

Cephalaspidea and gizzard plates

Many genera of Cephalaspideans possess gizzard plates and it is unfortunate that their exact relevance to taxonomy at higher levels will remain nebulous until more work is done. Somewhere along the length of the digestive tract, and posterior to the buccal bulb, the heavily reinforced sac which contains the gizzard plates can be found. The buccal bulb contains the radula, which is generally not that difficult to find and prepare for the microscope. Far easier to find, however, are the gizzard plates.

There are usually three plates composed of a tough, horny material that is dark and translucent. Each plate abuts the other two on its inner grinding face, while its back is embedded in the tough ligaments of the sac. The presence or absence of gizzard plates is most certainly of importance at the generic level i.e. all the species in a genus are alike in having or not having plates; usually their general shapes indicate a genus and the species are hard to differentiate except by very subtle variations. In genera such as *Cylichna* and *Philine* there are three equal (in size and shape) plates that are elongate, ovoidal, and flattened. In *Acteocina* and *Tornastra* (= *Acteocina*, in part) there are two equal paired plates and a third small plate of varied shape. In *Bulla* and *Haminaea* the three equal plates have their ends curled backward and their faces are adorned with a series of ridges for extra grinding efficiency. The shapes must reflect both the food item and the exact masticatory movements employed. Three equal, simple plates would seem to be the primitive condition with asymmetrical teeth (and masticatory patterns) arising later.

Locating gizzard plates

In benthic surveys, the most frequently encountered specimens are preserved rather than live animals, and therefore what follows refers to dead, contracted specimens. You will need a binocular microscope, very fine forceps and a small sharp scalpel.

Usually for the genera *Cylichna*, *Tornastra*, *Bulla*, *Haminaea*, etc., the gizzard sac is located just below the shell under the portion of the body whorl adjacent to the anterior part of the aperture. If this region of the shell is broken away, at least the uppermost gizzard plate will become apparent and the entire sac can be lifted out using only forceps and digging a little. With inspection it can be seen where the plates separate and a few careful scalpel cuts will cut the binding ligaments exposing the individual plates. The plates in *Bulla* and *Haminaea* are so large and obvious almost any cut through the animal is sufficient to expose them. In *Philine* spp. the sac is along the midline of the body and a simple incision through the center will cut through flesh and then encounter the sac which can be teased out with forceps.