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“Looking at paper”

Rob Wheeler

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The Charles Close Society was founded in 1980 to bring together all those with an interest in the maps and history of the Ordnance Survey of Great Britain and its counterparts in the island of Ireland. The Society takes its name from Colonel Sir Charles Arden-Close, OS Director General from 1911 to 1922, and initiator of many of the maps now sought after by collectors.

The Society publishes a wide range of books and booklets on historic OS map series and its journal, *Sheetlines*, is recognised internationally for its specialist articles on Ordnance Survey-related topics.

Looking at paper

Rob Wheeler

There is a lot that could be said about the Survey's endeavour to procure paper economically that would meet the needs of its printers and of its varied users. The purpose of this article is more limited. It sets out to describe why it can be important in looking at maps not to forget the 'white bits' and to explain how fairly straightforward observations can help one to understand the maps

I shall be writing about machine-made papers. Hand-made papers account for a tiny percentage of OS maps and there are numerous accounts of how such paper is made. In contrast, little has been written about machine papers.

These are made by pumping *stock* (that is, wet pulp) onto one end of a wide conveyor-belt woven from wire (and called, simply, the *wire*). The excess water drains away and further water is removed by compression between rollers. By the time it reaches the end of the wire section, the resulting web is strong enough to be transferred to a belt of cloth (called the *felt*). As it progresses along the felt the web is dried still further until, at the far end it is dry enough to be slit and cut to produce the particular sizes that have been ordered and it can be stacked in reams (traditionally of 480 sheets), wrapped and despatched. In the course of its passage through the machine, the web tends to be stretched and the fibres in the pulp tend to become aligned with the direction of motion. This direction is called the *grain*. Paper tears most readily along the grain. (Try it on a sheet of unwanted A4: the grain on A4 (or A2, or A0) normally runs lengthways - known as 'grain-long'; on A3 etc it runs crossways - grain-short.) Paper folds most neatly with the grain parallel to the fold. (So modern OS maps use paper that is grain short for the sake of that first top-to-bottom fold. If paper takes up water from the atmosphere, the fibres swell, but they don't extend significantly. Thus paper is dimensionally more stable along the grain.

Recognising the Grain

Every printer knows the importance of grain and how to recognise it. Some of the tests (like tearing) are destructive. Others (like the droop test) work with a flat sheet of paper straight from the supplier but not where the paper has been rolled or folded at some time in the past. My preference is to view the paper illuminated at a very shallow angle by the pencil beam of an LED torch.

For the purpose of illustrating this article I took *figures 1 and 2* using a filament inspection lamp at an extremely shallow incidence angle, and it produces a more complicated picture because one sees phenomena at several different scales. At a scale of about 1cm, *figure 2* shows regular ripples. This is the result of its physical maltreatment in the past and need not concern us. (As a sort of scale, the (latitude) gradations in *figure 1* are about 3mm apart, those in *figure 2* (longitude) about 2mm.) At a scale of around 0.1mm, both views show a lot of grit and what may be seeds embedded in the surface and

sometimes casting shadows. Sherlock Holmes would no doubt be fascinated, but they do not concern us here. What matters is the scale of around 0.5 to 1mm, where *figure 1* shows a pronounced ripple pattern, whilst *figure 2* is bland by comparison. That is the contrast we are looking for: *figure 1* is illuminated cross-grain, *figure 2* along-grain.

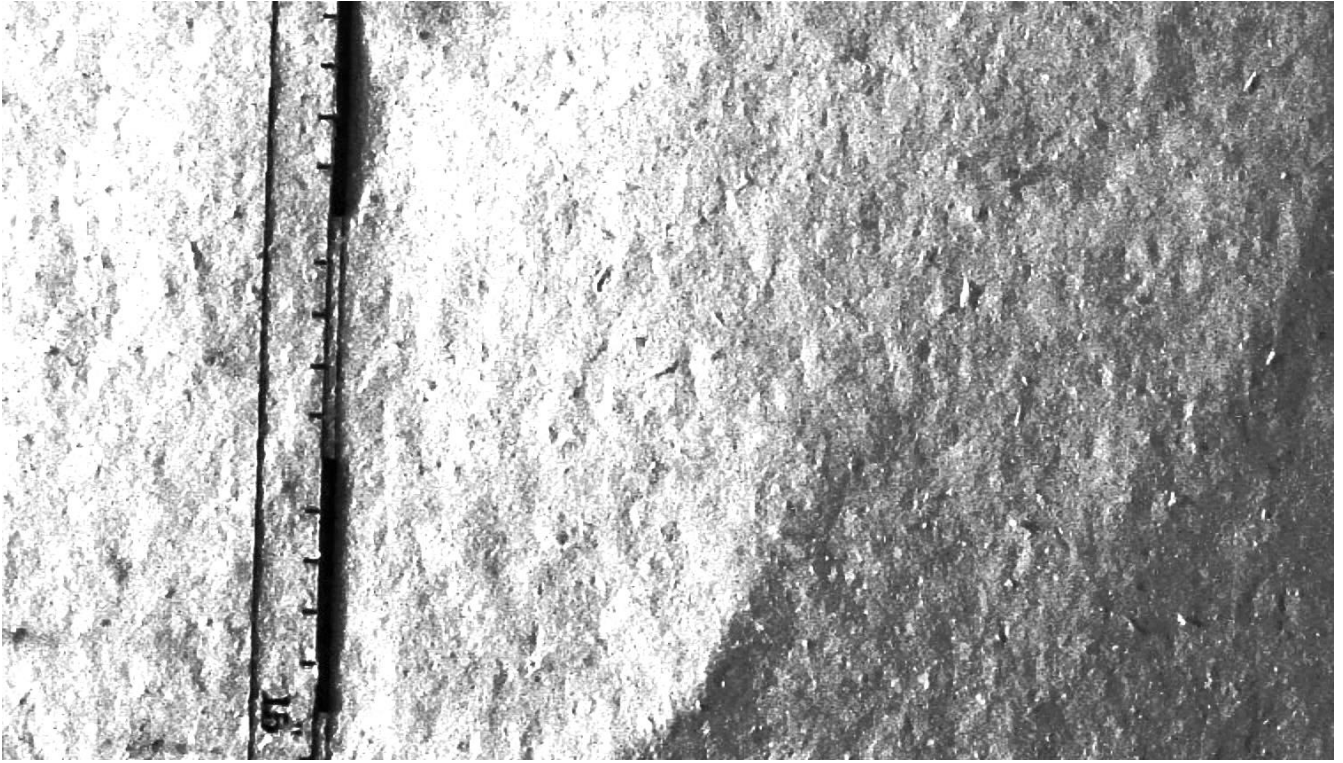


Figure 1



Figure 2

These images show T&JH paper, by far the commonest supplier from the 1860s to the end of the century. With experience one learns to recognise other suppliers, or at least to see that they are different. And if there is no difference between the two directions, especially if you see a swirling pattern, then there is a fair chance you are looking at hand-made paper.

Example 1: Portsmouth

Let us see how such things can be of use.

As a result of concerns about the adequacy of Portsmouth's defences, survey was authorised of an area that corresponds to Hants 75 and 83, the eastern halves of 74 and 82, and the western halves of 76 and 84. The survey was undertaken in 1856-59. (The dates are known from later maps, which oscillate between quoting the dates of this survey and the next one.) It would appear from the Area Books that all this survey was published in 1860.

Following the authorisation of a general resurvey of southern England in 1863, the whole of Hampshire was surveyed, including the parts that had recent military surveys. Thus the Portsmouth area was re-done in the second half of the 1860s. I shall term these surveys *the 1850s survey* and *the 1860s survey*. There was a further full revision 1872-75. This can normally be recognised from the marginalia. The problem lies in distinguishing the two earlier surveys, because in this era maps - at least, parish sets - came with a title page that gave the date of survey and the name of the surveyor. The individual maps simply had two mile-long scale-bars in the lower margin, the upper one graduated in chains, the lower in feet and in yards. Maps tend to become separated from their title pages - indeed just what form the title pages took in the 1850s survey is an open question. So how can one tell which survey a map is from?

- a. The first point to look at is the embossed printing date (epd). Unfortunately this is sometimes illegible and there are cases where what should be a '5' looks convincingly like a '6'.
- b. The second point - once one has discovered it - is that the 1860s survey was published by parishes, the 1850s survey in complete sheets; but there are ambiguous cases, eg when a single parish fills the entire sheet.

But what always serves to distinguish the surveys - and can be applied even with cropped and mounted specimens - is that up to 1860 the paper used was always grain-long, whereas from 1866 it was always grain-short. I have not encountered any lithographed sheets of the Portsmouth area that were printed in the years 1861-65.

Watermarks

Watermarks in machine-made paper were impressed into the top surface using pre-formed metal letters attached to an unpowered roll made from some form of wire mesh and known as a *dandy roll*. The mark normally extended over two lines. The upper line identified the manufacturer; the lower, at least until 1861, gave the year when the paper was made. Until 1861 there was an excise duty on paper; to make evasion more difficult there was a requirement

that a certain proportion of the sheets in every ream must bear a date. If the dandy roll had a diameter of 12 inches - which was a common size for thickish papers - its pattern would repeat about every 38 inches. This would bear no relation to the cutting process, so it would have been unreasonable to require every sheet to bear a date. For most of the ordinary papers used for books and suchlike, the watermark ran parallel to the axis of the dandy roll. It would typically be placed in the middle of the paper web, and would be balanced by another mark opposite it on the roll. Thus, with a 12-inch roll there is a water mark running across the grain in the middle of the paper web, and it repeats every 19 inches. But the effect of the cutting scheme is that such a watermark occurs at a totally unpredictable position on the supplied sheet.

The papers used for maps were also used by artists. A water-colourist who had created a beautifully limpid sunset was liable to be upset if he saw the name of the paper's manufacturer blazoned in the sky. Artists wanted watermarks at the edge of a sheet. This could be achieved if the watermark ran around the circumference of the dandy roll close to its edge, or, better, next to both the edges. Whatever the cutting scheme used these watermarks would end up on the edge of the delivered sheet.

The great majority of the papers delivered to the OS were of this form. Such watermarks run along the grain. On a grain-long sheet, they will be at the top or bottom edge; on grain-short, on one side or the other. Exactly how far from the edge will depend on how much of the edge of the web has been trimmed off as waste. The date is always closest to the edge and sometimes the bottoms of the figures are lost, but the date usually remains legible. Unless an illuminated panel is built into the working surface (as in the best-equipped map rooms) finding watermarks is not easy, so it is well-worth establishing the grain direction prior to searching, so that one knows where to look.

Dire warnings have been given about paper being used for printing maps long after it was made. Certainly the very early papers seem to have been procured in highly optimistic quantities and to have been managed in a disorganised way. A further problem was caused by the Railway Mania of 1845-6: map demand increased; supplies of all sorts became difficult; the Survey over-reacted, and found itself with excessive stocks when map demand returned to normal levels. Sanity was restored from about 1853-57, with most papers being used within a year or so of manufacture.

The removal of paper duty in 1861 had strange repercussions. It may be that duty-paid reams were retained by manufacturers hoping to reclaim the duty and eventually offered for sale when they had lost hope of a refund. At any rate papers of 1859 and 1860 (and occasionally 1858) appear with epds up to four years later. Meanwhile there is a dearth of watermarks of 1861-64. What seems to have happened is that, freed from the legal obligation to watermark papers, most manufacturers ceased to apply watermarks. And one finds quite a few maps printed in these years on unwatermarked paper, often on paper whose appearance strongly suggests it is from the usual suppliers.

And then, in 1865, dated watermarks re-appear. For quality control, there is no need for a watermark if a defect is discovered before or during printing: one can simply look at the wrapper. If a defect becomes apparent at a later stage, it becomes a challenge to decide what the paper was. So perhaps the OS re-imposed the requirement as a condition of contract. And then, after 1870, the OS seems to have decided there was no need for the date. So, after this date, watermarks become rather less useful.

Watermarks are often presented as the one attribute of a paper that matters. I would argue that what is really important is to look for the grain and look at the texture. That will, amongst other things, make it easier to find a watermark. If you do find a dated watermark, that is certainly of value, not least because it can sometimes show that an epd has been mis-read or perhaps is simply wrong. But an awful lot of watermarks are only of limited assistance.

When the OS introduced the lithographed six-inch, it dropped the requirement for a watermark on these papers. Watermarks remained on the papers used for engraved maps until as late as 1909. But, in general, for 20th century maps, one has to do without them.

Example 2: 'Special Revision'

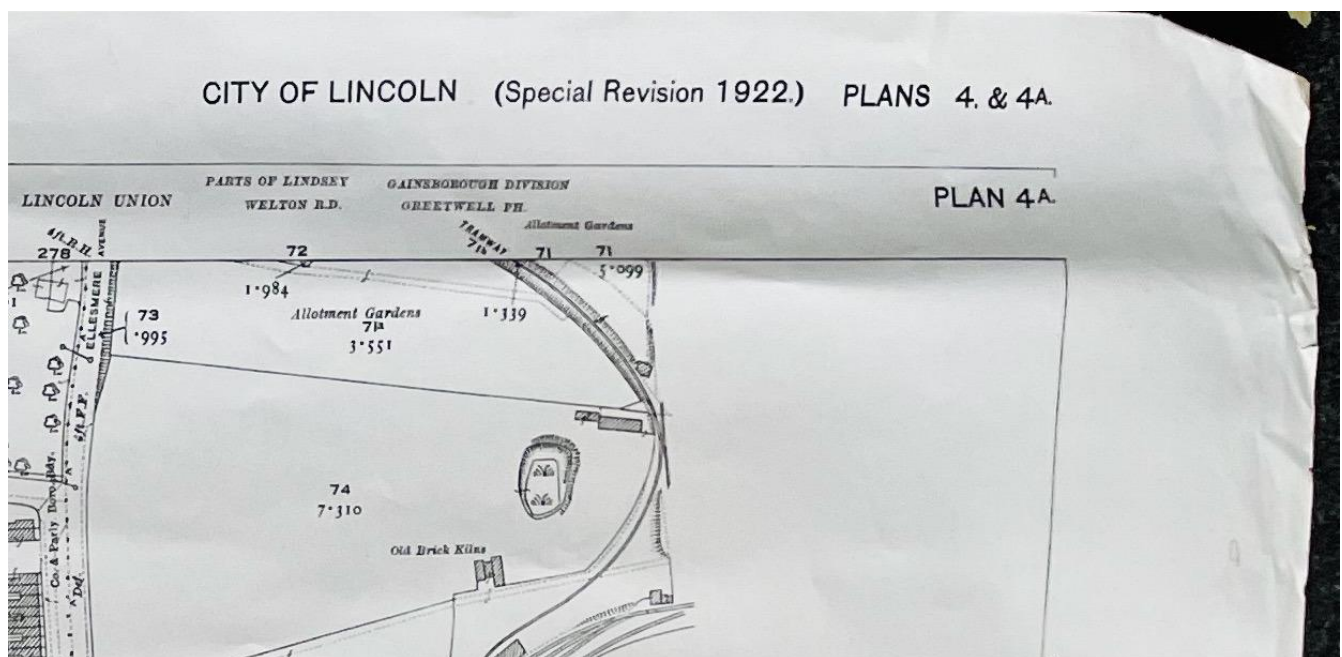


Figure 3 (above) is an extract from a map found in City Hall at Lincoln. In general, it seems to be an OS product; but although it is the normal size for a 25-inch map, it is portrait-format, detail stops at the city boundary, and this sheet consists of two irregularly-shaped areas crammed together so tightly that the detail actually touches. Another sheet (also with two irregular areas) has one rotated through 90 degrees in order to fit. Such practices seem to be unrecorded in any other OS output.

The map is in a collection that includes a lot of material from the Planning Department. One learns to be wary of Town Planning staffs: they attracted geographers, they often employed good draughtsmen, and they had

access to high-quality facilities for copying maps of this size - notably the services of Cook, Hammond, & Kell. By way of example, the earliest depiction at the 25-inch scale of Cambridge University Library is on a version of Cambs 47.2 revised by Cambridgeshire Planning Department. That origin is acknowledged in the marginalia (twice); without that, few users would not suppose it was not an OS product.

So how confident are we that *figure 3* is really a 'pure' OS job? It is on thin paper, might it be a modern photocopy rather than an original, especially as there were multiple copies rolled together?

The updating of maps by local authorities was enjoined by the Local Government Board as early as 1910 in regulations it issued in expansion of the 1909 Housing, Town Planning, etc, Act;¹ but there was never any suggestion that such updates should extend to Area Computation functions and it is unlikely that any authorities possessed the knowledge of this activity found within the OS. Therefore it is a good rule of thumb that any updating which has led to fresh area-computation has been done by the OS; any updating which violates the rules for showing areas has been done by someone else. If one compares *figure 3* with the previous edition (revised 1904) one finds that all the areas have been re-calculated and a new parcel number ('Tramway 71b') has appeared; therefore this is an OS product - presumably a 'repayment job'. But is the thin paper original or the result of modern photocopying?



The way to answer this is to look at the map in transmitted light (*figure 4, left*). One sees dots (or small blotches) aligned in rows that form a lozenge pattern. They are clearer in some areas than in others. The red lines have been drawn in *figure 4* to show the alignment of the dots; the angles between them have then been measured with a protractor: 69° and 114° (the latter having a complement of 66°). Of course, one weakness in measuring angles from a photograph, especially a close-up, is that there will be a certain amount of distortion so these angles may be out by a couple of degrees.

¹ EG Bentley & S Pointon Taylor, *A Practical Guide in the Preparation of Town Planning Schemes*, 1911. (Available online)

Nevertheless, the angles do appear larger than 60°. They are probably felt marks, reflecting the way the felt is woven; and what might have originally been 60° has perhaps been increased by the stretching of the felt with use. Marks like this are characteristic of a wide range of papers up to the 1960s. Modern papers usually exhibit an unstructured blotchiness; if a linear pattern is visible it tends to be parallel to the grain. Incidentally, with a felt mark, the alignment of the paper ought to intersect the two directions marked. That is indeed the case here: the paper when it was photographed was at an arbitrary angle. Drawing the red lines without knowing the paper direction can help preclude wishful thinking.

It will be apparent that this test is not very informative as to date, but it does rule out the period of readily-available, high-quality office photocopiers. The map is almost certainly of the date it appears to be.

Example 3: Place's Waterproof Paper

The one type of 20th century paper for maps that is widely known is that developed by Col Place, RE. Much has been written about it, which it would be superfluous to repeat. However, no means has been given by which it can be definitively recognised. It has a waxy feel and water droplets tend to remain droplets on the surface rather than soaking in; but there are other papers used by the OS for which this is true. So far as civil maps are concerned, we recognise Place's paper by a statement on the map cover, or a sticker on the map itself. It is military issues that are the problem, issued paper-flat. There are numerous such maps on waxy paper that have been tentatively identified as Place's - but how do we know?

After attempts to devise a protocol for introducing water droplets and measuring their behaviour - a practice which collectors may be persuaded to tolerate but which few map librarians will countenance - the answer turned out to be the same as for Example 2: view the map in transmitted light. Specimens on Place's paper are translucent without any pronounced colouring, except where acid has penetrated at folds and turned the paper brown. The dots or blotches making up lozenge patterns that one sees in *figure 4* and which are found to some extent on all other OS papers of this era are never seen on Place's paper. What one can see on close inspection is a rectilinear pattern of lines at about 30 to the inch, that run vertically and horizontally. This is shown (*following page*) on *figure 5* (which also includes a portion of the kilometre scale). The figure does not, of course, bring out the translucent appearance: the brightness and contrast have been set specifically to bring out this barely perceptible grid of lines. As for the cause of this grid, it may well be the impress of the wire belt from the 'wet end' of manufacture, but that is speculation. What matters is that we have a straightforward way of distinguishing Place's paper from everything else.

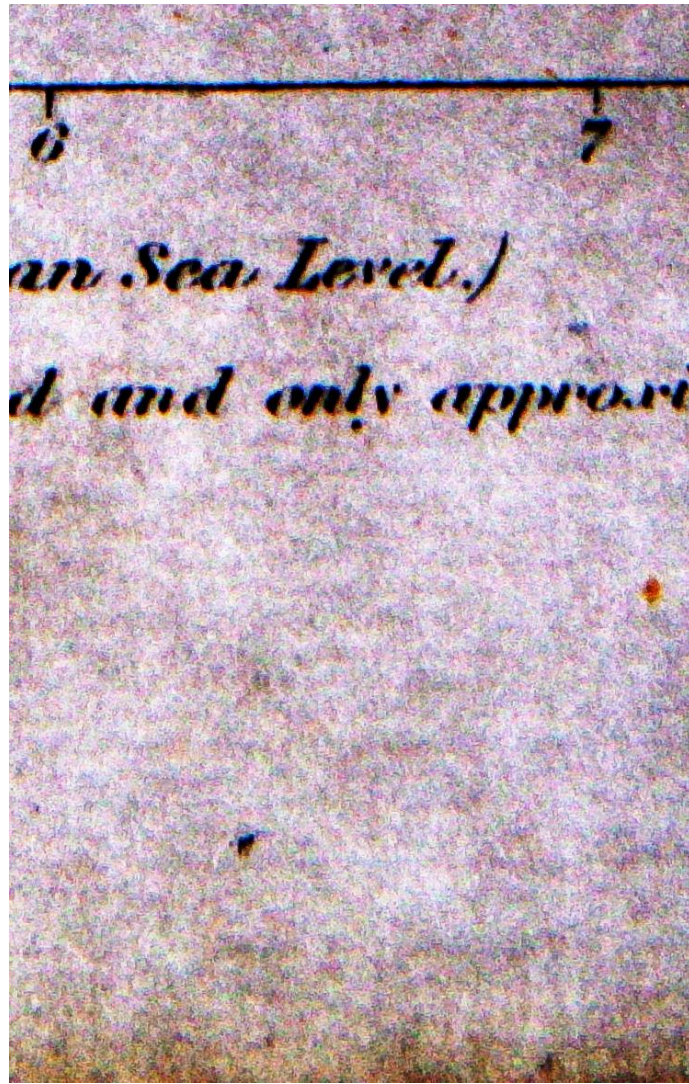


Figure 5. Place's paper in transmitted light

Conclusion

It would be tempting to sum up by declaring that every collector needs a back-lit panel and that one should always have an LED pencil torch to hand when examining a map. A rejoinder to this would be that the examples above are quite exceptional. Sub-editions within the 25-inch '1st edition' are known from elsewhere but is there anywhere other than Portsmouth where they cannot be distinguished by their marginalia?² My second case, of a map which might not be what it seems to be, is perhaps not so very uncommon, though the test described here offers limited discrimination. The third example is somewhat specialist, but it does offer a powerful test that is easy to apply. One does not really need a back-lit panel: just lift a corner of the map and look through it.

It may however be worth making the point that maps are physical objects, and there are occasions when even the very best digital image is no substitute for looking at the map itself.

² The 1850s survey of the Aldershot area carries a title identifying it as such, along with a local sheet number.