like pattern, making it both difficult to break and to work. All of the nephrite cobbles and boulders with burrows tested by us have a hardness of between 5 and 6 on the Mohs scale and a specific gravity of 3 to 3.44. This would seem to be an inhospitable substratum for infaunal organisms.

Burrows

All of the burrows in nephrite seen in cross-section have the typical teardrop shape of pholadid burrows (Figs. 1, 6). Selected latex casts of other burrows in the nephrite show that they have similar shapes. No burrows were seen with shapes that are typical of boring clams other than pholadids. The size of the burrows is variable, with entrances that range from 1.5 to 4.5 mm in diameter. The largest burrow has a depth of 36 mm and a maximum width of 16 mm. A darkened halo around one of the sectioned burrows is as much as 7 mm wide (Fig. 1) and strongly suggests chemical alteration of the nephrite. The hardness in the discolored zone, however, is unaltered. Halos around burrows in mudstone formed by the boring mytilid *Lithophaga* Röding, 1798, considered to be a chemical borer by most workers, were attributed to subaerial weathering by Warme and Marshall (1969).

The specimen of *Penitella conradi* (Fig. 4) was taken from a subtidally collected nephrite cobble (Fig. 3). The valves are of an adult animal with callum and are 13 mm long (without siphonoplax). The shells are not misshapen, as is the case with some pholadids that bore into hard substrates, but the concentric ridges on the anterior slope are very tightly packed.

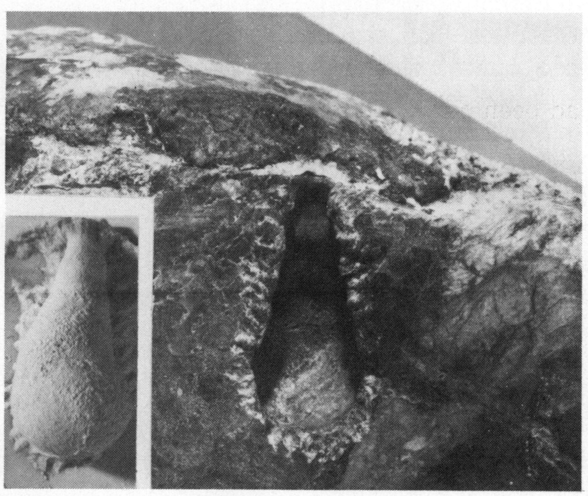

FIG. 6. Cut piece of nephrite cobble showing longitudinally sectioned pholadid burrow. Collection of Mr. Kenneth Comello. Inset: latex cast made from this burrow. LACMIP hypotype 2482. Both Figs. ×1.0.

Discussion

"Members of the family Pholadidae bore into stiff clays or muds, shales, friable or soft rock, shells, poor grade cement, wood, nuts, or other plant products" (Turner, 1969). The implication of "soft rock" is that it is either sedimentary or relatively nonresistant to erosion. However, pholadids infrequently have been reported boring into volcanic and metamorphic rocks. Boring generally is considered to be mechanical and not chemical in nature. On the basis of wear patterns on pholadid shells, Kennedy (1974) concluded that mechanical rasping of the burrow wall was done primarily with the fore edge of the last concentric ridge of the anterior slope. The mechanics of boring in numerous species of pholadids was discussed by Röder (1977).

Reports of two researchers (Smith, 1969; Haderlie, 1976, 1979, 1980) contradict the traditional view that pholadids bore only mechanically.

The process of boring by *Penitella conradi* was studied by Smith (1969). After examination of California abalone shells bored by this species, he concluded that "the role of mechanical abrasion by *P. conradi* is minor . . . The boring process in *P. conradi* proceeds mainly by chemical dissolution of the calcareous substrate". He suspected that epithelial glands in the mantle were used for chemical dissolution of the abalone shell.

Smith (1969) also observed that during the characteristic rocking motion of the pholadid boring cycle, the mantle of *P. conradi* was in contact with the anterior burrow wall as far as the maximum diameter of the burrow and that it simultaneously covered most of the anterior portions of the valves. Apparently a biochemical secretion was being deployed to the calcareous substrate by specialized cells in the mantle. The mantle was then withdrawn and the rotation cycle initiated, during which the mechanical abrasion occurred.

Haderlie (1976, 1979, 1980) reported that *P. conradi* and six other species of pholadids bore