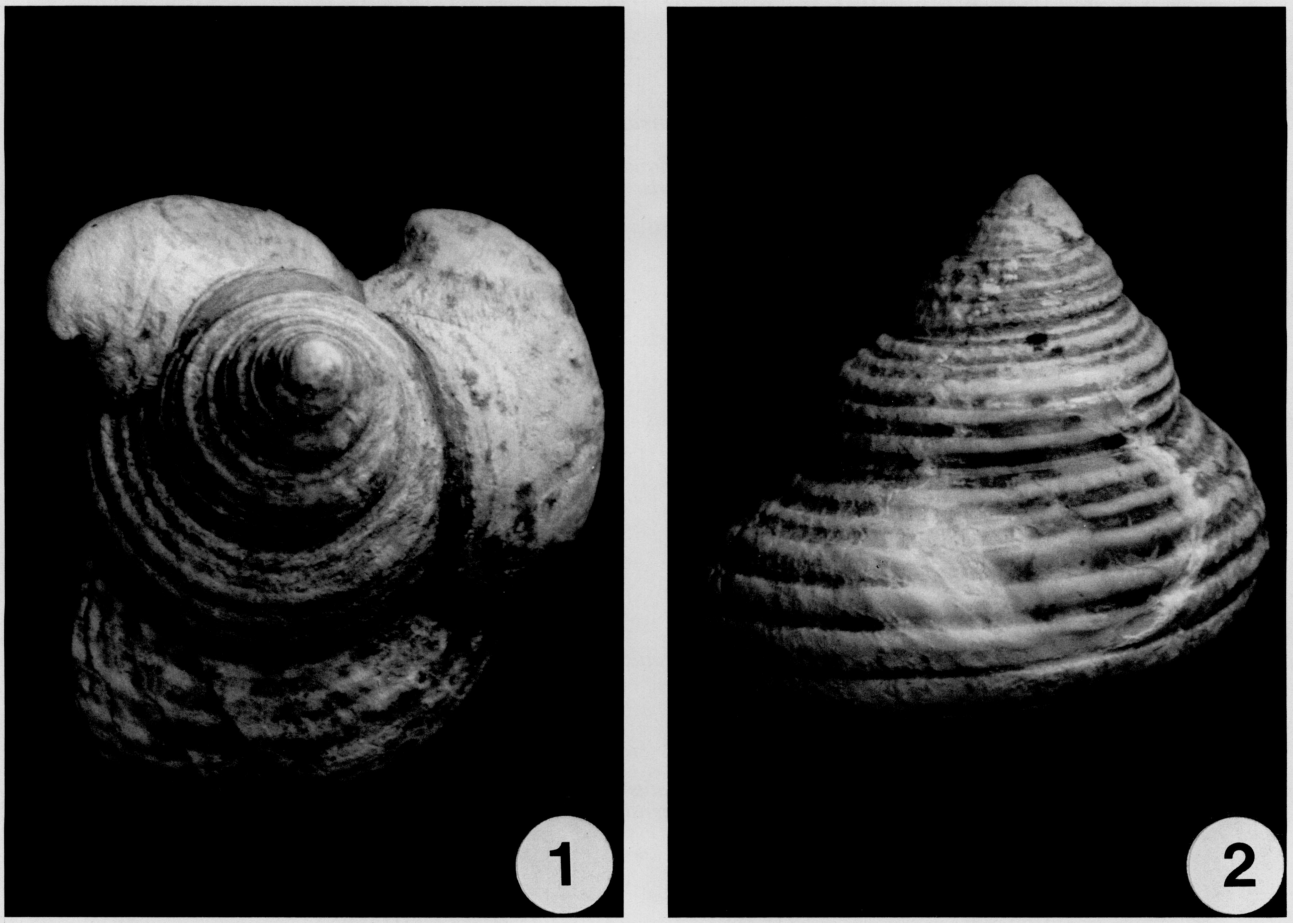

FIGURE 9—*Crepidula adunca* encrusting living *Calliostoma ligatum,* Friday Harbor, Washington, shell height of *C. ligatum,* 21.0 mm, UCMP Type No. 39688. *1,* two *C. adunca* conforming to upper whorls of *C. ligatum*; *2, C. adunca* permanent scar on last whorl of hermitted *C. ligatum,* shell height, 22.0 mm, UCMP Type No. 39689.

1979). Other species also compete for, or inhabit, gastropod shells (McLean, 1983; Vermeij, 1987; Walker, 1990). Because empty shells may be rare, post-Triassic gastropod fossil assemblages have most likely been taphonomically affected by secondary occupants of shells. Because hermit crab modification of gastropod assemblages is great, Shimoyama et al. (1979) suggested that the bivalve fossil record provided a more accurate paleoecological record than gastropod assemblages. However, gastropod fossil assemblages provide valuable paleoecological information for the history of the hermit crab.

Hermit crab body fossils are rare. Therefore, it is important to study their other fossil record: that of the epi- and endobionts associated with hermitted shells. As a rule, hermit crabs are not preserved within the gastropod shell (Schafer, 1972). Only one fossil hermit crab has been reported from a gastropod shell (Hyden and Forest, 1980). However, the shell-encrusting and boring organisms that occur with hermit crabs have a long fossil record, dating from the middle Jurassic. Determining the extent of hermitted shells in fossil assemblages should be the first line of inquiry before paleoecological or evolutionary assessments are made.

TABLE *10*—Frequency of occurrence of *Crepidula* sp. in apertures of *Cerithium stercusmuscarum* from Cholla Bay, Puerto Penasco, Mexico (May 1990 data).

Size class (mm)	Total hermit crabs	*Crepidula*
1.0–9.9	22	1 (0.45)
10.0–19.9	97	50 (0.51)
20.0–29.9	78	37 (0.47)
Totals	197	91 (0.46)

Pagurized shells can be recognized by the settlement of bionts in specific locations on fossil shells (Palmer and Hancock, 1973; Walker, 1988b, 1989, this paper). Recent and fossil biont patterns appear to be conservative from the Oligocene to the present. That is, taphonomically preserved biont patterns (e.g., east Gulf Coast examples) are similar to Recent pagurized shells. The common patterns of subtle encrusters are as follows: hermit crabs do not occlude the apertural area like the living snail. Accordingly, bionts settle on the following areas on hermitted shells: the apertural periphery, the junction between the last whorl and the aperture (the apertural notch), callus, columella, and the interior whorls of the shell. Bionts that settle in these areas are filter feeders, taking advantage of the feeding and respiratory currents generated by the hermit crab (see Carlton, 1971; Tomlinson, 1969b). Bionts also settle on the shell exterior, especially if an infaunal snail shell has been used by an epifaunal hermit crab (Walker, 1988b).

Fossil pagurized shells are present in middle Jurassic strata to the present. The first recognized fossil bionts associated with hermit crabs are thickly encrusting bryozoans. Bryozoans, hydractinians, and corals have received the most notoriety as they