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IN May of last year, the Museum acquired, with the assistance of a grant from the PRISM fund of the Museums and Galleries Commission, an example of a small compound microscope.

The microscope is neither signed nor dated, but could be broadly placed, on first sight, between about 1780 and 1840. However, a close examination of some of its accessories has allowed Professor Gerard Turner to attribute the micrometers accompanying the microscope to the maker John Coventry (1735-1812). As a result, the microscope can now be dated somewhat more precisely, to between c. 1797 and 1812.
The microscope is quite small (approximately 170 mm in height) but is very well made. While it is difficult to be precise about a maker due to the amount of similar unsigned work from the period, it is likely to have been made in a London rather than a Birmingham workshop. Its basic form is similar to and may have evolved from the 'New compendious Pocket Microscope' that appears in the 4th edition of George Adams Senior's Micrographia Illustrata (London, 1771). The cone-shaped nose piece is also suggestive of the Cary-type or Gould pattern microscope popular in the early nineteenth century.
The whole microscope packs away into a fitted mahogany box. The supports in the box are covered in green baize, which is normal for the eighteenth century and first decades of the nineteenth, after which blue velvet tended to be employed. Every slot in the box is occupied by an accessory of some sort. Eight simple objective lenses in brass mounts are provided, which could be used alone as a simple microscope or fitted onto the end of the nosepiece to use the microscope as a compound instrument.

As well as the objective lenses, the box also houses a standard repertoire of attachments almost universal from the middle of the eighteenth century to the middle of the nineteenth. These include several accessories for viewing opaque objects: a circular disc about 24 mm in diameter, one side of which is made of ivory, the other of ebony, for whichever gave the better contrast against the specimen; a silver concave reflecting speculum or 'Lieberkühn', used without the stage in position to illuminate the top of opaque objects with light from below; jointed stage forceps designed to hold specimens; and a stage lens on an articulated arm for illuminating opaque objects from above with the light from a candle or lamp.

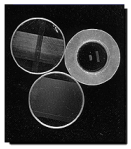
Also supplied is a glass disc with concave surfaces on which to place liquids or under which living specimens could be constrained. More mundane items include tweezers, variously described in contemporary accounts as 'nippers', 'plyers' or 'forceps', as well as a hand magnifier or 'common magnifying glass' of blackened ivory used for 'any occasional purpose', according to Adams.

Along with the accessories are 'sliders', not in ivory as might be expected, but made of two pieces of glass. Sandwiched between the glass are strips of white paper punched with holes to hold specimens. The sliders give the impression of being home-made. Several have become unstuck, and many are chipped or otherwise damaged, although in some the specimens survive.

Accompanying the microscope is a hand-written 'List of Objects' detailing the specimens in nine original sliders. Listed are such things as 'Head of a Gnat', 'Section of Lime', 'Polype Weed' and 'Section of Sponge'. Specimens provided with microscopes from the period tended to be very standardized (the maker William Cary even published a list of the 'principal objects which afford the highest entertainment and instruction by the microscope' divided into standard classes) and the specimens with this microscope are no exception. In addition to the mounted specimens, a small tray in the mahogany box contains the dried remains of what is, presumably, a 200-year-old butterfly.

As well as its fairly standard late eighteenth-century features, the microscope also has some more unusual characteristics. These include many of the features incorporated into W. and S. Jones's 'Improved' and 'Most improved' compound microscopes, as described in the second edition of George Adams Junior's Essays on the Microscope (London, 1798). Such improvements include the provision of a sub-stage condensing lens, for increasing the intensity of reflected light from a candle or lamp, and a sub-stage mirror with one plane and one convex surface.

However, the refinements in this microscope go beyond those outlined in Adams's volume for the Jones instruments. Of particular note is the movable stage. Pivoted stages, which allowed a mobile specimen to be followed more easily, were added to microscopes by Benjamin Martin and others from at least as early as the 1770s. But the stage in this microscope is not simply pivoted: it is movable in two perpendicular directions with a degree of precision, by a mechanical adjustment with two screws.
The most unusual feature of the microscope is not the stage itself, but what can be placed on it: the three micrometers. Each is a flat, circular disc, about 27 mm in diameter and 2 mm thick. Two appear to be just plain glass discs, while the remaining one is a smaller glass disc mounted within a brass ring. In the mahogany box there are slots for two of the discs, while the third is kept in a small wooden tray. This one is also provided with its own small pocket of thin dark leather, the inside of which is lined with wastepaper showing a portion of musical notation.



While the glass discs appear at first sight to be blank, closer inspection reveals that they are inscribed with very fine ruled lines, in various configurations. Under a modern microscope it is possible to make out the details of the rulings. In one, almost the entire glass surface has a cross grating with divisions of one hundredth of an inch (illustrated in the enlarged view below). Another has two very fine gratings intersecting at right angles; one is half an inch wide, the other is one tenth of an inch, with the spacing at one thousandth of an inch. The third has two separate small micrometer scales, one divided into a hundred spaces at a thousandth of an inch, the other a hundred spaces at one five-hundredth of an inch.

In use, the micrometers would have been placed in a brass holder, made expressly for the purpose, on top of the stage in place of the normal sprung holder for the sliders. Their purpose was to allow measurements to be made of microscopical objects, either directly, or by having first calculated the magnifying power of the microscope when used with its different objective lenses.

The means of making measurements of microscopical objects and of calculating the magnifying power of lenses was something that had vexed makers since the microscope was first put to use. Robert Hooke judged the magnifying power of his lenses by a direct visual comparison, viewing objects at the same distance with each eye, one looking through the microscope, one directly. Leeuwenhoek, his contemporary, used grains of sand for size comparison.
James Jurin, in the early eighteenth century, pursued a more systematic approach, scattering among his specimens small pieces of silver wire, the diameter of which he had calculated by wrapping it many times around a pin. In the 1740s John Cuff again used silver wire, this time arranging it in a lattice over the aperture of a slider. Martin and Adams later devised needle micrometers and other mechanical means of making microscopical measurements.

George Adams Senior had used a form of scale engraved on glass or ivory, which he called the 'sectoral scale' (an isosceles triangle with decreasing distance between its sides towards the apex) in combination with a moving needle micrometer. But it appears not to have been until the 1790s that ruled micrometer graticules and scales were deployed to allow direct measurements of microscopical objects to be made. These devices were introduced by John Coventry.
The earliest account of Coventry's micrometers appears in the third edition of the Encyclopædia Britannica, published in 1797. There, the editors reported that Coventry himself had favoured them with a 'description of a micrometer of his own invention; the scale of which surpasses every instrument of the kind of which we have any knowledge'. The following year saw an account of 'glass, pearl &c. micrometers' made by 'the ingenious Mr. Coventry' added to the second edition of Adams's Essays on the Microscope. Frederick Kanmacher, the editor of the second edition, wrote:
"The singular dexterity which Mr. Coventry and others now possess, of cutting by an engine fine parallel lines upon glass, pearl, ivory, and brass, at such minute distances as, by means of a microscope, are proved to be from the 100th to the 5000dth part of an inch, render this sort of micrometer the easiest and most accurate means of obtaining the exact natural size of the object to be magnified and how many times that object is magnified."

Kanmacher went on to add that 'A set of ivory and glass micrometers, about six in number, besides one or two pearl ones for the eye stops, are generally packed up with the best sort of microscopes made by Messrs. W. and S. Jones, Opticians, Holborn.' This, of course, may just be opportune salesmanship – W. and S. Jones were the sponsors of the second edition of Essays on the Microscope, having taken over Adams's stock-in-trade after his death.
Whether or not the Museum's recently-acquired microscope is by W. and S. Jones, Professor Turner concludes that the three micrometers are by Coventry. The attribution of the rulings to John Coventry is consistent with the general dating of the microscope. That Coventry supplied micrometers to the leading makers of his day for inclusion with their microscopes is very probable.

Rulings of the quality found in the micrometers with the Museum's microscope were not common and can be taken as diagnostic of Coventry's very special skills. The year after Coventry's death, David Brewster, in his Treatise on New Philosophical Instruments, was still able to write that: 'The most valuable contrivances, however, of this nature, are the beautifully divided scales which Mr Coventry has formed upon ivory, glass, and silver. These scales are constructed with a degree of minuteness and accuracy which has never been surpassed'.