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A Note on Two Mechanical Aids for Otolith Reading

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Two problems confront the otolith reader. The first of these is to view the ring structures satisfactorily, and the second is to interpret what is seen. It is obvious that the first of these considerations may well affect the second.

Most gadoid fish otoliths are too dense and thick to view whole and the most common method used to read them is as follows. A section is made (usually through the plane of least area) and this is viewed by mounting the piece of otolith in plasticine with the section horizontal. The otolith is then illuminated from the side and the sectioned surface placed in shadow. The effect of this is to show on the surface the dense opaque rings as dark areas and the hyaline rings as light areas.

The usual method of producing the section of the otolith is to break it with pressure of the thumbs or with a cutting tool. Where interpretation of the zones is easy the section thus produced is often good enough, provided that the break is reasonably square and through the centre of the otolith. However, many otoliths are more difficult to interpret and a good flat surface is needed on the section to view it satisfactorily.

This note describes two mechanical devices which have been developed at Lowestoft. The first of these enables the reader to prepare quickly an almost standard section of each otolith. The second enables him to control the illumination of the section surface.

1. Grinding/Polishing Machine (Plate 1)

This is simply a small fine carborundum wheel fitted to a fairly high speed motor. Grinding of otoliths has been tried before and rejected because (a) the heat generated damages the otolith, (b) clouds of dust harmful to the operator are produced, and (c) the time taken to get a good surface is too long.

These disadvantages are overcome by fitting a water supply which drips directly on to the point of contact of the otolith on the wheel. Heating is prevented, there is no dust and a good surface is produced very rapidly. The wheel itself is completely screened from the electrical parts of the machine to prevent danger from water spraying. The shields fitted are very effective and the machine is considered to be completely safe.

The machine is usually positioned with the drip tray overhanging a sink to carry away waste water. If, however, no sink or water supply is available, the drip tray can be used as a reservoir and water from it can be brushed on the wheel while the otolith is being ground.

It is generally agreed that the best position for the section to

be made is at the "V" shaped interruption of the sulcus acusticus. Using the grinding wheel this can always be achieved. The otolith is broken by pressure of the thumbs and the part containing the "V" shape is selected for grinding. The broken surface is held against the wheel with moderate pressure, care being taken to hold it square to the longitudinal axis of the otolith. Surplus material is removed very rapidly from even the largest otoliths and a flat surface bisecting the "V" is produced in approximately twenty seconds. Some slight striations and a deposit of dust are left on the surface and these can be clarified when the otolith is read, by brushing on a little Xylene.

Details of the Machine

- Motor $1/20$ H.P. 2,800 R.P.M: 230/250 v A.C. Single phase.
- Wheel 3 inches diam. x $3/4$ inch thick; abrasive texture, fine or very fine. It has been found that the wheels made for grinding valve seatings are ideal. These have a threaded centre which allows it to be screwed on to a brass boss fitted to the spindle of the motor.
- Water Shields These are made of 18 S.W.G. brass and are of such size that the hoop shaped guards clear the outside rim of the wheel by one inch.
- Assembly The apparatus is mounted on a 12 mm thick bonded plywood baseboard approximately 12 by 8 inches. This is supported by two pieces of wood fixed to the two long edges. These supports are tapered so that the water tray end is lower than the other end. A plywood or rigid plastic cover is fitted to the bottom of the apparatus.

2. The Microscope Light Screen (Plate 2)

Not all readers of gadoid fish otoliths use the method of side illumination and resultant transmitted light for viewing the section. The origin of this technique is probably to be found in the early Norwegian work on the otoliths of the cod and in the author's experience the majority of readers do use this method, certainly in Europe.

It is apparent from the many and varied methods used to put the section surface in shadow - pencils, the observer's finger, a match stick mounted in a second piece of plasticine are but a few - that this has always been something of a problem. It may indeed be one of the reasons why the method of direct illumination of the surface has been adopted by some observers.

However, it is the author's opinion that the method of transmitted light is preferable as it enables the reader to see more of the detailed structure of the otolith. Also by this method the dense opaque zones are in fact seen as dark zones and the light hyaline zones as light zones, a not unimportant consideration when describing structures particularly to trainees.

The light screen used at Lowestoft provides the reader with a simple tool that enables him to put the surface into any degree of shadow that he desires. The degree of shadow required may well be different from different parts of the same otolith and the fact that the bar can easily be moved up and down allows each part of the otolith to be examined under conditions most suitable to itself. Once the state of shadow is fixed the observer can leave the bar and have his hands free to brush on clearing agents, adjust focus and move the stage of the microscope.

The screen is simply an adjustable height bar. A brass base

plate supports a vertical pillar in which is housed a captive threaded rod. By turning this thread the bar is raised or lowered to the height required. The vertical pillar is sited in the centre of the shorter side of the base plate so that the screen may be used both right and left handed.

Materials and Dimensions

The base plate is 16 S.W.G. plate brass size 3 inches by 2 inches.

The vertical pillar is machined from 5/8 inch square brass and is 2 inches high.

The bar is 3/16 inch deep and is soldered to a brass block which has a hold threaded 2BA to fit the vertical threaded rod.

The brass block is keyed into a 1/8 inch slot in the vertical pillar.

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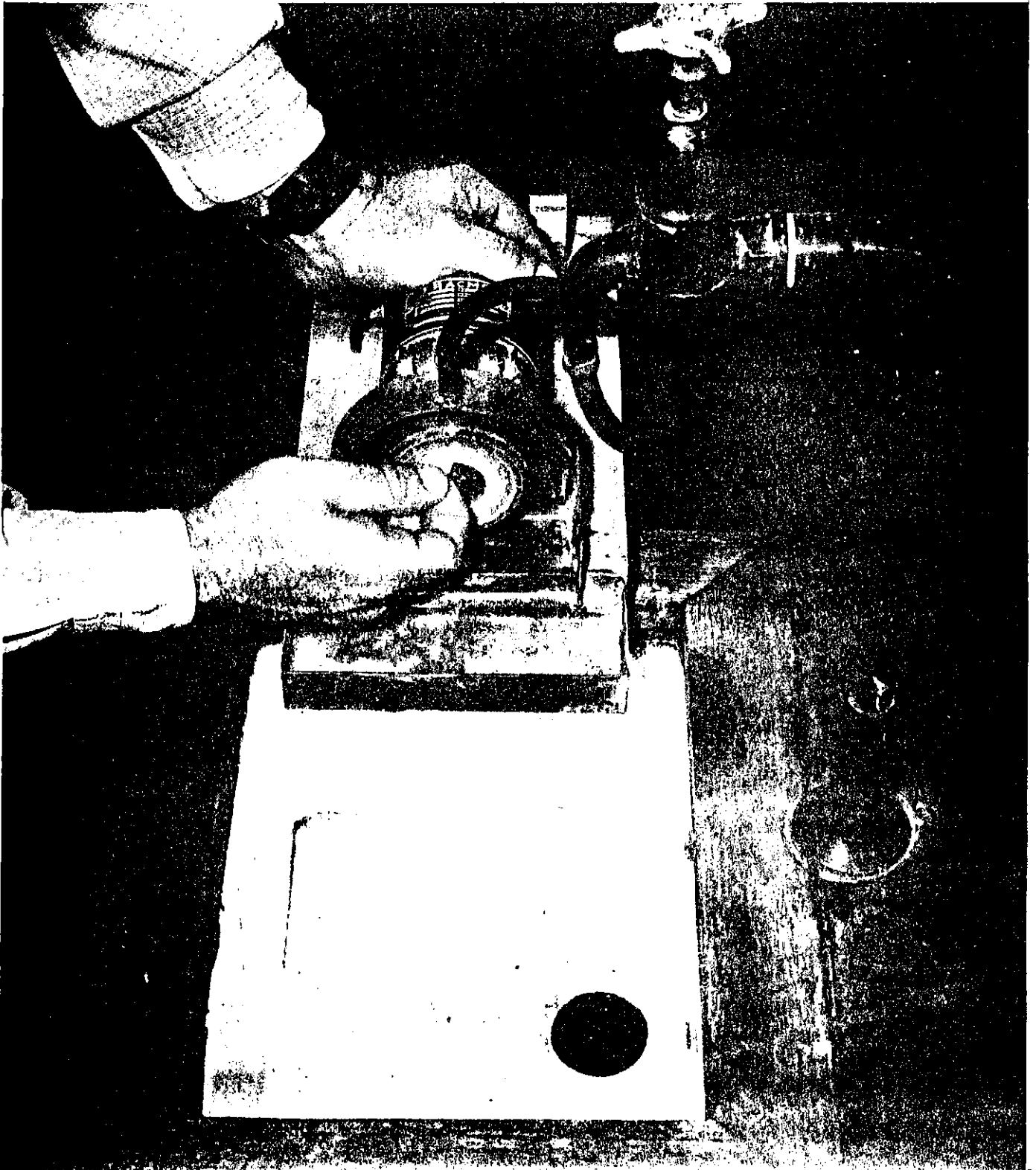


Plate 1. Grinding machine in use.

N.B. The on - off switch of the machine is controlled by the upward finger of the left hand of the operator.

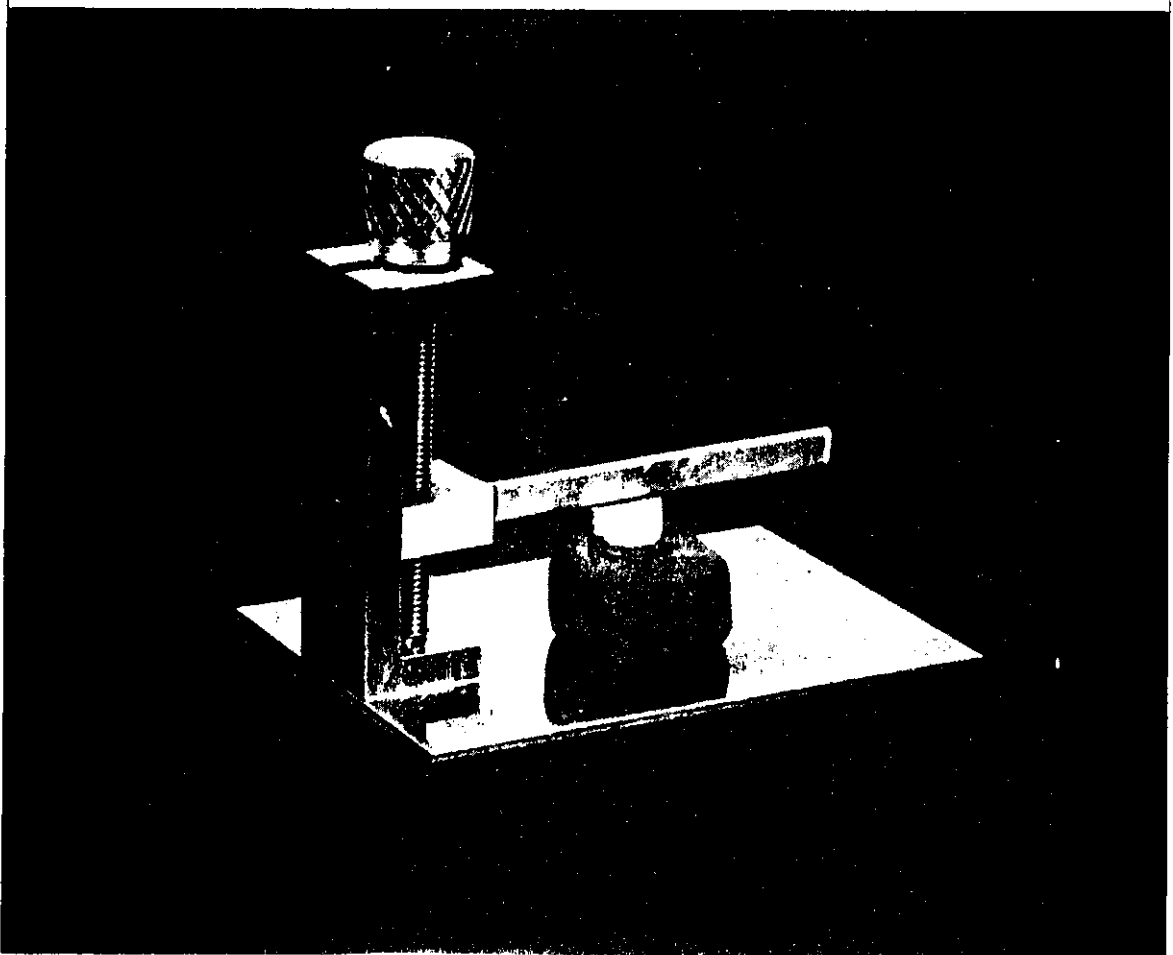


Plate 2.

View of light screen with otolith mounted.