

early juvenile part of the valves (i.e., the first 20 to 25 mm of growth).

Glycimeris maccrayi Waring, 1917 is questionably a synonym of *Glycymerita major*. Waring's species is based on a single valve whose hinge needs cleaning. Waring (1917, fig. 3, loc. 8) indicated the location of its type locality as a dot on his map, but he did not provide a written description. This locality is in a faulted area where the Eocene Llajas Formation and the upper Paleocene Santa Susana Formation are juxtaposed (see Squires, 1984, fig. 15). Based on the stratigraphic occurrence elsewhere of *G. major*, it is likely that the locality is in upper Paleocene strata, even though Moore (1983, p. A57) reported it as located in the Eocene Llajas Formation.

Coan et al. (2000, p. 143) reported that *Glycymeris* (*Glycymerita*) *major* is a junior synonym of *Glycymeris barbarentis* (Conrad, 1857a), a name that has significant uncertainties associated with it. Conrad (1857a, p. 314; 1857b, p. 71, pl. 3, fig. 11) used the name for a specimen that Dall (1909, p. 108) reported to be from the coast near Santa Barbara, California. Willett (1943, p. 112, pl. 11, fig. 4) reproduced the line drawing of this specimen. In addition to having very inexact locality information, the specimen is presumed missing, and the original description of it is not diagnostic. Conrad (1857c, p. 194, pl. 6, fig. 3) also used the name *Glycymeris barbarentis* for a specimen (hypotype USNM 13358) from the coast somewhere between San Luis Obispo and Santa Barbara, California. One of the labels associated with this specimen has its age as Miocene. The original description of this immature specimen is not diagnostic and the line-drawing illustration is very misleading. Based on the observation of the actual specimen, photographed here (Fig. 12.1) for the first time, half of it is an internal mold, and the dorsal margin of the other half is embedded in hard, very fine-grained sandstone. Even though Dall (1909, p. 109) did not believe this specimen could be a *Glycymeris veatchii*, Woodring et al. (1946, p. 79) believed that it might be a *Glycymeris veatchii* of either Paleocene or Late Cretaceous age [note: *Glycymerita veatchii* does not range into the Paleocene]. Hypotype USNM 13358 is poorly preserved, and attempts by the author to identify it as to species were unsuccessful, even when same-sized (length 14.6 mm) specimens of *G. veatchii* and *G. major* were used for comparison.

Dall (1909, p. 108) reported that the two specimens for which Conrad used the name "*Glycymeris barbarentis*" are not the same species, and subsequent workers (e.g., Woodring et al., 1946; Hertlein and Grant, 1972; Moore, 1983) have generally agreed. Based on the missing or poorly preserved, immature specimens, as well as on the inexact original descriptions and inexact type locality information, it is concluded that both of these "*Glycymeris barbarentis*" names constitute a *nomen dubium*.

PALEOENVIRONMENTS OF THE STUDIED GLYCYMERIDIDS

Most of the studied glycymeridids occur as single valves in silty fine-grained siliciclastic sandstone in shallow-marine formations. It is likely that these specimens underwent some post-mortem transport, based on the abundance of associated shell fragments. About 30 of the studied specimens are double-valved and represent material likely not far-travelled from its living environment. They include representatives of *Glycymerita pacifica*, *Glycymerita veatchii*, *Glycymerita banosensis*, and *Glycymerita major*. Nearly all are in siltstone or silty very fine-grained to fine-grained sandstone, thus indicating that the studied glycymeridids preferred these types of soft-bottom substrates. More detailed comments are given below.

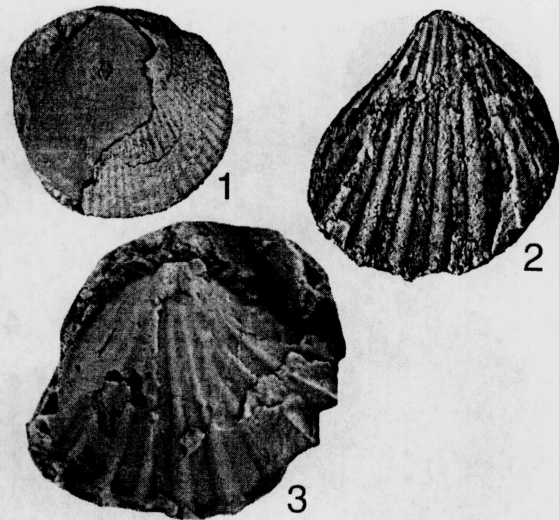


FIGURE 12—Miscellaneous bivalves. 1, "*Glycymeris barbarentis*" Conrad, 1857c, hypotype USNM 13358, exact locality unknown, right? valve, $\times 2$; 2, 3, "*Glycymeris*" *ovata* (Stanton, 1895), locality "near Stephenson's, on the Cold Fork of Cottonwood Creek," Tehama Co., California: 2, cotype USNM 23046, lateral view; 3, cotype USNM 23046, lateral view of partial-internal mold, $\times 3.4$.

Double-valved specimens of *Glycymerita pacifica* were found in the Baker Canyon Member (e.g., LACMIP loc. 8194) and in the immediately overlying lowermost beds of the Holz Shale-Baker Canyon transition beds of the Ladd Formation in the Santa Ana Mountains (Area 28). Saul (1982:70) reported that specimens of *Glycymeris pacifica* in these stratigraphic units lived at shallow-sublittoral depths. Sundberg (1980) reported that they lived below wave base and were a main faunal component of the *Glycymeris-Astarte* association of the *Inoperna-Glycymeris* paleocommunity in the Holz Shale.

Several double-valved specimens (e.g., Fig. 6.3) of *Glycymerita veatchii* were found in the Frazier Siltstone Member of the Redding Formation east of Redding (Area 12). Haggart (1986) reported that this member was deposited in middle to outer shelf depths. Three double-valved specimens of *G. veatchii* were found in the Jalama Formation (Area 23). Two of them are in very fine-grained sandstone similar to the quiet-water deposits that Dailey and Popenoe (1966) reported as containing complete bivalves from the Jalama Formation. The third specimen (Fig. 8.6) was found in poorly sorted, fine- to medium-grained sandstone, but the specimen is agape ventrally. It is possible that it became filled with matrix different than the substrate in which this bivalve lived.

The only two specimens of *Glycymerita veatchii* known from the Punta Baja Formation (Area 32) are in deep-marine, pebbly sandstone turbidite deposits. These specimens have undergone considerable post-mortem transport from shallow-marine depths into deeper waters.

Nearly all of the double-valved specimens of *Glycymerita banosensis* were found in siltstone in the Rosario Formation (Areas 30 and 31), whereas all of the very abundant specimens of this species in the Moreno Formation in the Los Banos region (Area 19) are unabraded single valves in pebbly, poorly sorted coarse sandstone. These Moreno Formation specimens were most likely transported short distances by storm waves and accumulated in nearshore depths.

The studied Cretaceous glycymeridids, including both *Glycymeris* and *Glycymerita*, are found with the common to abundant bivalves *Acila*, *Meekia*, *Calva*, and *Cymbophora*.