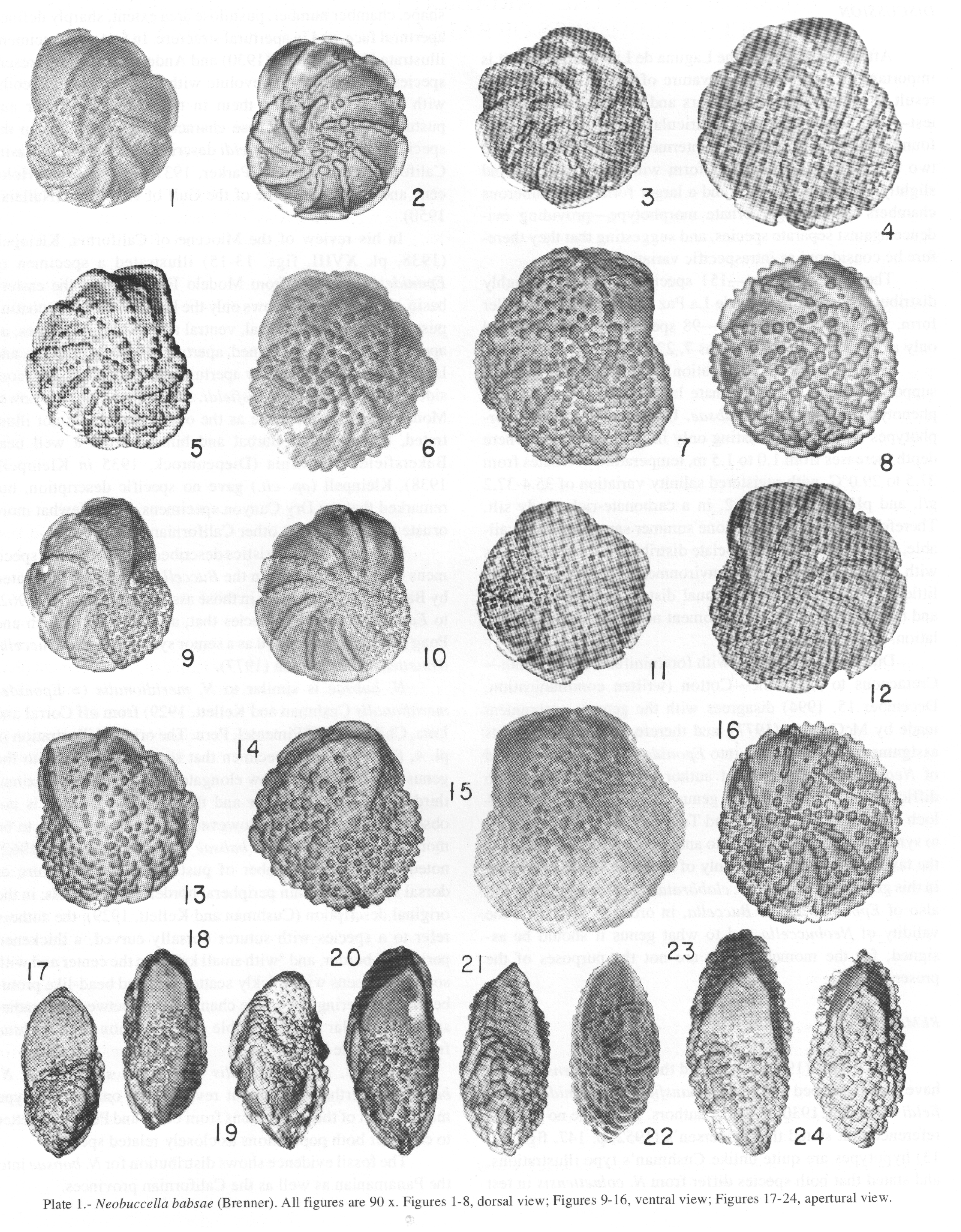

Plate 1.- *Neobuccella babsae* (Brenner). All figures are 90 x. Figures 1-8, dorsal view; Figures 9-16, ventral view; Figures 17-24, apertural view.

DISCUSSION

After observation of the Laguna de La Paz material, it is important to note that the curvature of dorsal sutures is the result of the number of chambers and the final shape of the test—subrounded, circular or auricular. All these forms were found coexisting and there are intermediate ones between the two end members—a smaller form with few chambers and slightly ornate morphotype and a larger form with numerous chambers and strongly ornate morphotype—providing evidence against separate species, and suggesting that they therefore be considered as intraspecific variations.

The most abundant—151 specimens—and thoroughly distributed form at Laguna de La Paz was the typical smaller form, whereas the larger one—98 specimens—was recorded only at three localities—stations 7, 22 and 25.

Poag (written communication, June 21, 1994) strongly supports the idea that the ornate larger form is just an ecophenotypic variant of *N. babsae*. Unfortunately, these morphotypes are found coexisting only in three localities, where depth increases from 1.0 to 1.5 m, temperature oscillates from 27.5 to 29.0°C, with registered salinity variation of 35.4-37.2 g/l, and pH from 8.0 to 8.2, in a carbonate-rich sandy silt. Therefore, and because only one summer sampling was available, it is not possible to associate distribution of these species with any of those particular environmental parameters. Also, little is known about the regional distribution of the forms, and there is virtually for the moment no environmental correlation.

Due to her experience with foraminifers of California—Cretaceous to Holocene—Cotton (written communication, December 15, 1994) disagrees with the generic assignment made by McCulloch (1977), and therefore strongly suggests assignment of this species into *Eponides* or *Buccella*, instead of *Neobuccella*. The present author, nevertheless, finds no difficulty in recognizing this genus as was stated by McCulloch (*op. cit.*) and Loeblich and Tappan (1988). Furthermore, to synonymize *Neobuccella* into another genus, clearly implies the taxonomic revision, not only of the three species included in this genus—*N. babsae*, *N. elaborata* and *N. angelensis*—but also of *Eponides* and/or *Buccella*, in order to determine the validity of *Neobuccella* and to what genus it should be assigned; for the moment, these are not the purposes of the present paper.

REMARKS

McCulloch (1977) mentioned that *N. colnettensis* might have been described as *Buccella mansfieldi* (= *Eponides mansfieldi* Cushman, 1930) by some authors. She made no specific reference, but stated that Andersen's (1952, p. 147, figs. 12, 13) hypotypes are quite unlike Cushman's type illustrations, and stated that both species differ from *N. colnettensis* in test shape, chamber number, pustulose area extent, sharply defined apertural face, and in apertural structure. In fact, the specimens illustrated by Cushman (1930) and Andersen (1952) represent species that are dorsally evolute with 2 1/2 to 3 visible coils, with variations between them in the chamber number and pustulose area extent. These characteristics are found in the species of *Eponides mansfieldi* described from Ventura Basin, California (Cushman and Parker, 1931), and from the Holocene and middle Pliocene of the Gulf of California (Natland, 1950).

In his review of the Miocene of California, Kleinpell (1938, pl. XVIII, figs. 13-15) illustrated a specimen of *Eponides mansfieldi* from Modelo Formation at the eastern basin, which dorsally shows only the last formed coil, a coating pustulose material at dorsal, ventral and apertural surfaces, an apertural face sharply defined, aperture closed by pustules, and lack of open supplementary apertures. Kleinpell (*op. cit.*) considers that *Eponides mansfieldi*, from Dry Canyon Lower Modelo shale, is the same as the one reported, but not illustrated, by Cushman, Barbat and himself from a well near Bakersfield, California (Diepenbrock, 1935 *in* Kleinpell, 1938). Kleinpell (*op. cit.*) gave no specific description, but remarked that the Dry Canyon specimens are somewhat more ornate than those from other Californian localities.

The same characteristics described for Kleinpell's specimens could be observed in the *Buccella mansfieldi* illustrated by Bandy (1961), and also in those assigned by Brenner (1962) to *Eponides babsae*, a species that, according to Crouch and Poag (1987), is interpreted as a senior synonym of *Neobuccella colnettensis* McCulloch (1977).

N. babsae is similar to *N. meridionalis* (= *Eponides meridionalis* Cushman and Kellett, 1929) from off Corral and Lota, Chile, and off Pimentel, Peru. The original illustration in pl. 4, fig. 4 shows a specimen that seems to be closer to the genus *Eponides*, with a low elongate aperture on the proximal third of the ventral border and the pustulose coating is not observed. In pl. 4, fig. 6, however, the specimens seem to be more closely related to *N. babsae* except, as Brenner (1962) noted, in its lower number of pustules, lesser curvature of dorsal sutures, and thin peripheral border. Nevertheless, in the original description (Cushman and Kellett, 1929), the authors refer to a species with sutures dorsally curved, a thickened peripheral border, and "with small knobs in the center and with some specimens with thickly scattered raised bead-like protuberances covering the whole chamber wall between the radial sutures", similar to the variable ornamentation of *N. babsae* from Laguna de La Paz.

Possibly, *N. meridionalis* is a junior synonym of *N. babsae*; nevertheless, without revision not only of the type material, but of the populations from Chile and Peru, it is better to consider both populations as closely related species.

The fossil evidence shows distribution for *N. babsae* into the Panamanian as well as the Californian provinces.

MATERIAL

249 specimens

REPOSITORY

Colección Micropaleontológica, Instituto de Geología, Universidad Nacional Autónoma de México.

HYPOTYPES

IGM-566-Mi, IGM-567-Mi, IGM-568-Mi, IGM-569-Mi, IGM-570-Mi (*in* Segura-Vernis and Carreño, 1991); IGM-575-Mi (not illustrated); IGM-576-Mi (Plate 1, figures 1, 9, 17); IGM-577-Mi (Plate 1, figures 2, 10, 18); IGM-578-Mi (not illustrated); IGM-579-Mi (not illustrated); IGM-580-Mi (Plate 1, figures 3, 11, 19); IGM-581-Mi (not illustrated); IGM-582-Mi (Plate 1, figures 4, 12, 20); IGM-583-Mi (Plate 1, figures 8, 16, 24); IGM-584-Mi (Plate 1, figures 5, 13, 21); IGM-585-Mi (not illustrated); IGM-586-Mi (not illustrated); IGM-587-Mi (Plate 1, figures 6, 14, 22); IGM-588-Mi (not illustrated); IGM-589-Mi (not illustrated).

DIMENSIONS

Mean diameter, 0.32-0.49 mm; mean thickness, 0.15-0.21 mm.

STRATIGRAPHIC DISTRIBUTION

Upper Oligocene? to Holocene. In the Pliocene San Marcos, Carmen and Marquer formations (at early Pliocene Monserrate, middle Pliocene Carmen and late Pliocene Cerralvo Mexican islands), and in the San Joaquín and Ventura basins of California (Oligocene to late Miocene).

GEOGRAPHIC DISTRIBUTION

At the Laguna de La Paz, B.C.S., stations 1, 4-8, 11, 12, 14, 19, 22, 24-26, are particularly abundant in normal marine lagoonal biofacies (Figure 1). According to Crouch and Poag (1987), it occurs off the coast of Jalisco, Nayarit, Sinaloa, Sonora and off west and east of the coast of Baja California Sur, and also at several localities that, as a whole, are part of the Panamanian Province; therefore, it is considered an endemic species. Nevertheless, it is important to note that *N. babsae* is related morphologically to *Eponides meridionalis* of Cushman and Kellett (1929), described off the coast of Corral, Chile and Pimentel, Peru, pointing toward affinities between both species that could indicate a wider distribution of *N. babsae* into the Chilean-Peruvian Province.

SUMMARY

A revision of a benthic foraminifer from Holocene dry samples of Laguna de La Paz, Baja California Sur, previously assigned to *Polystomellina*? sp., allows its correct assignment to *Neobuccella babsae* (Brenner). Morphological analysis of specimens allows recognition of high intraspecific variability, particularly in the test shape and in its ornamentation; consequently, the original description of this species in here emended. The fossil evidence indicates a wide distribution throughout the Panamanian, as well as in the Californian Provinces. Affinities with *N. meridionalis* (Cushman and Kellett) suggest that distribution of this species could be extended into the Chilean-Peruvian Province.

SUMARIO

Una revisión de los foraminíferos bentónicos provenientes de sedimentos holocénicos de la laguna de La Paz, Baja Califonia Sur, previamente asignados a *Polystomellina*? sp., permitió su correcta asignación a *Neobuccella babsae* (Brenner). El análisis morfológico de estos especímenes demostró una variabilidad alta de la forma de la concha, así como en su ornamentación, por lo que se complementa la descripción original de esta especie. El registro fósil confirma la distribución amplia de esta especie en la Provincia Panameña, extendiéndola hasta la Provincia Californiana. Su afinidad con *N. meridionalis* (Cushman y Kellett) sugiere una posible distribución hasta la Provincia Chilena-Peruana.

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M. Alcayde-Orraca and A. Gómez-Caballero improved the style and English version of this manuscript, while A. Altamira made the photographic work and Fernando Vega prepared the line drawings. Y. Hornelas, from the Instituto de Ciencias del Mar y Limnología, UNAM, patiently took the SEM photographs. Technical assistance was provided by G. Diego-Casimiro. This work was partially supported by CONACyT grant number 2070-T9302 and by the Dirección General de Intercambio Académico UNAM-UABCS.

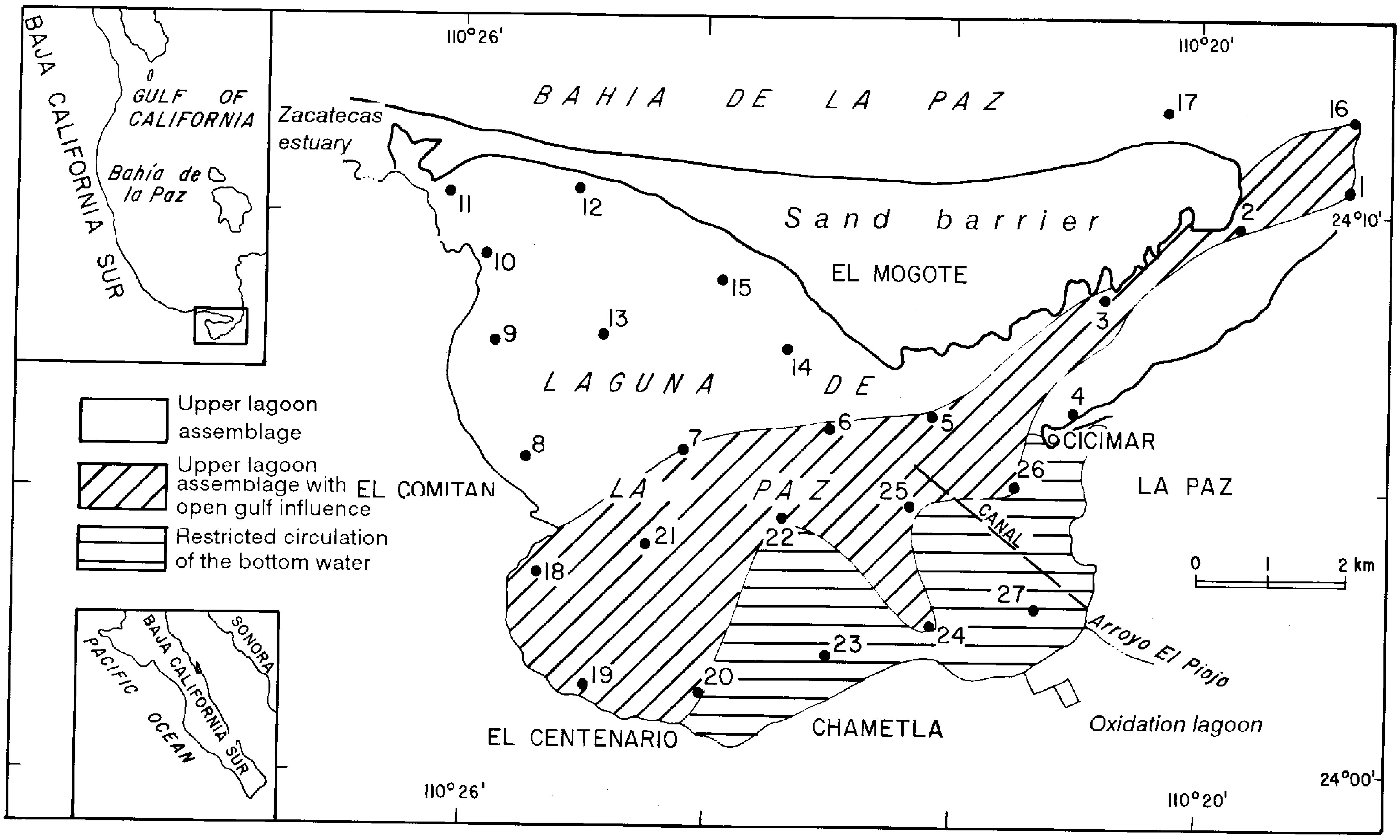

Figure 1.- Location map of marine lagoonal biofacies and sampling stations.

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