

THE SMALL-SCALE MAPS OF THE ORDNANCE SURVEY:  
*A paper read at the Afternoon Meeting of the Society on 9 November*  
1931, by

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IT is natural that we should, occasionally, take stock of our national cartography, and equally natural that it should be in the hall of this Society. The discussion which follows is then only one of a series. The immediate forerunners are the paper by Colonel W. J. Johnston in December 1919, a joint paper on national grids of March 1924, Captain Withycombe on lettering in November 1928, and Mr. Hinks's note in the *Journal* on the new 1-inch in October of this year.

In 1919 Colonel Johnston spoke of the early history of the engraved 1-inch. That history need not be repeated. There are one or two points of interest however which he did not mention. The first "county" sheets with their heavy woods and unsatisfactory hachures, "Mudge's Maps" we might call them, were evidently kept up to date more than we are able to do to-day, and published no doubt in very small numbers. There is a series of five successive sheets of this first map round Brighton, each successive print showing further extensions and new railway construction. On the earliest of these maps the margins were engraved round the outside of the County only. Interior margins were stuck on separately. Contours did not appear until the third edition, and as the spot heights were not very legible it really is difficult to read and to appreciate the country on these early efforts.

Colonel Johnston mentioned that when the time came for the revision of the small-sheet series it was decided to separate the hachures from the detail and water. Hachures should not alter, detail must, and the hachures as long as they were on the same plate would certainly suffer in the process. Thereafter hill features were printed in brown. It is a delightful map, that small engraved sheet with its beautifully clear detail and hills. Separation from the detail was then the first of those adventures which the hachures have met with: adventures which have greatly injured their original beauty. The worst of these adventures was the cutting and joining to fit into newer and more convenient sheet lines. At this time ideas on the best size of map were altering. As we get across country faster and farther, so the inconvenience of changing maps leads to larger sheets, however tiresome they may be to fold. It may be added that the detail plate suffered almost as much, in this cutting and patching of unequally worn copper plates, as did the hachure plate. The necessity of redrawing for the new edition is largely due to this fact.

We come now to the days, just before the War, of the Killarney experiment, and of the new French 1/50,000 which caused such comment and had so great an influence. Alas! those too comfortable and easy days soon passed. The newer French style is pleasant but has need to economize away half the printings of its pre-war forerunner. The Killarney style stood self-condemned in the light of post-war retrenchment. But there are still some of us who shared in

those experiments, and who determined one day to return to the charge. Enter then the "Popular Edition." We have it now complete, and a very good clear map it is. The six or seven printings (the exact number depending on the "water" plates) give a clear sharp result. Hill features come naturally and clearly to the educated eye from the 50-foot contours in all but flattish country. This edition has, to my thinking, two great defects however. No contours explain minor features, small accidents of the ground, as do hachures, and they had gone, some thought for ever. Again, the violent red of the first-class road, calling the eye back whenever it strays to hill or stream, is as unfortunate as it is unnecessary. Here a word of apology is due. Cartography is an art. It touches questions of taste. As we know, we must not wrangle on such matters, but this afternoon it is my privilege to talk for a moment, and I can only give expression to my own views.

We must notice in passing the excellence of some of the 1-inch tourist maps produced in these early post-war years. A beautiful map of the Isle of Wight is a good example.

Next let us turn to the "Popular" as it appears for Scotland. It would be wrong and unfair to come to the new lettering of the "Relief" edition by any other path, for this is a study in evolution, and the impetus of Sir Charles Close's day—a second golden age for the Survey—is not yet spent. In England the detail plates of the Popular were transferred from the old engraving. Naturally the writing and symbols were not suitable for colour work. We were all aware of that fact, and in 1919 we began at Sir Charles Close's order to elaborate a style of writing proper to a hand-drawn map.

The "Perth Sample" will live long in Survey thought and history. Bold and neat compared with the transferred work the writing so evolved proved a great advance. The Popular of Scotland, with a countryside made for contouring (our first contoured map was of Schiehallion in Perthshire and was made in 1778), is a most excellent map. If only the red of the roads had been used with more discretion it would be hard to beat.

Then we come to the modern English revival of lettering, and, as good fortune would have it, we had the services of Captain Withycombe and of Mr. Ellis Martin. The style of the new detail plate was born. We do not all approve of every letter. No revival but carries us just too far in our enthusiasm. The alphabets are, anyhow, a great improvement, the writing is just sufficiently varied to escape flatness, and the new lower case sloping Roman (who had heard of such a thing a few years back?) is particularly good and particularly original. Accompanying these alterations on the black plate there was to have been a highly ornamental margin, but when it was tried it proved altogether overpowering. Clarity and a helpful presentation of our still beautiful country must take first place. Too heavy a marginal decoration distracts the eye and overshadows even so fine a feature as Dartmoor.

You will remember that the copper plates from which the last edition was taken were originally prepared for the third edition. Not only had subsequent revisions been made upon them but changes in cartographic thought had meant further alteration and the cutting and joining had led, here and there, to singularly unfortunate results. It was decided to recompile from the 6-inch. The Popular of Scotland had been drawn on "blues" (at 2 inches to the mile)

of the old copper engraved work. The new edition is taken directly from the 6-inch.

A recompilation means a complete break with the old copper material and offers opportunity for any other changes which experience suggests. The most important of these changes is the choice of a new projection. Practically all the maps of England had been hitherto on the Cassini projection. So far as the cartography of a relatively small area goes the Cassini gives the required accuracy. Its main fault is that it introduces rapidly increasing errors in the northing and thereby distorts angles. The distortion is not, of course, sensible on paper, but it is very sensible in direct comparison with nature. Suppose, for example, that a theodolite is set up over one of the old triangulation stations, and that the old bearings to other stations are reobserved and compared with those deduced from the coordinates. A substantial discrepancy will be found. In other words the projection, although quite suitable cartographically, introduces sensible angular distortion, and complicates the work of the surveyor in repairing or in adding to the national triangulation. It need not be assumed that this observer must necessarily be a soldier. The same inconvenience will be found by a mining engineer, or by one who may be surveying the site for some scheme of water conservancy and power. It is for this simple and practical reason that the orthomorphic type of projection is employed so generally by the civilized world in national mapping, and as the occasion provides the opportunity for following the same path we have naturally adopted it. The Transverse Mercator which we now use is in reality the orthomorphic form of the Cassini because it achieves angular accuracy by introducing into the easting an error similar to that already existing in the northing.

The central meridian of this new projection is  $2^{\circ}$  west of Greenwich, and from this meridian we can extend to cover Great Britain without substantial error. In order to do this the more efficiently we have chosen two lines which are parallel to the central meridian and lie at 200,000 yards on either side. Along these lines the cartography will be correct at the scale of the map. In the band enclosed between these two lines, and therefore including the central meridian, the presentation will be slightly smaller in scale than that actually assumed, but the change is so slight that distances remain sensibly correct on paper. Outside the two parallel lines presentation becomes progressively somewhat enlarged. Even however at the extreme limits of East Anglia the errors thus introduced do not exceed one part in two thousand.

Somewhere upon this central meridian we must then choose a point as the datum for our coordinate calculation. The datum point so chosen is the intersection of  $2^{\circ}$  west with  $49^{\circ}$  north. The surveyor is not of course hampered by changes of sign. The man in the street would obviously prefer numbers to run consecutively throughout the whole area. For that purpose to each computed coordinate is added 1,000,000 yards east and 1,000,000 yards north. This arbitrary number has been chosen purely for computing convenience and displaces the origin of numbers to a point well out in the Atlantic southwest of Great Britain. Where this point actually lies is a matter of no importance whatever. The result is that the coordinates of the projection run consecutively with the same sign northwards and eastwards.

I must now refer again to the past. On 17 March 1924, at an afternoon

meeting of the Society, a discussion was held on the question of grids. The discussion was so organized that the respective views of the man in the street, the Director-General of the Ordnance Survey, and the Officer in Charge of Geographical Army matters, were expressed and summed up in the discussion. To that interesting discussion I need add but little to-day, except on the convenience of the grid system of reference. A few words are necessary because it has been stated that the old 2-inch squares of previous editions did in reality serve all national purposes, and should not lightly be abandoned. The great point is that they have not served national purposes. It is probably felt by every cartographer who has had the opportunity to produce an extended series that he has reached finality in the matter of his sheet lines. After considerable experience in peace and war I find myself able to affirm quite definitely that finality in sheet-lines is never reached. Even with that clear and excellent Popular Edition as it now exists we have found it necessary to provide numerous tourist or special sheets for the convenience of this or that locality which has fallen awkwardly upon the normal series. The squares on these sheets are not of the same letter and number as those corresponding on the regular series. Moreover, 1-inch,  $\frac{1}{2}$ -inch, and  $\frac{1}{4}$ -inch references have no connection with each other or even with neighbouring sheets of the same scale.

Supposing that we look a little farther back, and supposing that the place-names of England had been indexed with great care upon the small-sheet series of Great Britain, that index would have become automatically out of date at the introduction of the larger sheets, or else a really practical convenience to the public would have been put off in order to save re-indexing. Such indexes as that I have quoted are bound to multiply in the future. For national efficiency those questions which rest upon population and communications must more and more become a matter for scientific analysis and reasoned organization. Just as the soldier found it necessary to index his country so that there should be no question of difficulty or error in referring briefly to any desired spot, so must the same problem arise in any intensive use of country. The corollary is that a system of reference must rest upon the measurement of the country as a whole and not upon the contemporary arrangements of sheets, an arrangement which is bound to be more or less ephemeral.

Exactly how the man in the street will apply the coordinates of our national survey it is difficult to foresee. The soldier has evolved his own technique, but his wants are not those of the civil population, whilst he is perhaps more hampered by the necessity of brevity, and yet less hampered by size of area. The civilian may want a reference throughout Great Britain. For the temporary purposes of a soldier references might be confined, shall we say, to Wessex or to East Anglia.

We shall presently come to a national technique in this matter. In the meanwhile the coordinate numbers are given clearly upon all the scales on to which the lines of the new grid have been put. These lines are of course parallel to the central meridian or to the perpendicular to that central meridian through the point of origin ( $2^{\circ}$  west,  $49^{\circ}$  south). They are shown on the map merely as a convenience. Coordinates could of course be measured from the margins of the map without any grid lines across its interior surface. That would imply however long scales and considerable chance of error due to



distortion of the paper. For convenience, then, the surface of the map is broken up into small figures by these parallel lines, but it is to be noted that there is no actual necessity for these lines to form squares. For certain purposes, for example, it might be much more important to gauge distances east and west than north and south, and in such a case the lines shown on the surface of the map might be closer together in the east and west direction than in the north and south. It is however convenient and pleasant to the eye to maintain equal distances so that the coordinate lines do in practice form squares. The size of these squares is only important inasmuch as they should be neither too large for convenient sub-division nor so small as to interfere with map reading by reason of the number of added lines. On the new 1-inch scale lines are 5000 yards apart. On the  $\frac{1}{2}$ -inch they are 10,000, and on the  $\frac{1}{4}$ -inch as soon as the new projection is adopted in that connection the lines will also be on 10,000 yards. These matters have actually been adopted in conformity with the opinions expressed at the meeting to which I have already referred in March 1924.

The use of the word "grid" is perhaps somewhat unfortunate. Nowadays it has an electrical significance. In its geographical signification it should be regarded as something which is independent of any scale, and which will allow us to refer with accuracy and despatch to any given point in such a manner that the rest of the world will be able not only to identify that point, but to find it on any map at any scale produced by the national survey. I might add that we are already compiling on this grid a gazetteer of all the place-names which fall upon the 1-inch together with their coordinates. In using that gazetteer with other scale maps it need not be assumed that every name will be found upon them. The  $\frac{1}{4}$ -inch, for example, must omit a very large number of names upon the 1-inch. But the actual site, if not the name, will be identifiable without trouble.

In considering the new 1-inch we have now finished the discussion of the detail plate with its margins and its reference system. The important question of the relief still remains. Hachures are valuable in detail, untrustworthy in relative emphasis, apt to carve out rather than to round off; and our English hills are mostly rounded off. Layers are a conventional sign rather than a natural presentation. Hill shading is apt to confuse minor features, is often used in violent emphasis and unpleasant colour, but can be useful and is natural to the landscape. Finally, contours and spot-heights are the only reliable measure of altitude. Can they all be married off? I think they can and that the new 1-inch is proof. But if so, layers, hachures, and shadows must be regarded as mere aids to the general effect. The layer convention is really destroyed by the added colour of the hachures. The relative emphasis of the hachures is lost in the layer. Neither are referred to at all in the margin therefore. They have no individual significance on this map. They are parts of a whole. The general scheme is directly inspired by the Killarney sheet, but with the modifications imposed by the two considerations regarded as axiomatic. The map must not cost more than the popular, and must not take longer to prepare. We have therefore used existing material, have avoided the crayon shading of the Killarney, and have combined printings so as to keep within the number of the popular.

Mr. Hinks in a very kindly article has dealt with the projection, and indeed the whole map, and it is on view here and now. I need, then, say no more until I have to answer criticism, except on the one question of roads. An important committee asked some years ago for the vivid red. True, but committees of laymen should apportion urgency, and leave the choice of appropriate line, symbol, writing, and colour to the map-maker. That is what we are paid for. It should also be remembered that modern roads have improved as much as modern cars, and that any motor vehicle can use any second-class road.

If the 1-inch is but a modified Killarney, the new  $\frac{1}{2}$ -inch is also inspired by the experiments of the past. Our  $\frac{1}{2}$ -inch was in answer to a call from the War Office in the days when war maps were not printed in the field, and when one single scale was deemed sufficient for general and private, motor car and Shanks's mare. Names on this map were typed and not written, and are, to the modern eye, cramped and inferior. We cannot afford to redraw however. It was produced with a hill-shading, or with layers, and, for a few brief years, with both. The combined edition had the germs of success, but it defeated itself by a too pretentious layer system (no less than seventeen on the Alnwick sheet), by a vile bottom green, and an equally dreadful bluey top layer. In fact, the colour might have been laid on with a trowel. The hill shading was a brush drawing, photographed through a screen, photo-etched upon copper, worked on and improved in that stage, and finally transferred to stone. The stones have been cleaned off, but pulls from the copper plates exist. It is these we have used, and just as the 1-inch shadow is obtained by erasing the "sunny" side from a duplicate hachure plate, so in the  $\frac{1}{2}$ -inch have we used a doctored plate of the hill shading.

A word on this question of the supposed direction of light. A map is normally held or laid before one with the north edge farthest away. The map-user, then, keeps "south light" from the map which is lit from opposite (or "north") (or, on the office table, most commonly from the north-west). This is the only but quite convincing reason for a convention which is continually being called in question by the ultra-logical.

The new  $\frac{1}{2}$ -inch is not the equal of the new 1-inch. We may do better yet, and in this connection I should like to refer to a most useful and instructive correspondence with Mr. Hinks. We shall certainly alter the margins and we may modify the colouring, but, on the whole, we are content to think that this new  $\frac{1}{2}$ -inch is a great advance on its predecessors. I shall leave you to judge.

Now that we have discussed the new 1-inch and  $\frac{1}{2}$ -inch maps I should like to refer to some other maps. If any one prefers a plain uncoloured 1-inch map let them try the outline editions. They are excellent and clear maps for those who really can visualize country from contours. If any one desires to study physical features without the possibly disturbing effect of the detail and road plates let him try the physical edition.

Colonel Johnston referred to the  $\frac{1}{4}$ -inch. He spoke of the first edition. It was one based upon Mudge's maps and singularly inaccurate according to our standards. The new post-war  $\frac{1}{4}$ -inch is a clear and excellent map. As it first appeared however the sheet-lines were not always happily chosen. These have been revised, and although it is impossible to please everybody, a general liking for the new arrangement is reflected by the sales.

There is a sheet of the civil aeronautical edition in which railways, water, and woods are given the prominence which the pilot demands. To emphasize railways and water is easy, but as the bottom layer of the normal edition of the  $\frac{1}{4}$ -inch is green it was impossible to show woods clearly without removing that layer.

Now I pass to the 10-mile map which is all too little known. It is most useful for any one who covers the face of this country in visit or inspection. The best of maps on which to plan a journey or to frame a country wide administration, it deserves far more notice than it gets. It is on this scale that we are preparing a new map for the Ministry of Transport in order to give a clear general guide to the scheme and to the road numbers. This road map will, presently, be on sale and will be so designed as to include on one sheet, mounted on both sides, the whole of Great Britain. This type of mounting has the appeal of ingenuity and is as handy to examine as a whole as it is to use section by section, in a car.

The Ministry of Transport map introduces, fitly enough, the question of the road directions in the margins of our small-scale maps. In the "hunting map" times before even the bicycle had appeared it had been the custom to describe a road as coming from, or going to, the next village. To-day all the main roads have definite names or at any rate definite final objectives. There may still be many who want to know about that neighbouring village; there are just as many whose next stop may be 100 miles away.

We are trying, then, to think in a wider sense and to help the motorist to see his way clear with the minimum of trouble. We have an overlap now on our 1-inch sheets. An overlap is little use in a car however. The bother of passing from one map to another is not thereby avoided. It helps more to have a label on the end of each road, so as to key one to the other, and to ensure that it *is* the London, or the Portsmouth, or the Edinburgh road one is following. On the new  $\frac{1}{2}$ -inch Cotswold map we have tried perhaps to be too clever. We are sure that the scheme can be bettered, and if any of you know of a "better 'ole" we will gladly go to it. Still on the question of traffic direction we have begun to bind in with the  $\frac{1}{4}$ -inch traffic diagrams of the more difficult towns and villages. These diagrams, conventional and not to scale, are easy to make, for our boys under instruction draw them, and they will be useful to the motoring public. No doubt we all remember the times when the partner of our travels has remarked, "But, my dear, the map shows clearly that the second turning was the right one!" The  $\frac{1}{4}$ -inch itself cannot, and does not pretend to show every turning.

When we come down so far in scale as the 1/Million I think the audience may cease to be wholly interested. It is the scale of the historian and of the internationalist. Yet presently it will assume an importance as yet undreamt of except perhaps by Sir Charles Close on that afternoon cruise when the international 1/M was born. Historians, scientists, geographers, and politicians (I feel that I should have given these in alphabetical order) are gathering information at a rate and in a volume which are too much for atlas scales. We shall see an increasing use of these 1/M maps as illustrations both of the past and of the hopes for the future. This Society took a worthy part in the preparation of 1/M maps in the War. Since then the Ordnance Survey has indulged now and again in a busman's holiday. We have our Physical, our Roman

Britain, and our Seventeenth Century England editions. We shall soon have, I hope, our Saxon edition. We should have our population edition, and it should be one of hundreds of similar sheets to cover the civilized world. Where is the map of the Ancient Cradles of Civilization, where can we study the wonderful travels of Herodotus and Alexander the Great? These maps will come, but all we can do now is to show such editions as we have got.

### DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: There is no part of the work which we do in this Society which is more interesting, more useful, and, indeed, more fascinating than that of the actual making of maps; and everybody knows that the making of maps comes largely under the Ordnance Survey. We have with us this afternoon Brigadier Winterbotham, the Director-General of the Ordnance Survey, who will tell us of the small-scale maps of the Ordnance Survey in a lecture which I now ask him to begin.

*Brigadier Winterbotham then delivered the lecture printed above, and a discussion followed.*

Colonel Sir CHARLES CLOSE, *who was unable to be present throughout the meeting, left the following notes which were then read by Mr. Sclater:*

I much regret that I am prevented from having the pleasure of listening to Brigadier Winterbotham's paper on "The Small-Scale Maps of the Ordnance Survey"; but he has kindly sent me a copy of his paper, and I write these few remarks after a study of the paper and of the specimen 1-inch and  $\frac{1}{2}$ -inch sheets which he also kindly sent me.

As a former Director-General it is a great pleasure to me to see my old Department steadily progressing, particularly because, as we all know, after the War a very necessary period of intensive economy set in, and a good many pet schemes had to be dropped at the time, and amongst these we had to abandon the proposed new type of 1-inch map. The type of map will be found, as I have said in a letter to the *Geographical Journal*, in an illustration in the 'Text Book of Topographical Surveying,' second edition. I may say, in parenthesis, that the Ordnance Survey was almost the only public department which did genuinely economize; it is a great pity that all public departments did not follow suit, and some of our present financial troubles are due to their failure to do so. Well, the present Director-General has found the means of producing approximately the same type of map with fewer printings, thus paying due heed to the imperative need for economy.

I think that the result is very successful, and I congratulate the Ordnance Survey on the production of an admirable map. I personally like almost all the new features of the map; the use of the combined effect of contours, hachures, and layers, in much the same way, in fact, as had been intended eighteen years ago. I like the new lettering, and think that the adoption of the Transverse Mercator as a projection is a very desirable improvement—by the way, I hope that it will not be called the Gauss Conformal: "conformal" is rather an ugly and somewhat meaningless word, and Gauss did not invent the projection. With regard to the use of coordinates, it must be confessed that, though these are more exact and scientific, they are not as convenient for ordinary purposes as the old marginal numbers and letters. This small change has the disadvantage that it rather upsets the system of the English Place-Name Society, which is doing such excellent national work. Up to now, all the place-names have been referred to



the marginal letters and numbers of the now obsolescent 1-inch map, Popular Edition. But I don't see what can be done in the matter.

Technically there is one point to which no doubt due attention has been given, but which may perhaps be mentioned here. The use, in order to save the preparation of new plates—a most laudable reason—of the south and east portions of the old hachure plates, printed in mauve, will obviously require great care. In the lighter portions it seems successful; in some of the heavier it tends to smudge. A specially drawn shade would, without doubt, have a cleaner result. When this country comes on the gold standard again, perhaps the extra cost of the preparation of special shade plates could be afforded. But the matter is not of first-class importance. However, these are small matters. I look upon the new map as very successful, and congratulate Brigadier Winterbotham and his Department on its production.

As to the new  $\frac{1}{2}$ -inch, it seems to me to be a decided improvement on its predecessors. The old  $\frac{1}{2}$ -inch never was a very happy map; the mistake was made, more than twenty years ago, of typing the names; perhaps, one of these days, it may be possible to draw the names in the excellent new alphabets. Otherwise the new  $\frac{1}{2}$ -inch is to be welcomed; it has many merits and should be most useful to motorists. I will end these remarks with a note about the  $\frac{1}{4}$ -inch. This map was finished ten years ago, so far as England and Wales are concerned. I shall be interested to learn the new arrangement of the sheet-lines. I gather that the map itself has undergone no change.

Colonel M. N. MACLEOD (Geographical Section, General Staff): The introduction of the completely new series of 1-inch maps by the Ordnance Survey is a cartographic event which I think very few are privileged to witness, a thing that happens barely once in a lifetime; and it has been a great privilege to us to hear direct from the Director-General himself the plans which he has made to take advantage of this unique opportunity. Personally I feel lost in admiration at the extraordinary ingenuity and thought that has been put into this production: the way in which the Director-General has made use of existing material, adapted it, and, so to speak, modernized it, is I think quite remarkable. Though it would be effrontery on my part to offer him praise, I hope he will allow me to congratulate him on what he has done and on the effect that has been produced.

The map is a departure from orthodoxy in a number of ways, and in criticizing it one has to try, if possible, to adopt different points of view. One may criticize it from the point of view of the public, or from the point of view of the soldier, or that of the financier—the man who has to pay for it—or from that of the artist, and it is not always possible to reconcile all those points of view. At the same time, I think the new map is a very excellent compromise between them, and if we compare it with the old map that Brigadier Winterbotham showed—which was a very good map in its day—there is no doubt that the new map is a vast improvement in clearness and legibility.

I would like first to say a word or two about the grid system, because that is one of the biggest departures from current practice. The grid system is an adaptation of the requirements of the soldier to the requirements of the civilian. It is another example of “turning swords into ploughshares.” Looking at the map from the military point of view the soldier has to consider the use which has to be made of it. He naturally uses the Ordnance Survey Map for training, but it is also necessary that he should look a little farther and envisage the possibility, though I hope it will not occur in our lifetime, of the nation having to be mobilized and the civilian once more turned into a soldier. It will naturally be the greatest advantage to the military authorities if the recruit, when he first dons his uniform, is already familiar with the grid system. Brigadier Winterbotham has pointed

out that on the  $\frac{1}{2}$ -inch map a 10,000-yard square is used, and on the 1-inch map a 5000-yard square is used. The soldier uses his coordinate system in two ways: he has what he calls a "map reference" system, the object of which is solely to indicate position, and he uses the coordinate system proper for such things as the calculation of ranges for artillery. The system is such that the "map reference" is an abbreviated coordinate. But the map reference is based on a decimal subdivision of the square, and you will find that if your square is not in multiples of tens of units, the map reference, based on the decimal division of the square, will not be an abbreviated coordinate. That of course can be got over by certain devices, but those devices are all, in a sense, the abandonment of the decimal system of division of the square. Now I suggest that there may not be any necessity to make the square on the 1-inch map 5000 yards. Is there any reason why it should not be 10,000 yards? The old system consisting of a, b, c, d, etc., down one margin, and 1, 2, 3, 4, etc., along the top only enabled one to define a point to something like a mile. Now the tenth of a 10,000-yard square is a good deal more precise than that, and if we want a still closer definition it is easy to get a measuring scale and so arrive at the correct figures. Is there any particular merit about the square of 2-inch size? The smaller the square the more it obscures the map; I suggest to the Director-General that he might consider putting 10,000-yard squares on the 1-inch as well as on the  $\frac{1}{2}$ -inch map.

One other point before leaving the grid system. The Ordnance Survey has adopted the yard as the unit for its grid. Brigadier Winterbotham did not tell us the reasons for taking that as the unit, but it is a fact that the surveyor's units have hitherto been the foot or the metre. Perhaps Brigadier Winterbotham would tell us why he has abandoned those two units and adopted the yard instead.

Next I would like to offer a few remarks on the relief. Here I propose to criticize not so much from the point of view of the artist as from the point of view of the soldier. The soldier specifies certain conditions under which the map must be used. Until recently those conditions were usually a dug-out in which the map had to be read by the light of a single candle. If the map could not be read under those conditions some people said it was no good. Recently that specification has been considerably stiffened and the condition we are asked to legislate for is the interior of a tank in which apparently the only light falling on the map is lubricating oil! The soldier requires contours to give him numerical information. He has, for example, to determine the height of his gun and the height of its target in order to work the "angle of sight" (the angle of elevation). When he has to do that under the rather stringent conditions that I have specified it is a great help to him if some of the contour lines are drawn thicker so that he can count easily from the nearest thick line, or nearest spot-height, and get the value of the particular height he desires.

Another point I should like to mention is the question of shading. Great ingenuity has been shown in the way those existing hachure plates have been used, and I thought that the Physical Edition of the 1-inch was extraordinarily good. It showed up the shape of the ground very well. But some of that clearness is lost when all the names and all the writing are superposed on it; it seemed to me that just as in those other respects where Brigadier Winterbotham told us it had to be done, the relief also might have been accentuated still more, even exaggerated a little, so that when the roads, writing, etc., were printed on top it would show up through them. I suggest that that might be done by introducing a "half-tone" somewhere in the scheme. By the present arrangement not only that part of the hill which faces the light is left white, but also all parts which are level as well. I believe that, originally, hill-shading was only put on to the "shaded" side of the hill in order to leave as much white paper showing as

possible. That idea has now definitely been abandoned. As you have seen, the whole map is covered with tints. I suggest it might be possible to bring out the relief still more by only picking out white the parts of the hill which directly face the light, leaving the flat summits and valleys in half-tone and the actual shadows in still darker tone.

Now a word about the  $\frac{1}{4}$ -inch and 1/M. These two maps are coming more and more into use for flying. They are typically the airman's maps. The Air Ministry have initiated and are asking the Ordnance Survey to produce a special airman's  $\frac{1}{4}$ -inch. Perhaps Brigadier Winterbotham would say a few words about that, because that is a use for a map which, it seems to me, will come more and more into prominence as time goes on. The requirements of the airman differ in certain respects from the requirements of the man on foot. There is no consensus of opinion yet among airmen as to what is the best style of map, but it is interesting to see, I think, the trends in that direction.

Then a word or two about the lettering. I must say I think the lettering on the new map is very beautiful indeed. I admire it very much. At first I had an idea that it would be an improvement if more use was made of the upright type. I believe it is no accident that a book is printed in upright rather than sloping lettering; when you have to show a lot of names, words, and letters in a small compass they are clearer if printed upright rather than in italics. But if you compare the 1/M International Sheets in which nearly all the lettering is upright, I think you will agree that the effect is monotonous in comparison with these new maps. Brigadier Winterbotham and Sir Charles Close have rather condemned the use of type, but I cannot help feeling that their objections might be overcome by the choice of suitable founts. Typing is decidedly cheaper than writing; it costs half as much, and I personally do not dislike a typed map provided the type is properly selected. I believe founts could be made to match the new style which has been introduced by the Ordnance Survey and could be employed not perhaps with advantage but certainly with economy.

Last of all, a word or two on the question of margins. I must confess that in this matter I think Brigadier Winterbotham's margin is an improvement. I was not very greatly taken with the highly elaborate margin which was once suggested by Brigadier Jack which seemed to me, on a proof copy of the sheet which I saw, to overshadow the sheet very much indeed. After all, every map is a convention, and if you depart too much from a convention in search of decoration it seems there is no limit to what may happen. We might find ourselves reverting to maps like the old ones of the past in which mermaids and sea-serpents disported themselves in the sea.

Mr. H. E. DALE (Ministry of Agriculture): I am very glad to say a few words, not to criticize Brigadier Winterbotham's paper, but merely to assure you that the Ministry of Agriculture is very sensible of the importance of the work of the Ordnance Survey and will do its utmost to ensure, even in these hard times, that it does not suffer any diminution or injury which can be avoided.

It may seem an odd arrangement that in a highly industrialized country such as ours the Ordnance Survey should be under the Ministry of Agriculture, but I trust it is an arrangement which Brigadier Winterbotham will not wish to alter, and it certainly is not an arrangement which we want to change. We are proud of our association with the Ordnance Survey, and (through it) with such men as Sir Charles Close. And it is not merely a matter of pride: we have a very lively sense of past favours which the Ordnance Survey has conferred on agriculture, and we have a lively hope of favours to come. Every one knows, of course, that the buying and selling of land—an occupation which still goes on even under the somewhat depressed circumstances of the moment—depends very largely on the

work of the Ordnance Survey for its accuracy and for its legal value. There is the work which the Ordnance Survey does for the Geological Survey; this again is of the greatest interest to agriculture, for geology is one of the sciences on which agriculture is based. Finally, there is one particular matter which I should like to commend to the attention of every one interested in agriculture, and that is the agricultural map of England and Wales which the Ordnance Survey produced some years ago and which is now coming out in a new edition. Any one who takes the least interest in agriculture will find that map not only agriculturally valuable but also historically and socially useful.

I am scarcely competent to speak on the paper in detail, and I must leave that to the experts present: I need only conclude by thanking Brigadier Winterbotham for his paper, and the Society for the opportunity of saying these few words.

Mr. HINKS: I confess that when we were promised an ornamental border by Brigadier Jack I looked forward to it with great pleasure because I have always felt that we have gone too far in making our maps severe and unadorned. At the same time, I quite appreciate Brigadier Winterbotham's horror at the danger of having angels and cupids in the personnel of the Ordnance Survey.

In the course of the last fortnight I have had a remarkably interesting correspondence with him upon the details of the new  $\frac{1}{2}$ -inch maps, on which he did me the honour to ask my opinion, and I am flattered to find that two or three of the suggestions I made for the border have gone so far as to be included in the specimen shown on the screen this afternoon. To my mind you can get all, or nearly all, the decoration you need by making the necessary division of those borders into a sort of elongated chequer pattern such as we use in the page-blocks of the *Geographical Journal*, and such as might, I think, be used upon the borders of the Ordnance Survey sheet. Brigadier Winterbotham has tried the idea of separating the two borders, and I would ask him whether he does not think they have been made, in the Ordnance Survey specimen, a little too narrow. If those divisions were made rather broader I feel that they would add a definite decorative effect.

There are a number of points upon which Brigadier Winterbotham and I have had a great deal of discussion, and on which the last word has not been said, such as the method of numbering the grid, references in the margin to the destination of roads, and so on; but I ought not to speak further about them now. I would only express my thanks to Brigadier Winterbotham not only for having appreciated what was written about the 1-inch map in the October *Journal*, but also for his kindly reference to his correspondence with me about the  $\frac{1}{2}$ -inch map.

Major E. M. BULL (Ministry of Transport): I have listened with very great pleasure to Brigadier Winterbotham's lecture. We use the Ordnance Survey maps to a very large extent, and it is particularly gratifying to know that we are to have a grid system of map reference by which any two individuals can be perfectly certain that they are dealing with precisely the same place in the countryside. In France that was most essential, and I remember how useful the system of map reference was on the 1/20,000 and 1/40,000 scale sheets. The new borders on the  $\frac{1}{2}$ -inch map will be most useful, and the numbers of roads being given it will now be easier to identify the course of a road from one sheet to another. I know I am expressing the Chief Engineer's wishes when I say we thank Brigadier-General Winterbotham for his hearty cooperation with the Ministry of Transport in all matters in which the two Departments are interested.

Mr. REEVES: The layer system, notwithstanding all that can be said in its favour, certainly has its disadvantages and limitations, and I have long felt that for exhibiting the general topographical features and relief on a map of this kind there is no better method than that of a combination of contours and shading



much on the lines of that now adopted. If carefully carried out the land forms and true heights are given by the contours, while the shading gives a graphic effect to the relief.

As regards the relief on this sheet it appears to me that there is room for some further improvement, and, although perhaps better in colour, I do not think it comes up to the excellent Killarney sheet which has been referred to. In places the hills and valleys do not stand out quite as they might, and there is, in parts, a lack of definiteness about them that might be obviated by a little more oblique illumination. When there is a sufficient number of accurate contours, as in this case, there is no chance of any one being misled by supposing the light to fall on one side of the hills more than the other, and the graphic effect of relief is frequently greatly enhanced.

The rivers and lakes are very properly shown in blue, but why not have the names of them in blue as well? This is a great help when looking for a place, especially on a small-scale map full of names, for one knows at once that if a name is in blue it refers to water of some kind. This is now being done on several Government surveys. To transfer all the water names from the black plates to the blue plates would doubtless be a serious undertaking, and it is perhaps too late now to make the alteration.

On the subject of the lettering I am on dangerous ground. Well, my opinion is that Captain Withycombe has developed a style that has many points in its favour. Still, I do not think it is as suitable as the best lettering already on Ordnance Survey maps. Brigadier Winterbotham has shown on the screen specimens of lettering amongst which is that of the 1-inch Scotland. On this the fine hair lines have been thickened and made clearer, and generally speaking it is in my opinion excellent, leaving little to be desired. On the new 1-inch sheet we are considering I am pleased to see that no attempt has been made to keep rigidly to one style of lettering, for I notice that at least three styles have been used. Another good feature is that it has a restrained and simple border.

I quite agree with what Brigadier Winterbotham said about the figures. There is frequently little space on maps to write the figures for spot heights and contour numbers, and the simpler and more compact they are the better. The figures ordinarily used are perfectly clear if they are properly written. I feel it would be a great mistake to try to adopt the new figures, at any rate on small-scale maps crowded with detail.

Professor C. B. FAWCETT: As one of those whose business lies not in making maps but in using them, I have been very glad to have the privilege of listening to Brigadier Winterbotham's paper. I feel I am expressing the opinion of my colleagues when I say it is, for us at any rate, a very great advantage to be able to get a map in separate sections: the relief and the outline editions and possibly also, we hope, the water alone. Also from the point of view of the geographer I should like to welcome the new grid system. The old reference by letters and figures was fairly adequate for use with a particular sheet of a particular map; but the limitation to one sheet made it of very little use for any one who needed to refer to maps on different scales. It also made the reference more cumbersome.

Some work will be involved in the transposition of recorded references to the new system. But I think the difficulty of transfer is very much counterbalanced by the great advantage of the new system which, it seems, depends largely on the new projection which is being used. On all those points I feel I have nothing but congratulation to offer. But there is one point I should like to raise. I have been looking at some of the names that are printed on the new edition of the 1/M map. I do not know on what system the selection and placing of the names has been decided, or who decides it; but on one of the maps shown outside there

are names which are not correctly placed. Also our old friend the "Lincoln Gap" has been rechristened the "Witham Gap." I do not know the source of this new name, but the older name is the one in general use, and, I think, the more satisfactory. Not by any means all these names of physical features and of districts are agreed upon; and to find the general usage may in some cases be difficult. The Ordnance Survey has a very great influence in establishing local names of this type, and in giving them wide currency. Hence the Survey has a special responsibility in the matter.

Brigadier H. S. L. WINTERBOTHAM: Several questions have been asked, and I do not think I can answer them all now. Sir Charles Close spoke of the name "Gauss Conformal." I used to know the projection in question by that name, but agree that, for various reasons, the expression "Transverse Mercator" is better and more descriptive. Sir Charles Close prefers the old square to the new grid. As the years go by thought inevitably progresses and brings about changes. I do not agree that the square referring always to a particular sheet (which may be out of print) can be considered the equal of a national and lasting grid, and it is about the only thing I do not agree with Sir Charles Close about. I am sure the grid is better.

Colonel MacLeod has raised a number of questions, some of which I will not answer now. The size of the square, we may say, is dictated by finding the balance between what is theoretically desirable, what is pleasing cartographically, and what the public is accustomed to. Colonel MacLeod talks also about the unit of length, and suggests a 10,000-foot side for the square. In referencing the unit is not very important. One may have a yard here, a metre elsewhere, and a foot somewhere else. The ultimate division is a measure by eye and depends upon the length on paper. It is however preferable to adopt a unit which is easy from the surveyor's point of view—coinciding with his unit of survey measurement—and at the same time is in customary national use. The yard, in England, is the best compromise. Any sane man can pass from yards to feet if he desires.

As regards the particular needs of this or that variety of up-to-date soldier I agree that it is very difficult to find an answer which may be considered generally suitable. There must however be one clear, detailed, and really useful map. Particular needs will have to be met in the future, as in the past, by special editions.

Colonel MacLeod talked about the Air Edition of the  $\frac{1}{4}$ -inch. It is a pleasant map, but I have doubts as to its suitability as a scale. The map for use in the air varies with the amount of quickly recognizable detail and the visibility. Generally speaking, in clear weather, the man in the car requires a  $\frac{1}{4}$  inch; the man in the air, travelling much faster, would, I think, prefer the 10-mile, if he can see far enough through our not very clear atmosphere.

Colonel MacLeod spoke of typing or stamping names, and asked why we are not using that method on the 1-inch. Typed names are used on many good maps, but they tend to make the map flat because of the necessary formality and sameness of letter and spacing. On a hand-written map names are fitted in with minor variations of size and spacing, proper to the occasion, and pleasant to the eye. If one takes up a hand-written map it will tend to show the little personal characteristics of the draughtsman, so that the expert may say, "Mr. Scotland did this." Fitting in names on so full a map as the 1-inch is not easy.

Then, as regards Mr. Hinks's remarks on the width of the marginal scales, I am sorry to say that I myself drew the models for these scales and laid down width of line and border. No two people of individuality can see entirely eye to eye, yet we are much in Mr. Hinks's debt, and his ideas, if not his exact dimensions, will be incorporated.

Mr. Reeves said that the Killarney sheet is better in its presentation of the relief. Admitted, yet the finger of God has as much to do with that fact as the hand of man. On the Plymouth sheet we have the infinite variety of the normal English countryside, on the Killarney bold mountain, wide plain, open water, and a clear-cut drainage. I could not in any way question the excellence of Sir Charles Close's topographical scheme, but I do maintain that he had an easier job.

Professor Fawcett has asked some questions about authority for place-names in the 1/M. I have taken the questions to heart and will reply in writing. I cannot give the answer here and now, because I do not know it.

The PRESIDENT: I wish I was not timekeeper as well as President, for there is much I should like to say. When I find myself among a body of experts, as I do this afternoon, I put myself in the position of one of the general public. I say to myself, "What do we demand of this great public body who make our maps?" We demand such a map as Brigadier Winterbotham and his predecessors have given us; a map which when we look at it shows us the natural features of the country, by which we can go from place to place with comparative ease and, so far as our upbringing goes, with no great previous knowledge of how to read a map. What we demand of the public is that they should be able to read a map, for it is a most extraordinary thing that people of all countries travel from place to place more and more, and more and more they display their entire ignorance of what a map really means and how properly to read it. I feel quite sure that Professor Fawcett and his colleagues whose business in life it is to teach geography in all its forms to the rising generation will teach them how to read a map. And I am glad to hear we are paying more attention to the air maps.

You have given us a most interesting afternoon, Brigadier Winterbotham, and we are very much obliged to you: not only a very interesting but also an entertaining afternoon. You have put problems before people which will give them much to think about; and we ask you to accept, on behalf of the audience and of the Society, our most sincere thanks.

*The Geographical Journal*, Vol 80, no. 4, October 1932, pp. 358-359

#### THE NEW ONE-INCH MAP

The newly published Special District Map of Aldershot North in the Fifth (Relief) Edition of the O.S. 1-inch map gives opportunity to see how the new style, which most people have thought so successful on Dartmoor, will suit the complexity of an English countryside with small relief and much detail. In the country between Aldershot and Windsor there is much wood and rough pasture and a good deal of marsh, all of which are represented by symbols on the black plate, and it is open to question whether this plate is not somewhat overloaded thereby, especially with tree signs, through which the smaller names glimmer a little indistinctly. If it is not considered permissible or practical to draw the names rather heavier when they are immersed in much detail, it might be possible to lighten a little the tree signs, especially for conifers. But the names do seem to have lost something of their modelling, as if the drawing had been over-reduced, except the names in Roman lower-case, which are excellent. The double hill-shading, the vague layer-colouring are as successful in this undulating country as on the more strongly modelled. The border has been greatly improved by taking the latitude and longitude division to the outer edge, to keep clear of the grid, and the grid division in each corner is helpful. But it might be worth while to try getting the numbers of the vertical grid lines horizontal and to give the red plate a little more to do by putting county and parish boundaries on it, for boundaries are not topographical features, and the combined county and parish boundary symbol in black is very destructive to others.

We may notice here an article by Mr. Basil Nicholson in the August number of *The Nineteenth Century and After*, which has some just remarks in it, but what