

AIR PHOTOGRAPHY AND ARCHAEOLOGY

Being the Presidential Address delivered to the Society on
23rd February, 1951

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AIR photography, as applied archaeologically, is in a way a comparatively new thing, though it has been going on for some years. The real credit for its development in this country belongs to Mr. O. G. S. Crawford who, having had practical experience as an airman in the first world war, realised long before its end the potentialities of the method. As soon as the war was over he set about putting some of his ideas into practice.

The first use of the air view for archaeology goes back actually to the time of the balloon, and there are in existence a number of photographs, of Stonehenge particularly, which were taken from a balloon in the early years of this century. But of course the balloon is a comparatively inflexible instrument. It failed to achieve results that the aeroplane succeeded in getting quite quickly.

A point which must be made clear at once is that there is no special virtue in the eye of the aerial camera. The camera does not see things which are invisible to the human eye. Its value lies in its viewpoint: raised high above its subject it can define shapes which to the onlooker on the ground are formless and meaningless. The difference is that between the cat's eye view and the man's eye view of a piece of carpet: the cat sees the carpet, one imagines, as a meaningless jumble of threads of different colours; the man, from his height, sees it and its pattern clearly and completely. So with the air photograph. The crop-marks which are often the only visible sign of antiquities, can be seen and photographed on the ground and their meaning may be quite obvious. Indeed, before the days of air photography, plans of sites in the Oxford area had been prepared from marks they made in the crops. But the view from the air is clearer, even for the simpler marks,

while for the more complicated patterns interpretation may be impossible without it.

The classification of archaeological sites for purposes of air photography is a triple one: shadow-sites, soil-sites and crop-sites. *Shadow-sites* are those of which there are still visible remains on the surface and whose photography depends on the use of shadows to enable their different shapes to be picked up by the camera. Shadow-sites are of various kinds: earthworks, buildings and so on. *Soil-sites*, in which the antiquity is recognisable by variations in the colour of the soil itself, are comparatively rare and unimportant: they are really visible only when bare of crops and they normally belong to one of the other categories. *Crop-sites* are those which betray their presence by the fact that the disturbances which they have caused below the surface have affected the crops growing above it. The ditches and other excavations of early man become filled with soil, the greater depth of which retains the moisture so that the crop grows darker and thicker, and sometimes higher also, over them as compared with the surrounding ground with its shallower covering of soil.

We start then with the shadow-sites, which depend primarily on the source of light, the angle at which the light reaches the object, and therefore upon a combination of time of day and season of the year. Conditions of lighting here are all-important: if they are wrong, failure will result and little will appear in the picture, even when the site is well preserved.

Thus an area at Bainbridge, in Yorkshire, when photographed in the middle of the day with the high sun casting no shadows, showed nothing definite in the way of features. But a photograph of the same site with a low sun casting a raking light, reveals a Roman fort, recognisable by its well-preserved rectangular outline.

Shadow-sites may be photographed either vertically or obliquely. Oblique photographs, like that of the famous White Horse and the neighbouring camp at Uffington, in Berkshire, make exciting pictures, but are not as a rule particularly informative. The best results for this type of site are usually from the vertical.

A vertical photograph of Hod Hill Camp, in Dorset, brings out not only the Iron Age earthwork, with the Roman camp which is a later addition in one corner of it, but also several features of interest which are either invisible on the ground

or at least cannot be recognised for what they really are. In particular, there are traces of the pits dating from the occupation in the Iron Age and of the quarry holes, which originally were the sources of material for the rampart and later were used by the inhabitants of the site for dwelling-places. A further point of interest is the variation in the surface texture of the ground in the part of the camp which has been cultivated. One area was ploughed during the Napoleonic wars and over it the marks of the early settlement have very largely disappeared. Where, however, the pre-Roman remains have undergone no alteration, it is possible from a study of the air photographs to form some idea of the density of the occupation.

A particularly good example of the value of air photographs as applied to hill-forts is provided by the site known as Ladle Hill, in Berkshire. On the ground the remains consist of irregular shapeless heaps and hollows; on the air photograph these features acquire form and become the remains of an unfinished "camp": the partly-dug ditch can be traced; and the shapeless heaps are the material from the ditch not yet organised into a true rampart. Such a photograph is of outstanding value in the study of the methods followed by the builders of Iron Age fortifications.

Another aspect of archaeology which is very much illumined by air photographs is that of the early field systems, a subject of special interest to many other people besides archaeologists; for example, to economists, historians and students of agricultural history. It would not be true to say that the recognition of early cultivation systems has been due to air photography, though many new discoveries have resulted from it; but air photography has been of special value in their interpretation and mapping. A photograph of Windmill Hill, in Hampshire, illustrates the small type of enclosure forming the Celtic field system which was adopted in the Early Iron Age—and a little earlier—when farmers were equipped with primitive ploughs too small to break up large pieces of ground. On the ground the remains appear as the step-like features which are due to the creep of the soil under the action of the plough. Elsewhere they are often seen as soil marks because the white chalk of the banks shows through the thin soil.

The second type of cultivation is that of the great strip-lynchets which appear in series along the valley slopes of many

of the rivers of the South of England. These formations are in part due to the natural process of soil creep to which I have already referred, in part probably to the deliberate building-up of the "steps." They were introduced by the Saxons, but continued down to a later date.

The third is that of the open field system, of which there is a very great deal in the Midlands. Under this system the land was held in common by the community and divided into narrow strips, which were allotted to the various members in such a way that each man had a fair share of good and bad soil. The strips are separated by furrows, forming the "ridge-and-furrow," which then appears on the photographs as a series of corrugated areas or patches.

Quite often the air photograph will shed light upon chronological problems. Examples of the super-position of one system of fields upon another have been observed. The Celtic type of small rectangular fields, for instance, dating back to 500 B.C. or even earlier, has been seen to be overlaid by the long strips characteristic of the Saxon cultivators. Once again such features can sometimes be recognised on the ground, but they do not appear with half the clarity when seen from below as when photographed from the air.

Similarly, the relationship of the field systems to the hill-forts can sometimes be clarified by photographs. At Quarley Hill, in Hampshire, for instance, the hill-fort can be seen to be overlying part of a field system. The fort itself has been dated by excavation to an early phase in the prehistoric Iron Age and the fields must therefore be correspondingly early. Information of a similar kind is forthcoming from a site known as Wudu Burh, in Wiltshire, where a system of fields of a rather elongated type has been succeeded by a straight-sided enclosure which is probably an Iron Age cattle enclosure.

As with fields so with roads. Near Figsbury Hill, in Wiltshire, for example, the changing behaviour of roads of successive periods can be studied, with the Roman road succeeded by the less direct multiple hollow-ways of the Middle Ages, and the hollow-ways in their turn giving way to the modern road.

Bronze Age barrows photograph well when they are well preserved and the right conditions of lighting are chosen. One group, at Oakley Down, in Dorset, shows a number of barrows of different types, together with a Roman road which cuts right through some of them. The road itself has been

used as a quarry: the pits dug for its metal showed clearly along it.

Another kind of site which is assuming great importance to-day is that of such Midland villages as Gainsthorpe, in Lincolnshire, deserted in the 14th century and still preserving completely the pattern of its streets and the outlines of many of its buildings. The remains show up well in photographs, partly because of the shadows which have been cast by the banks which mark the sites of walls, partly because the banks, being stony, do not hold moisture, so that the vegetation on them is parched and light in colour. Obviously, a photograph of such a site is of the greatest value to the archaeologist, because in excavating he has a plan ready made for him. He can see what he has to do, what he ought to excavate, and his actions can be conducted on a definite plan: the air photograph is an excellent short cut to knowledge, eliminating much that may be both unnecessary and tedious.

As I have said, the soil-sites are less numerous and less important than the others. The best examples occur in the chalk country because of the strong contrast between the chalk and the top soil. The chalk mounds of some of the barrows at Stonehenge show up through their thin top soil in this way, while the deeper soil in their surrounding ditches shows dark. So too the enclosing banks of the Celtic fields of Wiltshire and Dorset are prominent for the same reason.

But probably the greatest amount of new knowledge and of enlightenment about old settlements comes from the third group, that of the crop-sites, whose recognition depends on the variation in soils and on the changes which that variation has made in the crops growing over them. The principle is well illustrated at Stanton Harcourt, in Oxfordshire, where a monument of the "henge" type—that is, of the same general class as Stonehenge and Avebury—was recognised by the crop-mark made by its enclosing ditch. The corn over the ditch was over a foot higher than elsewhere—a fact to be accounted for by the 7 or 8 ft. of soil in the ditch (excavated in 1940) as compared with the thin soil over the surrounding undisturbed gravel. With crop-mark sites, therefore, contrast is important; and gravel and chalk, which are by nature readily drained, give the best results.

On the other hand, as a general rule, crop-marks do not show up well on clay because of this lack of contrast. There

is not sufficient difference between the natural clay and the artificial fillings: both are heavy and affect the crop in the same way. The contrasts of chalk and gravel can often be accentuated by conditions of drought: a long spell of dry weather often leads to new discoveries.

For the study of crop-sites the best time, apart from drought, is in spring and early summer, when crops are growing; the worst, the winter. The classic illustration of this is the Roman villa at Ditchley, in Oxfordshire. In the winter the field in which it stood was featureless; in early summer, under a corn crop, every detail of the buildings and enclosures was revealed so clearly that the excavator was able to decide in advance exactly where he should plan his trenches in order to get the best results with a minimum of labour.

The seasonal difference appeared once again at the famous site of Woodhenge, not far from Stonehenge, in Wiltshire. A winter photograph revealed but little; a summer photograph exposed distinctly not only the enclosing earthwork, but even the post holes—the whole so clear that one might doubt whether the photograph was completely untouched.

Certain crops play a more important part than others in this aspect of archaeological air photography. Corn crops give the best results because their roots react to deep moisture and the crop itself provides a good surface texture in which even subtle changes are rendered; on the whole, barley reacts better than the other cereals. Least satisfactory is permanent pasture and photographs of a number of sites in the Oxford region illustrate this fact. At Beard Mill, for instance, Bronze Age barrow-rings, which are so well marked in the corn that they form raised circles in its surface, stop abruptly where the corn gives way to grass. So too at different times of the year the effect will be different. In early summer crop-marks appear dark because of darker green and thicker growth of the crop above them. As the crop ripens and therefore takes on a lighter colour, the position is reversed: the marks show white against a darker background because the "natural" crop allows the colour of the soil to show through while the denser corn of the crop-mark blots out the ground colour completely.

The fact that so many of these sites appear on gravel is due to the favourable character of these districts for the settlement of early man. Such is the Oxford region of the Upper Thames valley, where the vestiges of extensive occupation

remain on many of the gravel terraces. Several periods have left their mark, for instance, at Foxlease Farm, Eynsham, where Bronze Age burial rings are mingled with irregular enclosures for huts of Iron Age and Romano-British date and portions of field enclosures. On top of all are traces of the ridge and furrow which belong to the open fields of the Middle Ages already described as shadow-sites. Such areas present the whole range of pre-history and early history, sometimes so clearly that the succession of the different elements can be readily established; and most of this would have been lost but for air photography. A feature of many of the photographs is the repetition of many of the forms of enclosure and the like. As knowledge advances, and particularly as more excavation is carried out, the dating of the different forms should be possible by the simple process of identifying them on the air photographs.

If the study of crop-sites has produced many new sites, it has also yielded fresh information about even well-known antiquities, and above all about Stonehenge. Stonehenge is, of course, something more than the ruined circles which are now represented by groups of massive stones, though the other features are not as obvious. Enclosing the area of the circles is an earthwork consisting of a comparatively slight bank and ditch. The earthwork has an entrance-break in its north-eastern quadrant; and, projecting north-eastwards from it, is an embanked way known as The Avenue, which continues for a distance of about 400 yd. before fading out on the open down. This, however, was not its end: by a lucky chance, Mr. Crawford found in the photographic library of a neighbouring air station photographs of the area in which The Avenue reappeared as a crop-mark: its side ditches showed as two parallel dark lines continuing the straight course of the visible feature for some distance before swinging round to the south-east to meet the River Avon not far from Amesbury.

The determination in this way of the exact course of The Avenue must have an important bearing on the problems of Stonehenge, about which there is still a great deal which we do not know. The Avenue is generally accepted as a sort of processional way to the circle and as such it must have some bearing on the question of the source of the stones themselves. The discovery was important for Stonehenge and important for the method because, when once it was evident that even a

well-known site like Stonehenge could be illuminated by the study of air photography, it was readily accepted on all sides that the method was one of value which ought to be applied to other places.

Another way in which air photography is valuable is in the use to which it can be put for the mapping of antiquities. Using the existing air photographs before the war, the Archaeological Branch of the Ordnance Survey began the production of a series of maps, the purpose of which was to reconstruct the farming area in the Late Bronze Age and Early Iron Age on Salisbury Plain. On this map of the Celtic Earthworks of Salisbury Plain, as it was called, the ancient field systems were shown heavily printed over a faint background of the modern detail. Air photographs formed the basis of the survey; and, combined with the essential checking on the ground, they have produced with comparatively little effort the first picture of the farming communities of the chalk downs, with their groups of fields, their lanes and even the sites of their dwellings, in the last centuries of the prehistoric era.

Finally, as to the tests by excavation which have been carried out on some of the sites whose existence was only revealed in the first place by air photography! Two of these have already been described: the villa at Ditchley, for which the air photograph provided the actual pattern of the excavation; and the "henge" monument at Stanton Harcourt and the effect of its deep surrounding ditch upon the corn crop above it. We know something too of the burial rings which are so numerous in the photographs: a neighbouring site at Stanton Harcourt showed double rings as ditches nowhere more than 5 ft. wide or 3 ft. deep; and the spot at the centre of the rings proved to be a burial pit which contained the crouched skeleton of a woman of Early Bronze Age date. Sensitive as the crop was, however, it had not revealed clearly a second burial, not very much later in date, whose shallower ditch had been dug across the larger and earlier ring. Here too a burial pit contained a crouched skeleton, this time of a young man. Secondly, excavation of one of the small settlement enclosures, also at Stanton Harcourt, has shown that some of the features that remain puzzling on the air photographs are due only to the history of the site itself and can be explained readily enough by excavation. It appears that such sites were not lived on continuously, but were returned to and reoccupied

after intervals in which the people must have moved elsewhere. Why this practice was followed is not yet known: conceivably it had to do with the type of primitive farming practised, which would have resulted in the rapid exhaustion of the land, compelling the occupants to move on to other places. In any case, the desertion of the site was sufficiently prolonged on each occasion to allow the ditches to silt up so that new ones had to be dug each time. The ditches themselves were quite slight: with a stockade they would have provided protection against animals, but would have been of little use against men; and they could have enclosed not more than one or two huts. But the profiles of the successive ditches can be readily seen in the sections; and the curiosities in the plans as they appear in the photographs—the unusual angles, absence of entrances and the like—are simply due to the alterations made by the occupiers, “run together,” as it were, in the ground.