thus formed, of any desired diameter and depth, by selecting the size of cell accordingly; and the *wall* being continued *all round*, gives the important advantage that the slide can be *laid down flat*, without any risk of water escaping; the water is, indeed, held so securely in the covered half of the cell, that it may be turned upside down without the object being displaced.

The water in the trough is readily renewed, and the living object refreshed at any time, by simply laying down the slide *flat*, and filling up the whole cell with water from a pipette, when the object floats out into the open part; and the surplus water is again readily withdrawn by a pipette.

The trough is originally filled, and the object placed in it in the same manner *on the flat*; thus allowing the entire area of the open half of the cell for this purpose, instead of only the narrow opening into the trough; and this affords much facility in the case of delicate objects, such as cast larva skins, that will not bear handling, and have to be floated into their place. Then, to empty the trough, it is held obliquely over a watch-glass, and a small jet from a curved pipette washes out the contents of the trough safely into the watch-glass.

The only practical objection found to these small troughs is, that they are too small to be cleaned inside; but this difficulty is completely got over by simply never letting them get dry, so as to prevent any film forming upon the glass, by keeping the troughs always immersed in a tumbler of clean water.

These troughs have the important advantage that any one can readily make them; the thin cover-glass is easily cut in half by scratching it across with a writing diamond whilst laid on a glass slide, wetted to make it stick close, and then shifting the cover-glass to the edge of the slide, with one of the halves projecting over, when it is separated by a light touch.

XI.—On the Preparation of Rock Sections for Microscopic Examination. By DAVID FORBES, F.R.S., &c.

THE results of microscopic investigation into the mineral character and physical structure of rocks have of late not only proved how essential an instrument the microscope is for inquiring into their origin, and studying the various changes which they have undergone, or are now undergoing, but also point out that its future and more extended application must throw great light upon many abstruse questions relating to the geological phenomena of nature, by the careful study of minute microscopic details which until lately have been quite neglected or overlooked.

The examination of rocks, especially of the more compact or apparently homogeneous ones, by transmitted light, is of much greater importance than when they are merely looked at superficially as opaque objects; and in order to do so it becomes necessary, at least in the case of most rocks, to render them as translucent as possible, by reducing them to the form of their uniform plates or sections; it is therefore proposed in this communication to give a short description, showing how such sections can be prepared, in order to induce more of our fellow-microscopists to direct their attention to this interesting subject, and thereby to assist in advancing the knowledge of the structure of minerals and rock masses.

If a lapidary's bench is at disposal, the preparation of such sections is greatly facilitated; but it is not at all imperative for the amateur microscopist to possess one, since with, it is true, somewhat more labour and patience, the finest sections can be made by hand, not only equally well, but in the case of some of the softer rocks—metamorphic schists and various others, which, especially when making cross-sections, are liable to tear or break up under the rougher and less easily controllable movements of the machine—larger and more perfect sections can be executed by hand than on the lapidary's wheel.

The first point to be attended to is to secure a proper fragment of the rock under consideration, which can be easily done in the case of massive homogeneous or crystalline rocks, by chipping off a piece about from one quarter to three quarters of an inch across, as flat as possible, with the aid of a steel chisel and hammer. Should the specimen, however, be a very small, rare, or valuable one, or if it be required that the line of section should pass along some given direction not easily followed by chipping with a chisel, it is necessary to use a toothless iron saw worked with emery and water, or to resort to what is termed "slitting," an operation performed by any working lapidary (at a trifling expense per square inch of cut surface), by means of a thin steel disk, charged on its edge with diamond powder and set in rapid rotation in his lathe.

One surface of the rough fragment or thin slice thus obtained is now ground down with emery and water, by holding it against the rapidly-rotating pewter plate of a lapidary's wheel, or, in default of this, by the motion of the hand on a circular plate of cast zinc, iron, or stone (from 4 to 6 in. diameter, and $\frac{1}{2}$ to 1 in. in thickness), using in succession various sizes of emery powder down to fine dust, until a perfectly flat surface is obtained; after this, it is now again worked with water alone, upon a small, circular, Turkey hone, until the under-surface becomes beautifully smooth, free from scratches, and almost polished in appearance.

Having thus obtained one finished surface, this is cemented with Canada balsam to a small piece of plate-glass about $\frac{3}{4}$ in. square and

$\frac{5}{8}$ in. in thickness, making both the stone and plate-glass tolerably hot, so that the balsam may sink into the pores, or softer parts of the section, which, upon cooling, remains firmly attached to the glass;—care must of course be taken not to employ a heat so elevated as to risk the expulsion of any liquid which might possibly be contained in fluid-cavities in the specimen.

This small square of plate-glass now serves as a handle when grinding down the other surface upon the lapidary's plate, or by hand, as before described, until the section, which should be examined from time to time, proves to be sufficiently translucent for use under the microscope. It is then finished in precisely the same manner as the former face, with water alone, upon a fine Turkey hone, and is ready for mounting upon its permanent slide. The mounting is done simply by warming the plate-glass square until the balsam is liquefied, when the rock section is carefully transferred on to the gently heated glass slide; afterwards the upper surface of the section is moistened with a drop of turpentine, and a thin glass cover fixed on the top of it with Canada balsam as usual.

The glass slides which I use are all $1\frac{1}{2}$ in. square, a size I consider more convenient than the usual one of 3 by 1 in., both as being less liable to crack right across the centre—to its utter destruction—as commonly occurs when the latter are accidentally let fall, and more particularly as permitting, in the case of very delicate or friable sections, that the section be finished upon the slide itself, without the necessity of any subsequent removal, as already recommended in ordinary cases. In such cases, in order to prevent the slide being scratched when grinding, it is only requisite to cement to each of its four corners a small piece of thin microscopic cover-glass or of sheet-zinc previous to commencing; these corners—which likewise ensure that the section is ground more flat and uniform in thickness—are removed after the operation.

Hard rocks are, as a rule, easier to prepare than soft or porous ones, which latter should first be soaked in turpentine, then in soft Canada balsam, and afterwards heated until quite hard. Rocks containing minerals of very different degrees of hardness, as, for example, quartz with calcite, &c., should be ground very carefully and slowly upon a close-grained stone or plate, so that whilst the hardest parts are being ground down the soft ones may not be worn away or destroyed at a greater rate.

The thickness of such rock sections must naturally vary greatly, according as the mineral components of the rock itself are more or less opaque; some of the more compact and opaque rocks necessitate sections not more than $\frac{1}{1000}$ th of an inch in thickness, but ordinarily one-tenth of this, or $\frac{1}{100}$ th of an inch, is sufficient, and in some cases no more than a quarter of this latter thickness is required.