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A LiDAR survey of Skokholm Island, Gateholm Islet and the Marloes Peninsular, Pembrokeshire

By Oliver Davis

Surviving earthworks of fields, enclosures and huts have long been recorded on Skokholm Island, Gateholm Islet and the Marloes peninsula, but they have not been mapped in any great detail. This paper presents the results of an extensive LiDAR survey of the islands and the adjacent mainland in this part of south-west Pembrokeshire. The survey was undertaken by the Geomatics Group on behalf of the Royal Commission on the Ancient and Historical Monuments of Wales in February 2011 and for the first time the extent of the upstanding archaeological remains have been revealed.

INTRODUCTION

Skokholm Island, Gateholm islet and the Marloes peninsula are located at the very south-western tip of Pembrokeshire (Fig. 1). Skokholm is an island of 107 hectares, 3 kilometres south-west of the mainland and a similar distance from its larger island neighbour Skomer. Aerial reconnaissance over the last 25 years by the Dyfed Archaeological Trust and the Royal Commission for the Ancient and Historical Monuments of Wales (RCAHMW) has confirmed traces of at least two periods of settlement on the island. However, no previous attempt has been made to map and characterise the archaeological remains and their nature and extent is little understood. Gateholm is a small tidal islet 2.6 kilometres to the north-east of Skokholm. The islet is only 600m in length and 130m in width, but previous archaeological surveys have revealed an extensive hut-settlement of late Roman or early medieval date (Cantrill 1910; Lethbridge and David 1930; Davies *et al.* 1971). The adjacent mainland of the Marloes peninsula forms the western most tip of the southern shore of St Bride's Bay and is bounded on the south, west and north by precipitous cliffs. The western end of the peninsula is demarcated from the main portion of the promontory, partly by the inlet of Martin's Haven and partly by a scarp which has been accentuated with a rampart to create the vast 22-hectare Iron Age promontory fort of Deerpark.

Long tussocky grass dominates the islands and parts of the mainland promontory, effectively obscuring the archaeology and making it difficult to map features from aerial photographs. However, after heavy snowfall in 2008 and 2010 when the fescue was sufficiently flattened, RCAHMW aerial reconnaissance revealed traces of previously unrecorded archaeology on Skomer, Skokholm and within the promontory fort of Deerpark. Archived Light Detection And Ranging (LiDAR) data with a resolution of 2m, provided by the Environment Agency, showed great promise for the detection of hitherto unknown earthworks for the eastern-most part of Skomer, but did not cover the other offshore islands. As part of the Skomer Island Mapping Project (Barker *et al.* 2012) the RCAHMW decided to commission the Geomatics Group of the Environment Agency to undertake a 0.5m-resolution LiDAR survey of Skomer in February 2011. The opportunity was also taken to acquire LiDAR data for Skokholm, Gateholm and the adjacent mainland peninsula. This has provided a highly detailed and accurate topographic map of this part of Pembrokeshire that has revealed for the first time the extent of the upstanding archaeological remains. While the results of the Skomer Island survey will be published elsewhere (Barker *et al.* 2012), the results of the wider LiDAR survey of the remaining areas are described here.

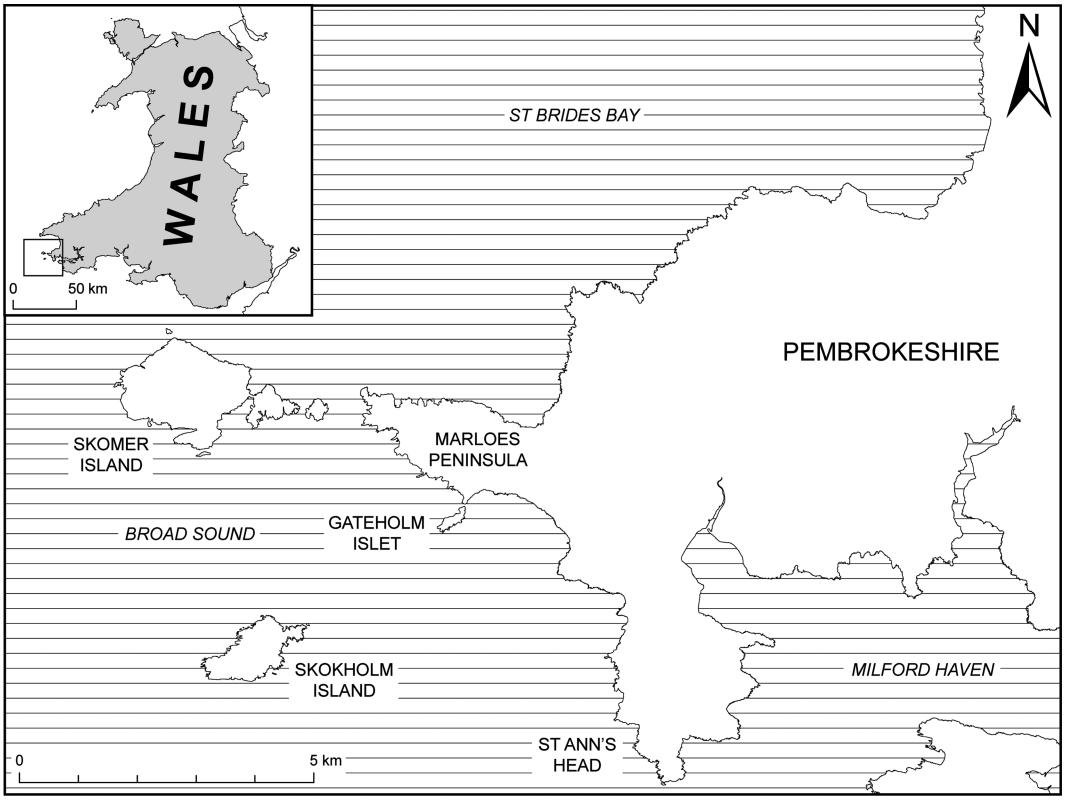

Fig. 1. Location map.

GEOLOGY, TOPOGRAPHY AND NATURAL HISTORY

The geology of Skokholm and Gateholm is dominated by Devonian Old Red Sandstone, which lends a distinctive red colour to the cliffs and outcrops, quite different to greys of the Silurian igneous intrusions that form Skomer and the Marloes Peninsula. In general, Old Red Sandstone sedimentary geology dominates the landscape across the southern part of Pembrokeshire from Skokholm in the west to mainland Dale and St Brides, across the Milford Haven waterway and east to Manobier (John 2009, 28–32).

The soils in this region are generally agriculturally productive and the topography low-lying. Skokholm itself is a plateau, sloping from southwest (50m OD) to north-east (20m OD), and bounded by high cliffs. There are no beaches although an inlet, South Haven, on the east side of the island provides a sheltered landing and embarkation point for seagoing traffic. Gateholm is a small plateau, which at its southern extremity reaches a height of 50m OD. There are steep cliff drops on all sides, but it is accessible from the mainland at low tide when you can climb up a precipitous cliff path on its north-eastern tip. The Marloes Peninsula, bounded by high cliffs, gently slopes from 40m OD in the west to a high point of 69m OD within the centre of the peninsula (Fig. 2).

Skokholm is currently managed by The Wildlife Trust of South and West Wales as a Nature Reserve, and is of international importance for its breeding seabirds. In particular its colony of Manx Shearwaters

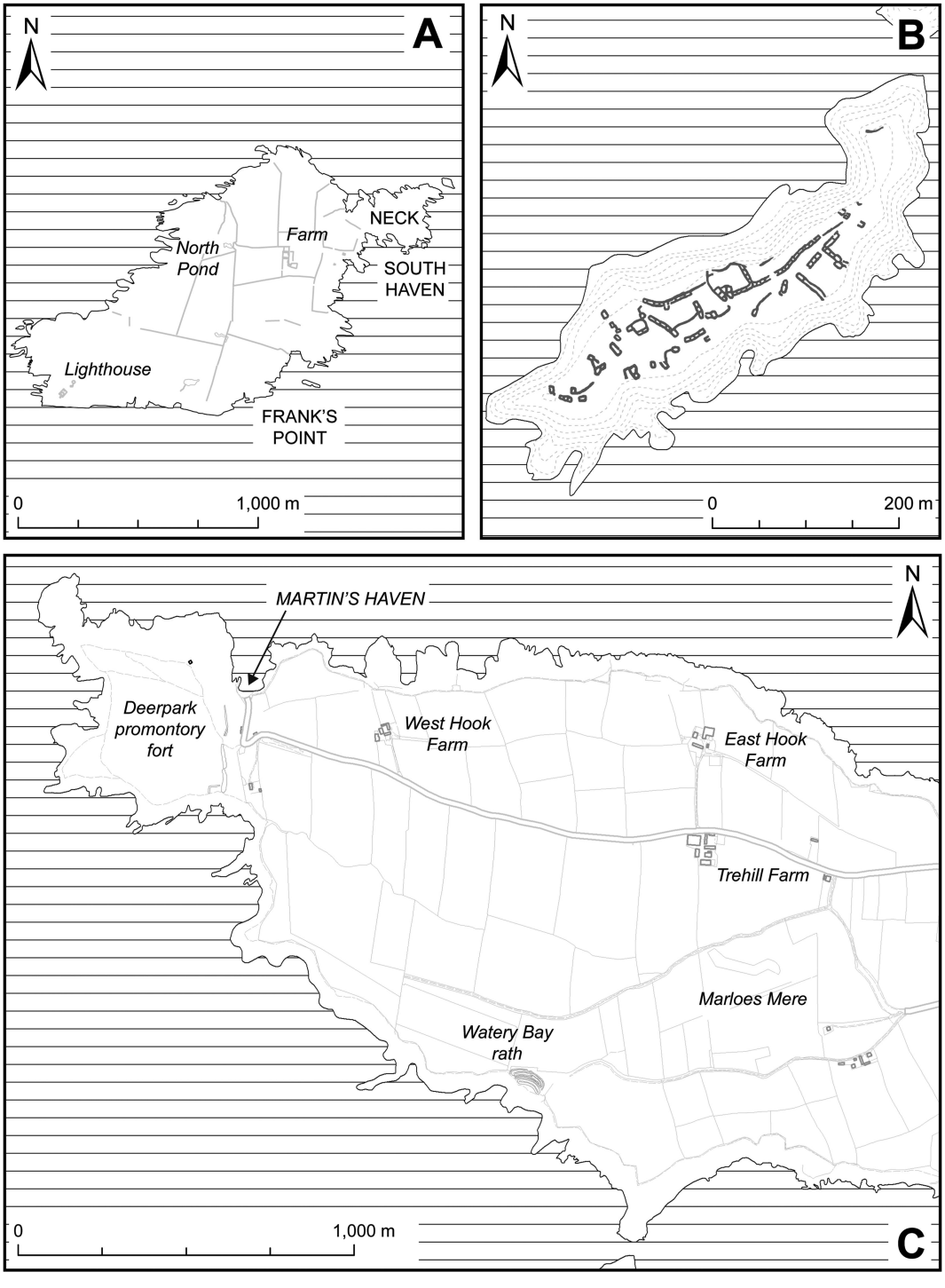

Fig. 2. Map of modern features, topography and known archaeology on Skokholm Island (A), Gateholm Islet (B) and the Marloes peninsula (C).

represents some 15 per cent of the world's population, but the island is also home to Storm Petrels, Puffins, Razorbills and Guillemots. Grey Seals are present in the waters around the island throughout the year and Cetaceans are frequently seen close inshore.

The vegetation is wind-pruned and trimmed by rabbits, but is dominated by inedible plants like thrift, sea campion and golden rod. Skokholm is a name of Scandinavian origin meaning 'wooded isle' and the presence of species such as lesser celandine and bluebells indicate that the island was wooded in the past.

Gateholm is managed by the National Trust as a Site of Special Scientific Interest (SSSI) due in part to the presence of important grass species *Festuca rubra* and *Holcus Lanatus*. Without the presence of grazing animals this means that the islet is dominated by coarse tussocky grass which obscures the majority of the archaeological features.

Much of the Marloes Peninsula is arable farmland, but there are some heathland habitats, particularly within the promontory fort of Deerpark. Marloes Mere, an area of wetland pools and marsh, is located within the centre of the peninsula and is managed by the National Trust as an SSSI.

KNOWN HISTORY AND ARCHAEOLOGY

This part of southwestern Pembrokeshire has a rich and interesting history. Skomer has received important archaeological attention (Grimes 1950; Evans 1990; Barker *et al.* 2012), which has revealed the remains of remarkably well-preserved prehistoric landscape of international significance, but Skokholm, Gatehom and the Marloes Peninsula are much less well explored. A review of the known archaeology and history is presented below, followed by a detailed discussion of the results of the LiDAR survey.

Skokholm

The present farm is depicted on the 1st edition Ordnance Survey County Series map (Pembroke XXXVII.3 1875), with cleared or improved fields extending over the north-eastern and central part of the island. The island was visited by Richard Fenton during his tour through Pembrokeshire (1811) and so the farm must date to at least the beginning of the nineteenth century and probably earlier. Fenton noted that the landowner, John Lloyd, farmed rabbits for great profit, but also kept cattle and sheep and sowed the enclosed fields with barley and oats (1811, 170). Lewis (1845, vol. 2, 372) recorded that peat was cut for fuel and that the island was well supplied with fresh water having several springs.

Next to the footpath that leads to the quay at South Haven is a nineteenth-century limekiln, a small square structure, 5m by 4m, with a circular flue. Two similar structures are evident on Skomer, and it is clear that lime was important on the islands to be used as mortar for building construction and to spread on the fields as fertilizer. A lighthouse was constructed in 1915 on the south-west tip of the island on a design by Sir Thomas Matthews. The optic was replaced in the 1970s and the lighthouse is now automatic. A modern helicopter pad is situated 50m to the northeast of the lighthouse.

Earlier features are known from aerial reconnaissance. These comprise slight earthworks of field systems ranged above the cliffs to the east of the lighthouse and above the north-west facing cliffs to the north. There are also patches of narrow plough ridges above Crab Bay. These features probably pre-date the farm and may be medieval, although earlier or later origins are also possible. That the island was exploited in prehistory is attested by Cantrill (1915, 180–1) who noted that flint flakes, possibly a Mesolithic flint scatter, were found from a field boundary 60 yards north of North Pond.

The significance of Skokholm's remarkable natural flora and fauna were highlighted by the naturalist Ronald Lockley, who arrived in 1927 to take up a 21-year lease. Lockley was one of the first people to

study the breeding biology of storm petrels, Manx shearwaters, puffins and rabbits, and his rabbit research formed the basis for Richard Adams' novel *Watership Down*. In 1933 the island became Britain's first bird observatory, but Lockley returned to the mainland when Skokholm was used by the military during the Second World War.

Gateholm

Although Gateholm is now an islet, it is likely that it was once a coastal promontory, attached to the mainland by a neck of land which has now fallen away. There is no freshwater spring on the islet, but there is an extensive hut-settlement, which has long been known about, but is not well understood (cf. Lane 1988). The whole plateau is covered by a large number of sub-rectangular buildings, possibly of a single homogenous plan (Lane 1988, 73). The buildings are conjoined in rows, and laid out either side of a trackway running down the spine of the island. Edward Laws described the huts as far back as the late nineteenth century (1888), but was doubtful as to their age. The first serious archaeological survey was undertaken by Cantrill (1910) who counted over 130 hut foundations. He planned some of the hut features and recovered a few finds, including a coin of Carausius (AD 286–93). The coin, along with a few sherds of Samian ware, led Cantrill to conclude that the site was a Romano-British village of the third century AD (1910, 281–2).

A more important contribution was made by Lethbridge and David (1930) who excavated two adjoining houses. The houses were sub-rectangular in plan with walls formed by a turf bank. The inside wall face of the larger house was lined with undressed stones arranged in courses of drystone walling. In the centre of the houses were postholes, presumably for upright timbers to carry the cross-beams for the roofs, and a hearth. Importantly, the excavators showed that the buildings were not of contemporary construction. They also recovered a bronze pin from the occupation deposits within one of the houses. The pin, with its facetted head and loose ring, was interpreted as of Irish type belonging to the sixth century AD (Lethbridge and David 1930, 371) pushing the occupation of the settlement into the post-Roman period. They also recovered pottery, mostly of late fourth-century date, but some sherds have been identified by Campbell (1985, 79–80) as Normandy gritty ware of eleventh- to thirteenth-century date.

The unusual character of the settlement led to a more complete survey of the islet by Davies *et al*. (1971). The result was the production of a detailed composite plan of the settlement and a reassessment of the date and purpose of the settlement. Davies *et al.* (1971, 103–4) estimated a total of *c.* 110 separate compartments and interpreted the site as an Early Christian monastic settlement even though there was no obvious building that could claim to be a church. The date was set at the fifth to sixth century AD based on a reassessment of the bronze pin recovered by Lethbridge and David (Davies *et al.* 1971, 108).

Davies has recently questioned the early date for this pin and suggested an eighth-century date is more likely (Jeff Davies pers comm.). If this is the case then the settlement would appear to have been initially set out in the late Roman period, but then intermittently occupied up to the eighth century, with a further period of activity during the eleventh to thirteenth centuries. The Scandinavian name of the island, meaning 'goat', may also suggest Viking occupation. Doubts have now been cast on a religious identification for the islet and a secular interpretation of Gateholm as an early medieval promontory citadel is now favoured (Redknap 2010). Possible later reuse of the huts as rabbit warrens has also been suggested, which may explain the unusual character of the remains and artefact collections (Alan Lane pers comm.).

Marloes Peninsula

The large Iron Age promontory fort of Deerpark at the western extremity of the Marloes Peninsula has received little archaeological attention and its history character is not well understood. The name possibly

derives from an intended, but not historically documented, deer park. The ramparts run along the lip of the north–south valley that delimits the plateau on the landward side. They consist of a large bank and ditch, *c.* 270m long, with at least two entrances. The first *c.* 65m north of the southern cliffs is slightly in-turned, while the second, immediately north of the southern cliff, opens into a small, roughly rectangular enclosure *c.* 72m north-south by *c.* 32m east-west.

Within the large enclosure aerial reconnaissance by RCAHMW has recorded earthworks of a field system, with a block of well-defined and regular fields in the south-west part of the promontory, along with unenclosed cultivation ridges in the northern part. The cultivation could be of any age from prehistoric to post-medieval, but it is unlikely to be more recent as field boundaries are not depicted on the OS 1st edition County Series map (Pembroke XXXVII.3 1875). More recent aerial reconnaissance in 2011 has revealed a small promontory enclosure, possibly of Iron Age date, enclosing the north-west rocky promontory within the larger 220,000m² main fort.

Located on the highest point of the promontory fort are the remains of a coastguard look-out built in the 1930s following the Molesey disaster in Jack Sound in 1929. Used as a coast-watching post during the Second World War, it reverted to its original purpose after the war and continued to be used as a coastguard lookout until the late 1970s.

A much smaller promontory fort, Watery Bay, is situated *c.* 1,400m south-east of Deerpark. Three large banks and ditches, possibly of two phases, define a small internal area of 2,500m² with an entrance on the eastern side. On the northern side of the peninsula a prehistoric hearth and associated flint scrapers and flakes were noted next to a spring *c.* 100m northwest of Westhook Farm (Cantrill and Jones 1911).

Other features on the Marloes Peninsula have also been revealed by recent RCAHMW aerial reconnaissance. These are comprised of a complex pattern of cropmarks, probably the remains of pits and ditches located *c.* 500m east of Watery Bay and include a possible rectangular enclosure. The date and function of these features is not known.

THE COLLECTION OF LIDAR DATA

In Britain LiDAR has been used as a tool for remote sensing in archaeology for more than ten years, but it is still relatively under-used in Wales. The principles of LiDAR data collection are described elsewhere (Crutchley 2010; Doneus and Briese 2011; Shaw and Corns 2011), but it is important to briefly outline how LiDAR data can be used to map and model archaeological landscapes.

The LiDAR sensor is mounted below an aeroplane where it emits short infrared laser pulses towards the earth's surface, fan-shaped across the flight path. Each pulse will result in one or more echoes. Some are received from trees and vegetation, but the last echo is typically received from the ground surface (Doneus and Briese 2011, 60–1). As the aeroplane moves forward the position of each echo, or point, can be calculated using a satellite navigation system. Each point therefore has a set of x, y, and z coordinates to reflect its position and elevation. A LiDAR survey produces thousands of such points, which when imported into a Geographic Information System (GIS) produce a point cloud: literally a cloud of points. The point cloud can then be processed using algorithms to create a Digital Surface Model (DSM) and Digital Terrain Model (DTM) for visualisation and interpretation. A DSM is a model of the surface of the earth that includes all the features on it such as vegetation and buildings, whereas a DTM is a 'bare-earth' model with vegetation and buildings stripped away. A DTM is particularly useful for seeing the ground surface beneath high vegetation.

The higher the density of measured points per square metre (resolution) the greater the clarity and detail of archaeological topography. Typically, four hits per metre gridded to 0.5m ground resolution are

sufficient for recording the majority of archaeological features. Experience elsewhere has suggested the significantly increased cost for 0.25m ground resolution is not justified by the slight increase in detail (Crutchley 2010).

RESULTS OF THE LIDAR SURVEY

Data were collected on 28 February 2011 using the Environment Agency ALTM Gemini 06SEN191 and 08SEN230 LiDAR instruments mounted on the Environment Agency's aerial survey platform. After processing, the data were provided as ArcView ASCII GRID files at 0.5m resolution. Both DSM and DTM and associated hillshade models were generated for the survey areas using ArcGIS 10. Ditches, banks, mounds and platforms were transcribed at 1:1,000 scale as polygons. Where cultivation ridges and furrows could be recognised every second ridge was depicted as a polyline.

Skokholm

The LiDAR survey has confirmed traces of at least three periods of settlement on the island (Fig. 3). The historic field boundaries, which are depicted on the OS 1st edition County Series map (Pembroke XXXVII.3 1875), are very clearly defined and still survive today as drystone walls up to 1m in height. The LiDAR survey has also revealed extensive traces of more denuded banks, lynchets, platforms and terraces, some of which clearly underlie the historic boundaries, and therefore must relate to former phases of occupation.

The farm and north-east of the island

Two large rectangular fields to the north of the farm contain broad plough ridges presumably of post-medieval or recent date (*c.* 9m across) running east–west. There is little other evidence of upstanding archaeology in these fields, which may suggest that post-medieval agricultural activity has levelled any earthworks in this area. Within the field immediately west of farm are the remains of broad plough ridges running north–south. These appear to truncate two much denuded linear banks running south-west to north-east, which must therefore relate to a previous phase of enclosure. The eastern most bank runs between two rock outcrops in the style of prehistoric boundaries on Skomer. An oval platform 20m by 11m lies in between the two linear banks and on a similar alignment. It is also truncated by, and therefore pre-dates, the north–south ploughing.

The fields to the north-east of the farm also appear to have been heavily cultivated in the recent past. To the south of the spring broad plough ridges (*c.* 9m across) are evident running east–west. To the north of the spring ploughing appears to have been undertaken on a roughly north–south alignment. The spring itself has been dammed, probably for water conservation. East–west plough ridges are also evident on the Neck, although they appear to stop abruptly halfway across the promontory. A small rectangular platform, 9m by 14 m, overlies the plough ridges and so must post date them, while a small circular depression, 8m in diameter, is evident on the north side of the Neck.

Immediately to the east of the farm the LiDAR survey has revealed evidence of two large conjoined rectangular platforms, 46m by 40m. The western platform appears to have been constructed partly overlying the eastern platform. Such an arrangement in the uplands of west Wales could be interpreted as a deserted rural settlement and associated small field (Roberts 2006). Therefore, it is possible that we are dealing with here an earlier, possibly medieval farmstead, which was abandoned, with the present settlement focus 30m to the west.

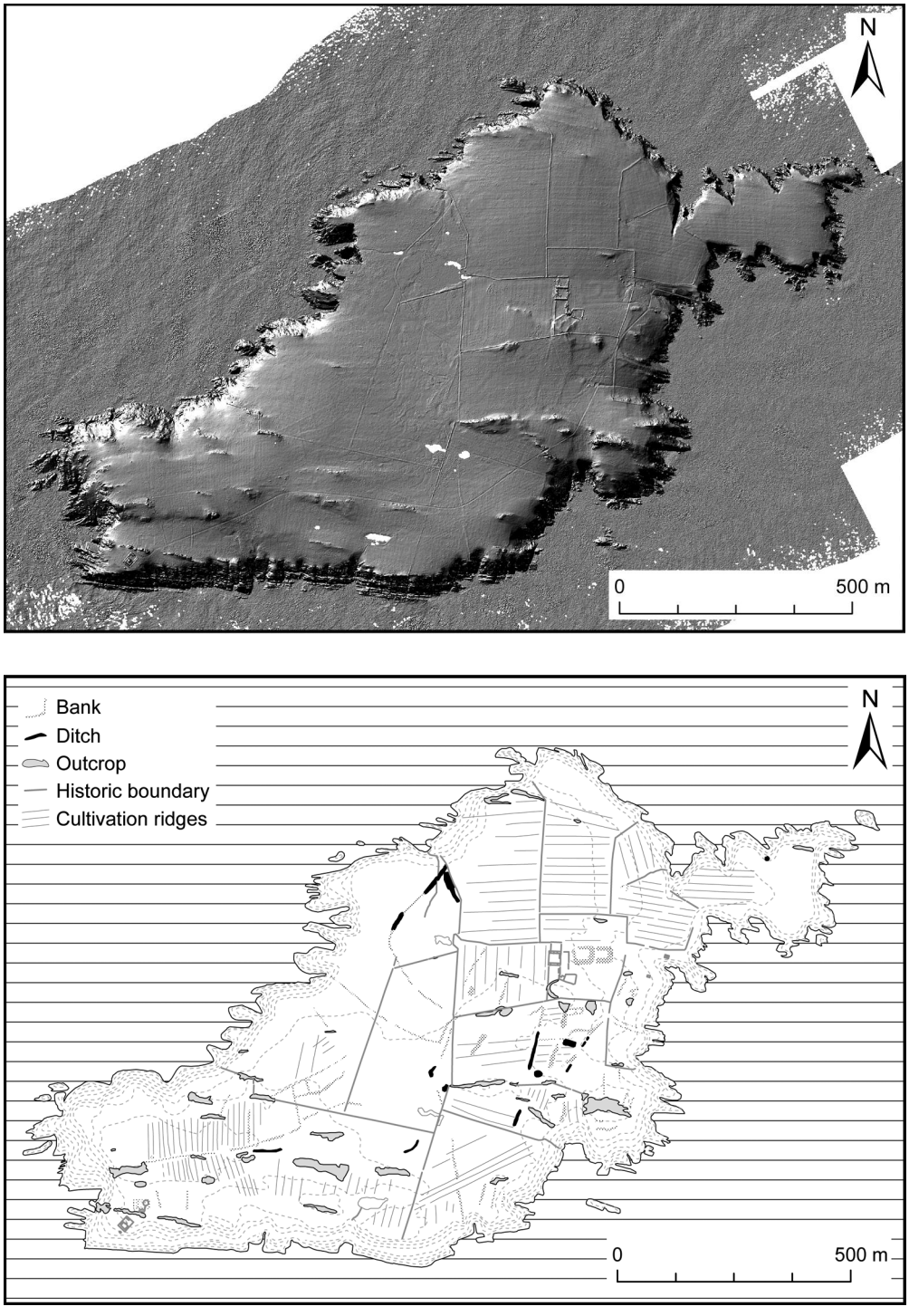

Fig. 3. DSM generated LiDAR image of Skokholm (top) and interpretation (bottom). © *Copyright Reserved, Environment Agency Geomatics Group; hillshade DSM view generated by RCAHMW*.

West of the farm

A sinuous curving bank and ditch appears to define the area of wetland around North Pond. This boundary is clearly truncated by the historic boundaries, but appears similar in character and may represent an initial setting out of enclosure which was subsequently altered. A hollow *c*. 100m north of North Pond could be the result of peat cutting, which is attested in the historical sources (Lewis 1845).

South and south-west of the farm

To the south and south-west of the farm is a complex pattern of banks, platforms, ditches and hollows. Immediately to the south of the farm are two conjoined rectangular enclosures situated between two rock outcrops. To the east of the conjoined enclosures is a rock cut pathway leading up from cliff edge.

Surrounding these enclosures to the south and west are several bank and ditch boundaries running broadly north–south and east–west, but the pattern is confusing possibly because of cuttings in this area for drainage. East–west plough ridges in this area, similar to those to the north of the farm, appear to overlie these features and so therefore must post-date them. A small oval hollow, 15m by 12m, situated just to east of a north–south boundary, and a square hollow, 24m by 10 m, situated 80m to the north-east could be platforms for structures. Along the coastal fringe short lengths of bank are evident, which are probably the remains of cultivation terraces.

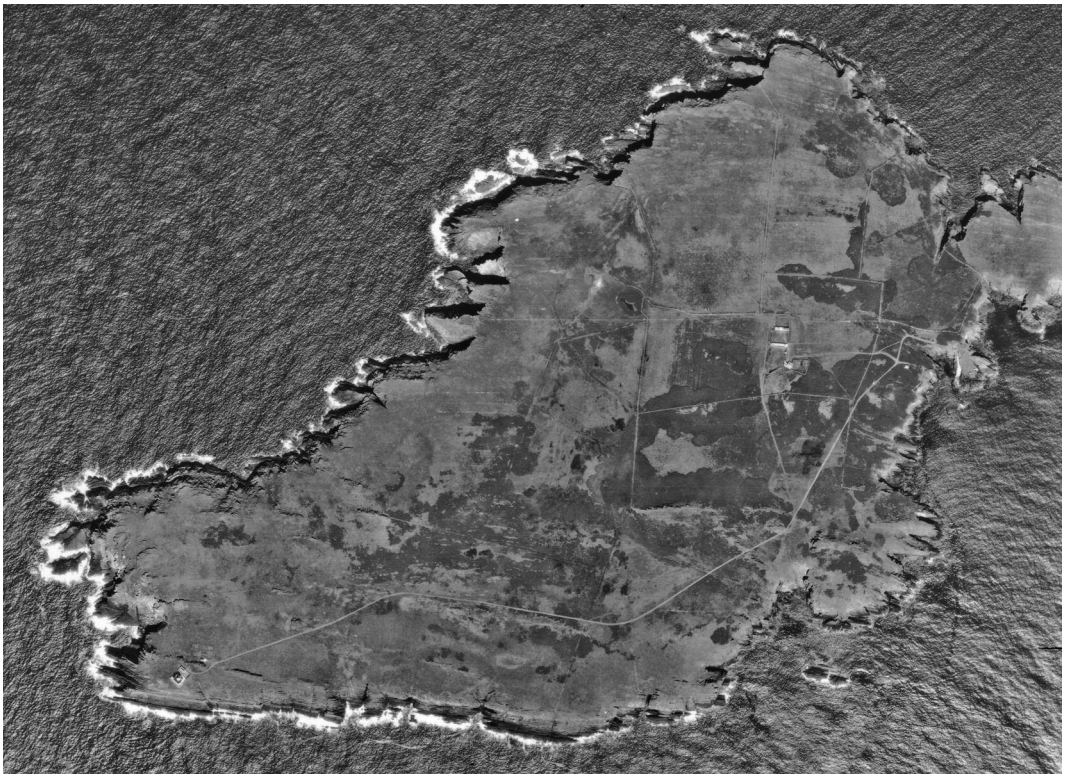

Fig. 4. RAF vertical photograph of Skokholm taken in 1959 showing possible sheep enclosure to the north of the lighthouse. © *Crown Copyright: RCAHMW, DI2011_0752*.

To the south-west of the farm the remains of a curving bank can be traced leading to the cliff edge on the western side of the island. This bank has been truncated by an historic field boundary running north–south as well as several more jagged curvilinear channels, undoubtedly the result of fluvial activity.

The south and south-west of the island appears to have been subject to less intensive cultivation over the last 300 years and the archaeology therefore survives well in this area. On the far south-western tip of the island is located the twentieth-century lighthouse. Just to the north-east of this structure is the modern helicopter landing pad, which overlies a rectangular enclosure, internally subdivided into seven compartments. This structure is still extant on the 1946 RAF vertical photograph (Fig. 4) and is likely to be a sheepfold.

To the north-east of the lighthouse is large block of fields and enclosures orientated west-south-west to east-north-east. These clearly underlie and therefore pre-date the historic field boundaries. Some of the boundaries can be seen to link the rock outcrops, presumably using the natural topography to help divide up the island. Contained within the fields are traces of cultivation ridges. These are generally orientated north-south and are much narrower (*c.* 5 m) than in the north-east of the island. A small circular bank, 8m in diameter, located *c.* 150m north of the lighthouse, could be the remains of a roundhouse.

At least two phases of ploughing are evident at Frank's Point in the south of the island. Cultivation ridges orientated south-west to north-east overlie a sinuous north–south bank and also truncate cultivation ridges running north–south.

Gateholm

An extensive plan of the settlement on Gateholm was revealed by Davies *et al.* (1971) as a result of detailed ground survey and interpolation of vertical RAF aerial photographs after heavy snowfall in 1968–69. Even though the fescue was significantly flattened to make many of the archaeological remains visible at that time, the results of the more recent LiDAR survey has revealed a more complete picture of the settlement remains (Fig. 5).

At least 120 separate compartments have now been identified, but the exact number is still unclear as the tussocky fescue still obscures the more ephemeral features. It is clear, however, that there has been little significant erosion over the last 40 years since all of the features depicted on the original plan (Davies *et al.* 1971, fig. 1) are still visible, even those along the northern edge of the plateau.

Marloes Peninsula

The LiDAR survey of the Marloes Peninsula covered an extensive area of 6,600,000m², which included the promontory forts of Deerpark and Watery Bay. The LiDAR data has revealed extensive traces of denuded banks, lynchets, platforms and terraces within the interior of these promontory forts, the results of which are described below (Fig. 6). It is clear however, that the survival of these features is a result of the lack of intensive modern arable cultivation since outside of these areas the modern landscape is one of large arable fields in which the plough has levelled any traces of earthworks. Cropmark evidence in these arable fields (see below) has revealed traces of small enclosures and pits suggesting that this part of Pembrokeshire was intensively occupied in the past.

Deerpark promontory fort is defined by a single bank and ditch running north–south for *c.* 270m (Fig. 7). It is punctuated in four places, although it is likely that the gap *c.* 65m north of the southern cliff is the original entrance as the bank here is slightly in-turned. A small block of fields had been noted from RAF verticals (Fig. 8) and RCAHMW aerial reconnaissance within the interior of the enclosure, but the LiDAR survey has shown that cultivation was much more extensive. Cultivation ridges are apparent in the north of the promontory, while in the centre and south are the remains of earthen bank field

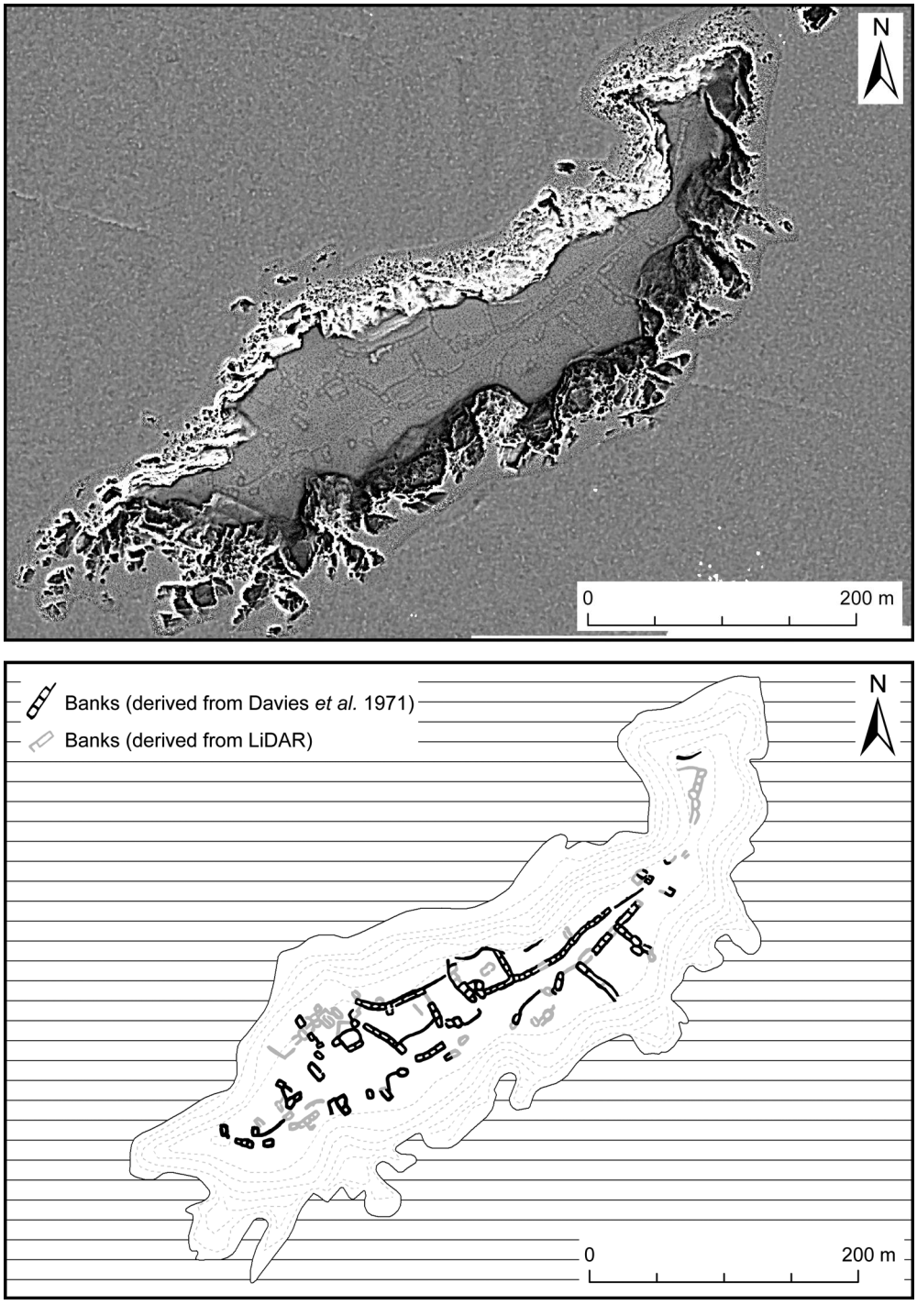

Fig. 5. Local relief model LiDAR image of Gateholm (top) and interpretation (bottom). © *Copyright Reserved, Environment Agency Geomatics Group; local relief model generated by RCAHMW*.

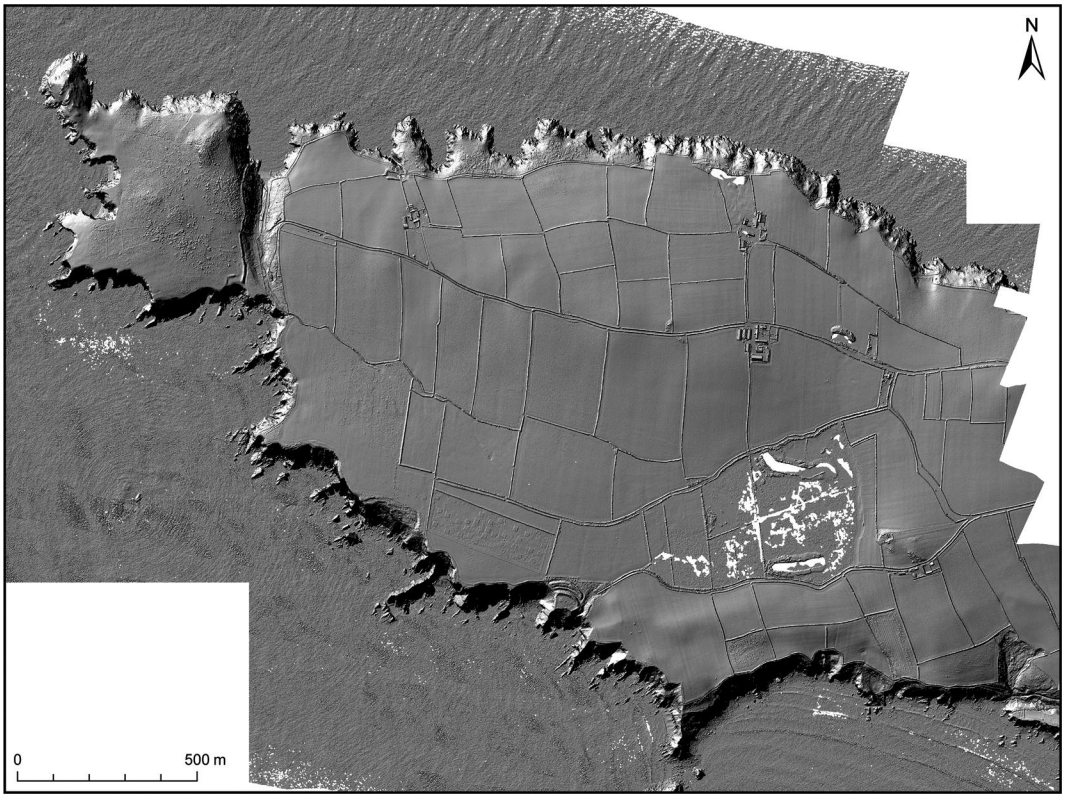

Fig. 6. DSM generated LiDAR image of Marloes peninsula. © *Copyright Reserved, Environment Agency Geomatics Group; hillshade DSM view generated by RCAHMW*.

boundaries and short lengths of lynchets. Their denuded nature makes it impossible to tell, even from the LiDAR data, whether they run up to and abut the enclosure bank or whether the enclosure boundary was built over them. It is possible therefore that we are dealing with at least two phases of activity, since the field boundaries could either pre-date or post-date the creation of the promontory fort, or be contemporary with its use.

Two other notable features, known from aerial survey, have been revealed in further detail by the LiDAR data. The first is the small enclosure in the south-east corner of the promontory fort. Roughly rectangular, it is defined on its northern and western sides by a broad bank, 8m across. Its chronological relationship to the main promontory fort enclosure bank is not possible to ascertain since an entrance gap on its northern side means that there is no stratigraphical association between the banks. Two separate phases of activity are therefore possible.

The second feature is a boundary cutting off the north-west rocky promontory within the larger main fort. The LiDAR has revealed this to be a double bank with a ditch in between. There are two possible entrances. Its relationship to the main enclosure is not known, but it could be a smaller, earlier promontory fort.

Three substantial curving banks and ditches define the northern side of the promontory fort of Watery Bay (Fig. 9). Another, much slighter and narrower, bank runs along the cliff-top on the western and

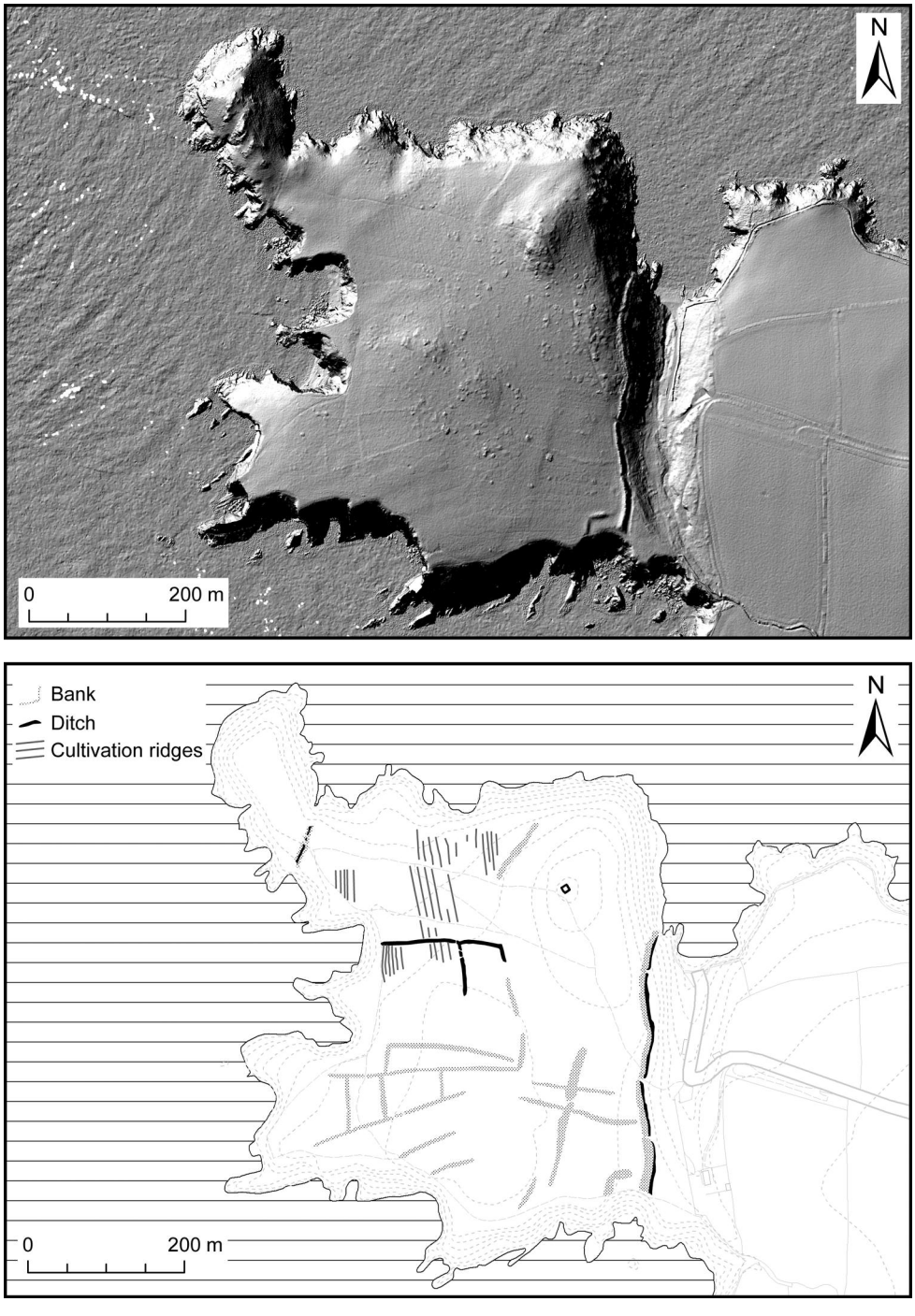

Fig. 7. DTM generated LiDAR image of Deerpark promontory fort (top) and interpretation (bottom). *© Copyright Reserved, Environment Agency Geomatics Group; hillshade DTM view generated by RCAHMW.*

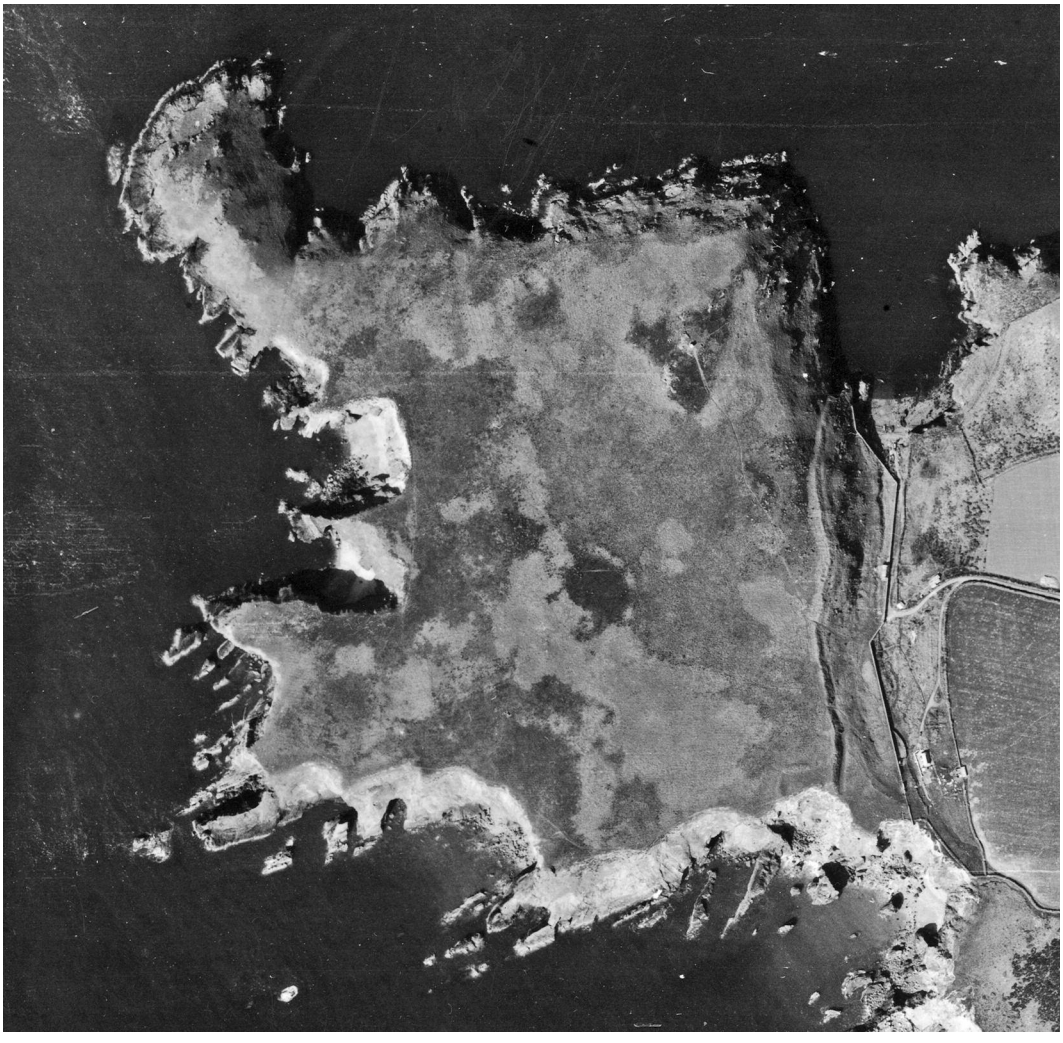

Fig. 8. RAF vertical photograph of Deerpark promontory fort taken in 1946 showing field system within the defensive earthworks. © *Crown Copyright: RCAHMW, DI2011_0751*.

southern sides. A small gap in the east between the inner northern rampart and the slighter southern bank is presumably the entrance into the enclosure. Several short stretches of denuded bank to the east of the entrance are also evident and may be prehistoric.

The fields immediately surrounding the promontory fort have clearly been plough levelled, and the LiDAR did not reveal any topographic evidence for associated fields and settlement. However, RCAHMW aerial reconnaissance in 2006 identified a complex pattern of cropmarks *c.* 500m east of the promontory fort (Fig. 10). A small rectangular ditched enclosure, 40m by 30m, is associated with a number of straight and curvilinear ditches and more ephemeral features, probably pits or platforms. The complex is likely to be the remains of settlement occupation of unknown date, although its association with the promontory fort suggests that it may be prehistoric.

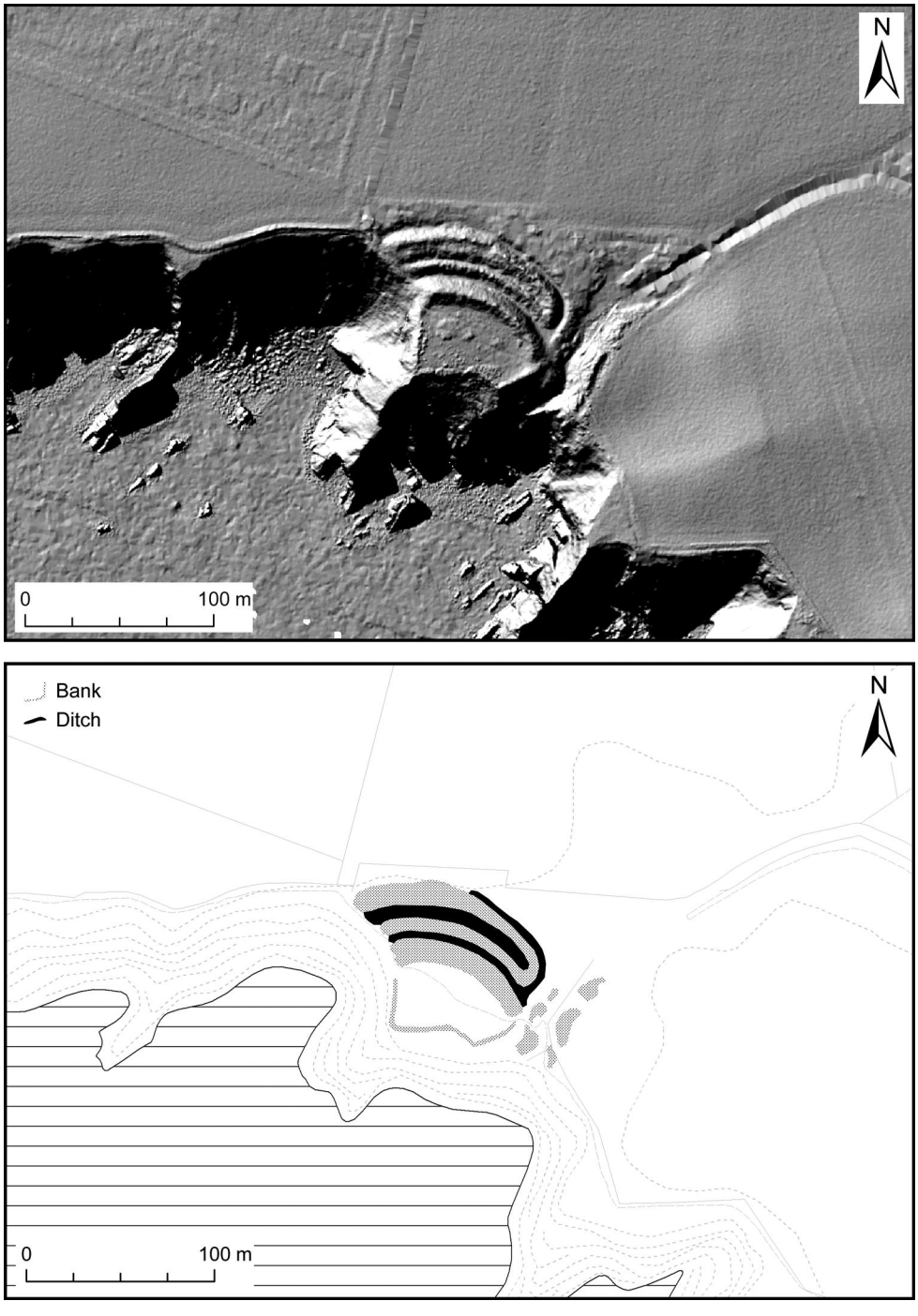

Fig. 9. DTM generated LiDAR image of Watery Bay promontory fort (top) and interpretation (bottom). *© Copyright Reserved, Environment Agency Geomatics Group; hillshade DTM view generated by RCAHMW.*

Fig. 10. Cropmarks of a possible settlement, 500m east of Watery Bay promontory fort.

CONCLUSIONS

The application of LiDAR as a survey tool in this part of Pembrokeshire has revealed significant traces of archaeology that has hitherto remained concealed, particularly in those areas such as Skokholm and Gateholm where the tussocky grass vegetation obscures much archaeology from aerial and ground survey.

At least three phases of settlement occupation have been identified on Skokholm. The historical enclosure and cultivation of the island is well documented (Fenton 1811; Lewis 1845), but it is clear that ploughing has destroyed much of the upstanding archaeology, particularly in the north-east of the island. However, sufficient has survived to suggest a more long-lived story of occupation on the island. The platforms to the east of the current farm could represent the remains of an earlier, possibly medieval farmstead, while the field systems in the south-west of the island could date from anywhere from the prehistoric to medieval periods. Given their similarity to remains found on nearby Skomer (Evans 1990), which are likely to be prehistoric, a pre-Roman date for this phase of enclosure and cultivation is probable. However, there is little complexity to their remains with no subdivision, which suggests that occupation was short lived or episodic. Undoubtedly, we have lost much of the upstanding archaeology on the island, but geophysical or aerial survey during drought conditions may reveal secrets hidden below the ground surface.

The LiDAR survey of Gateholm has shown that there has been little erosion of the islet plateau since the ground survey that took place during 1968–69 (Davies *et al.* 1971). However, the LiDAR revealed

traces of more houses and banks, and it is likely that other remains of structures exist, but they are now too ephemeral and obscured by the tussocky grass to be picked up by 0.5m-resolution LiDAR coverage. For the recovery of a complete plan of the settlement it would therefore be desirable for the islet to be grazed by livestock before the outlines of the buildings are permanently obscured, although this may not be possible due to its current designation as a SSSI.

Within the Deerpark promontory fort, the LiDAR revealed traces of an extensive field system. At least two phases of activity are possible if the field system and promontory fort were not contemporary. However, modern arable cultivation has levelled the majority of earthworks along the Marloes Peninsula, although cropmarks *c.* 500m east of Watery Bay suggest that the landscape was intensively occupied in the past.

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