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Geophysical survey of two bloomery mounds, Iron Acton [ST6908 8300]

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Geophysical Survey of two bloomery mounds, Iron Acton, S. Glos. [ST 6908 8300]

Dr T.P. Young

Abstract

Geophysical survey of two low mounds in a field to the east of Iron Acton was undertaken following their recognition as bloomery mounds. Each mound is approximately 10x15 m and marked by darker soil than the surrounding area. The slag assemblage includes dense cakes of tapped slag, irregular granular slag masses and thin dense concavo-convex sheets of slag with rusty upper (concave) surfaces. This assemblage indicates that smelting was being undertaken, but not bloomsmithing. Associated finds of pre-early modern age were limited to a single fragment of "puddingstone" quernstone. The geophysical data are strongly influenced by the modern ploughing and lack clear evidence for furnace survival

Contents

Abstract1
Background1
Techniques1
Geophysical Survey Results2
Slag Description2
Discussion2
Acknowledgements3
References3

Background

The site was first noticed by Mr D Hardwick, as a pair of sub-circular dark patches on the newly ploughed field in 2001. When the field was again ploughed (March 2002) arrangements were made for a visit by TY (9/4/02), and this was followed up by magnetic gradiometer survey (30/4/02). The March 2002 visit showed that the dark patches were yielding considerably more bloomery slag than they had been on initial inspection by DH in 2001. The southern mound (Mound 1) showed a slightly darker soil colour than the northern (Mound 2). A fragment of "puddingstone" quernstone was recovered from the surface of mound 2.

The mounds lie on a low ridge oriented NW-SE, with a sharp edge just to the west of the mounds (dotted line on Figure 1). This topographic ridge corresponds to a thin sandstone horizon between two shale bodies in the Pennant Measures. It becomes a more marked topographic feature further NW. The two shale horizons are slightly mis-positioned on the 1:63360 geological map (Bristol Special Sheet, 1962), but the intention is clear. Slabs of sandstone are abundant in the ploughsoil close to the mounds, suggesting that the present ploughing regime is actually cutting the bedrock on the crest of the ridge.

Techniques

The survey was located by means of a baseline placed between a point close to the SW side of the stile to the W of the site (4m SW of the re-entrant field corner) and the western of the two poles for electricity cables. This line is very close to E-W (estimated as 90.1°) with respect to the National Grid. The SW corner of the survey (0,0) lay 49.6m from the western end of the baseline and the point (40,0) lay 27.3m from the cable pole. The origin of the survey is estimated to lie at NGR [ST 690821 830091] The survey area was marked in 20m grid squares and surveyed with a Geoscan FM36 magnetic gradiometer with 1 m traverse spacing and 0.5m sample-spacing. The

traverses were aligned N-S and all walked in parallel, northwards. Data were initially handled and processed using Geoscan's *Geoplot* software, before transfer into Golden Software's *Surfer* software for presentation. The presented images are of a fitted surface, derived by kriging the dataset.

Geophysical Survey Results

The gradiometer results are characterised by a relatively low range of -71 to +193nT, with very few data points lying outside the range +/-50nT.

Strong features correspond to the surface topography, and form two oval zones of elevated and variable magnetic signature. The southern geophysical anomaly covers an area of 13m NS x 16m EW (Mound 1), the northern 14m EW x 23m NS (Mound2). The gradiometer data are dominated by NW-SE (130° grid) ploughing, showing as parallel zones becoming more marked within the mounds (particularly visible in Figure 3a). Both mounds show some features oriented approximately 030°, which is very close to the direction of the grubbed-out field boundary immediately to the west.

The Mound 1 shows a slightly darker soil colour than the northern mound. The gradiometer data are marked by a strong linear anomaly from (2.6, 2.8) to (20.3, 17.1). As mentioned above, this direction is parallel to a former field boundary, approximately 40m to the northwest. There are three peaks in the dataset: 102nT at (11.0, 11.1), 193nT at (13.0, 18.3) and 103nT at (20.0, 13.9). Two isolated peaks lie north of the mound: a broad high in the low 30s nT at (16.1, 23.3) and a sharper peak of 102nT at (19.1, 24.1).

Mound 2 shows a single peak within the mound of 60nT at (30.8, 32.7) and a much more marked isolated anomaly just to the north of the mound, with a peak of 82nT at (34.1, 40.8).

These data do not reveal clear indications of a furnace surviving within either of the mounds. Several of the peaks identified above would be worthy of investigation, perhaps particularly the isolated anomalies lying just to the north of each mound. The lack of clear geophysical evidence for furnace structures and the intense featuring of the dataset produced by the ploughing, raises the possibility that the furnaces no longer survive.

Slag description

No detailed investigation of the slag has been undertaken. Observation of surface material suggests that four broad classes of residue can be recognised:

1. *dense tap slags*. These form pieces of bowl-shaped cakes. The fragments range up to approximately 1kg in weight, with pieces of this size forming perhaps one quarter of a complete cake.

2. *open textured, porous, granular slags*. These slags are amorphous. They are interpreted as being slags formed inside the smelting furnace.

3. *dense thin fragments of sheets*. These pieces range up to 300g. The sheets are concavo-convex and up to 15mm thick. The lower surfaces appear to have been in contact with the base of the furnace, the upper surface (the concave surface) is often characterised by charcoal impressions and weathered iron fragments. Slags such as these have been reported in experimental furnaces, where a slag bath below the bloom has been drained, to leave a dense slag around the inside of the furnace bottom.

4. *pieces of furnace wall*.

These slag types are all associated with smelting. There is no evidence for bloomsmithing.

Discussion

The physical remains and slag textures give little clue to the age of the site. Isolated small bloomery mounds away from the immediate location of ore sources are typically, however, associated with medieval iron-making, particularly with operations where temporary bloomery furnaces were sited within managed woodland (e.g. Coed-y-brenin bloomeries, P Crew, pers. comm and the *forgeries itinerantes* of the Forest of Dean). The weight of slag in the dumps cannot be estimated, because of lack of understanding of the depth, but if the slag deposit averages 0.2m thick, then a 15m diameter dump might contain in the region of 35 - 70 tonnes (assuming 1-2 tonnes slag / cubic metre of deposit).

The small size of the present mounds is in apparent contrast with the slightly larger slag dump located S of Iron Acton in the field known as Parsonage Ground [ST 68138323] (Young 1999; Young & Macdonald 1999). The Parsonage Ground site was interpreted as a 30m diameter slag dump on the crest of the ridge, which has subsequently generated a spread of slag extending a considerable distance downslope on either side of the ridge. The total weight of slag remaining to the west of the ridge alone was estimated as 100 tonnes, that to the east (the larger spread) was not estimated.

There is some circumstantial evidence for early iron working in the area from the Domesday survey, in which a tax of "100 iron pieces less 10" was paid in Pucklechurch, the manor lying to the south of the Frome valley. A charter of Pucklechurch with a reputed date of AD950 records a "cinder ford" as one of its markers on its boundary with Iron Acton: this ford probably lay close to the present Algar's Mill, southwest of Iron Acton (Grundy 1936).

The location of the present bloomeries does not correspond to the location of known iron ore resources. The principal deposits are believed to lie on, or close to, the NNE -SSW Iron Acton Fault, which passes adjacent to the Parsonage Ground locality, close to Iron Acton church and then along the pronounced topographic feature towards Rangeworthy Court. Iron

ore was exploited briefly in this area in the 19th century from a mine near Dowell Farm [ST 681 854] on the northern boundary of Iron Acton parish. Iron ore was recorded (Curtis 1972) [ST 696824] during development work at a site 800m SSE of the present bloomeries, and there remains the possibility that small pockets of ore might have gone unnoticed by recent geological investigations. However, it remains more likely that the choice of location for the bloomeries was dictated by the availability of fuel. The northern slopes of the Frome valley and the low-lying ground to the NE (towards Engine Common) are both areas likely to have been wooded.

The medieval geography of Iron Acton is not well known. However, it has been argued (Manco 1995) that the village represents a nucleated settlement of Saxon age, with an original 5 hide manor, which had been divided before Domesday into two 2 1/2 hide manors (known as Iron Acton and Acton Ilger). The two manors became components of two different hundreds, and although the holdings became largely reunited in the early 14th century, the boundaries of the hundreds can still be traced on the 1881 Ordnance Survey. The part of the parish in Grumbald's Ash Hundred (the part descended from Acton Ilger, although probably in a form modified by enclosure) is concentrated in the southeast of the parish. The bloomeries described in this report lie within the area of Grumbald's Ash Hundred at this time; the Parsonage Ground site lies within Thornbury Hundred.

The sites are important, for so few bloomery sites are known in the area. Retrieval of dating evidence, together with evidence for structure of the furnace and any ancillary structures is highly desirable before the mounds have become completely degraded by ploughing.

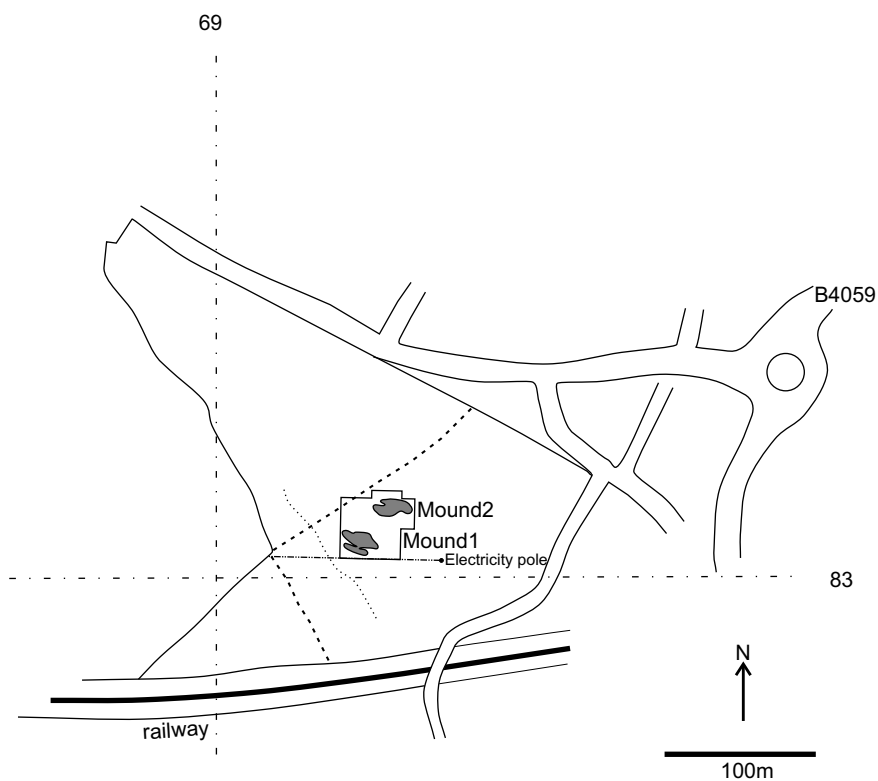
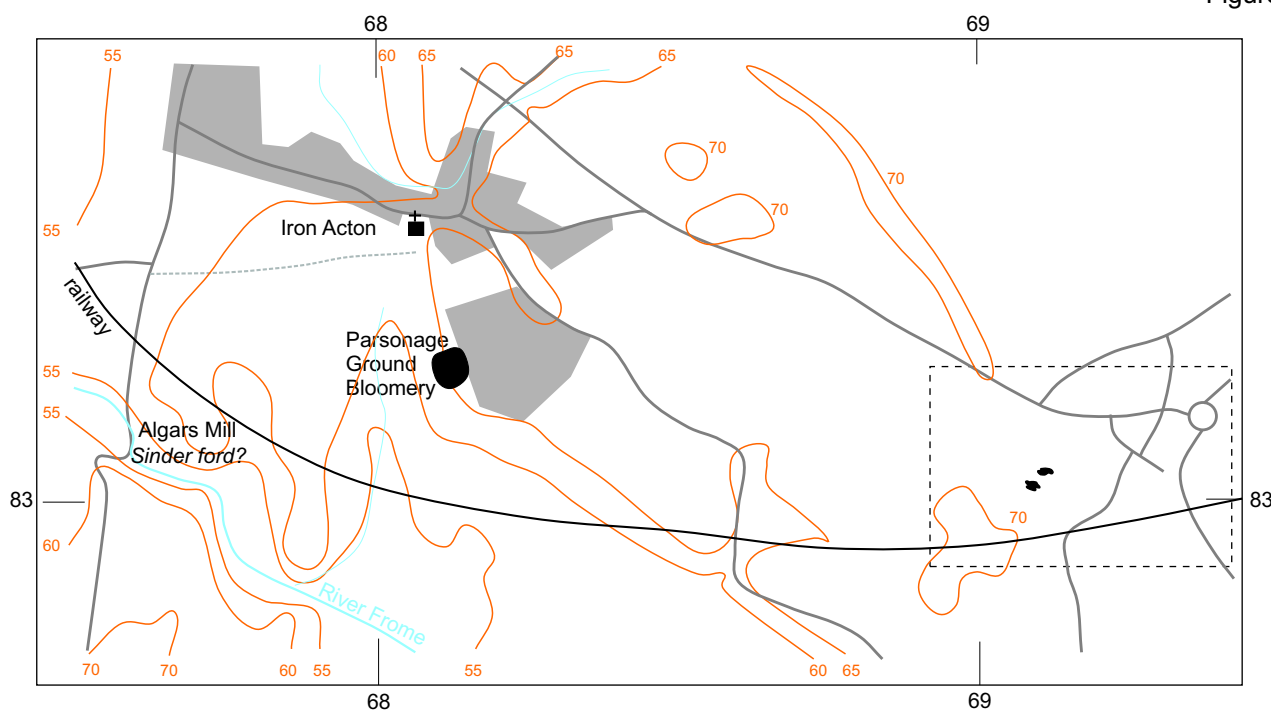
Acknowledgements

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Figure 1.



Location of sites mentioned in the text, with insert map below showing the two mounds, the extent of the geophysical survey, and the location of the site baseline. The dashed lines show the position of former field boundaries, and the dotted line shows the limit of the upstanding sandstone area of the field, to the west of which is a hollow, corresponding to the outcrop of a mudstone.

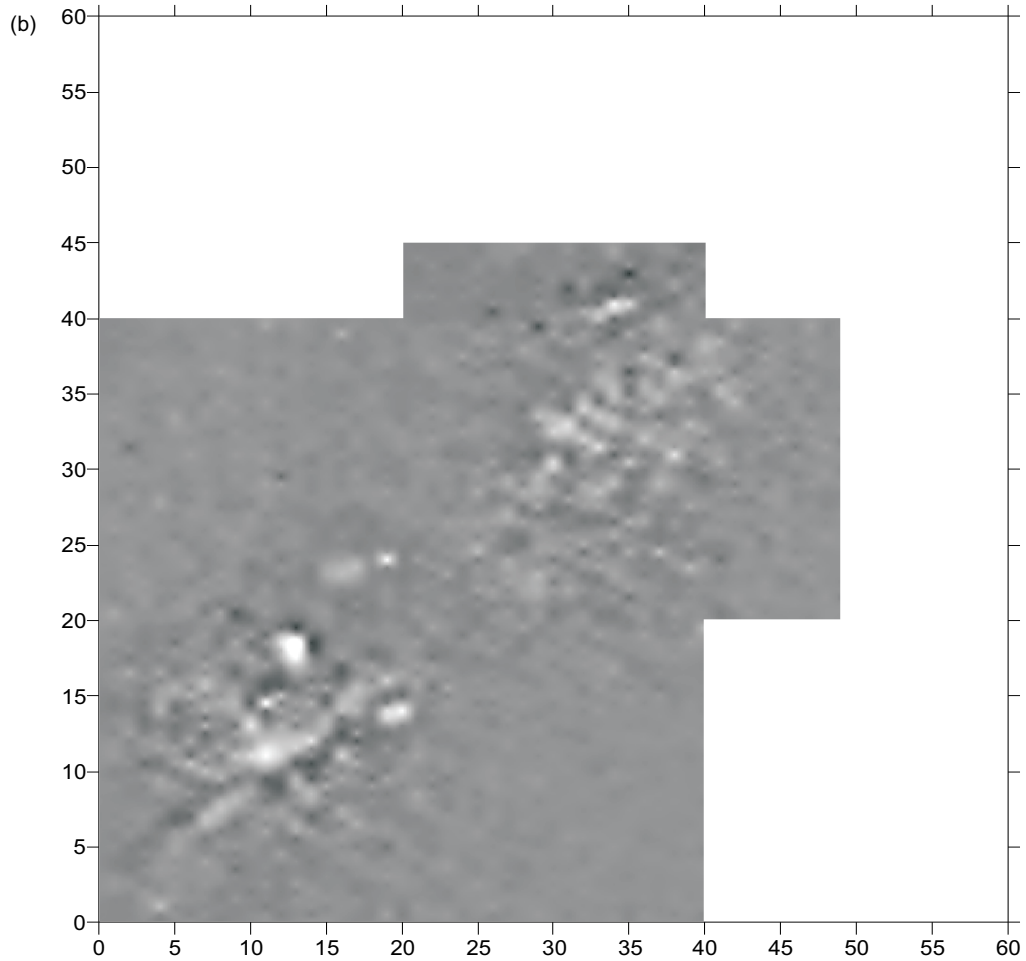
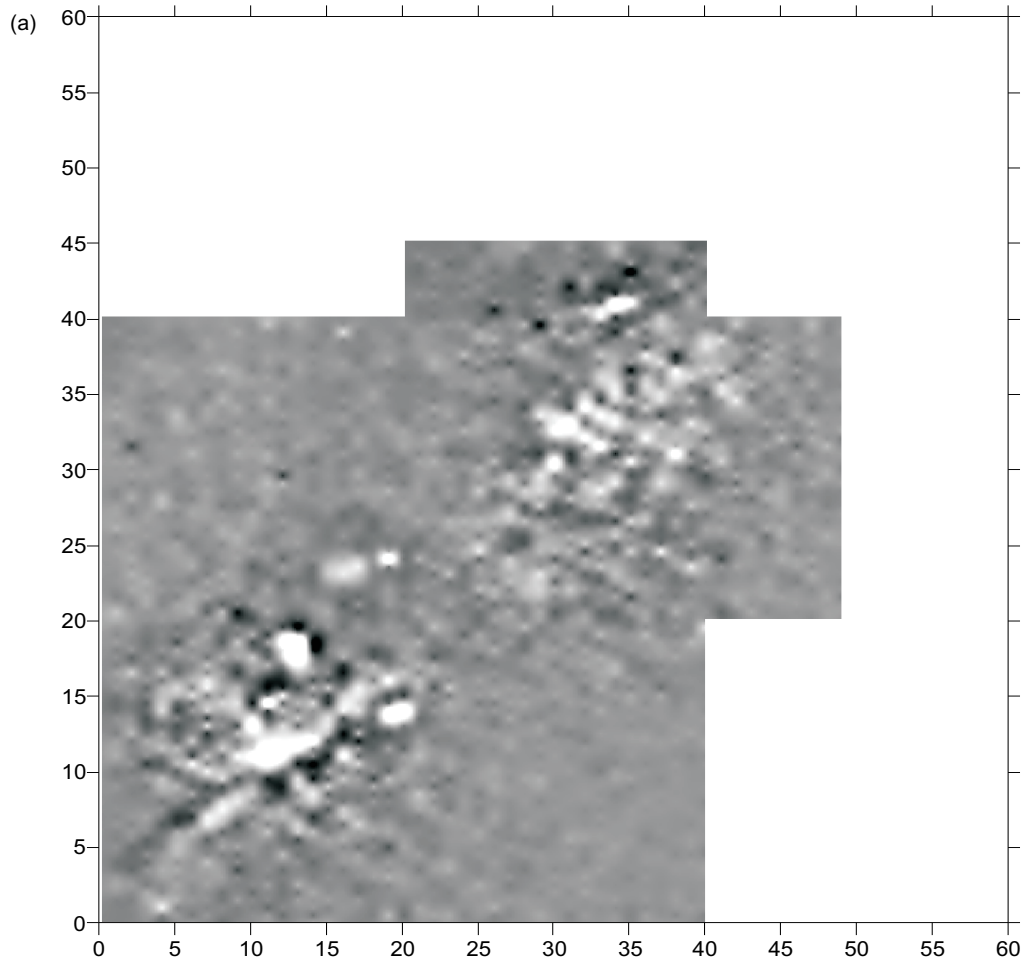


Figure 2. Kriged magnetic gradiometer data.
(a) greyscale from black (-40nT) to white (+40nT),
(b) greyscale from black (-100nT) to white (+100nT). Scale in metres, North to top.

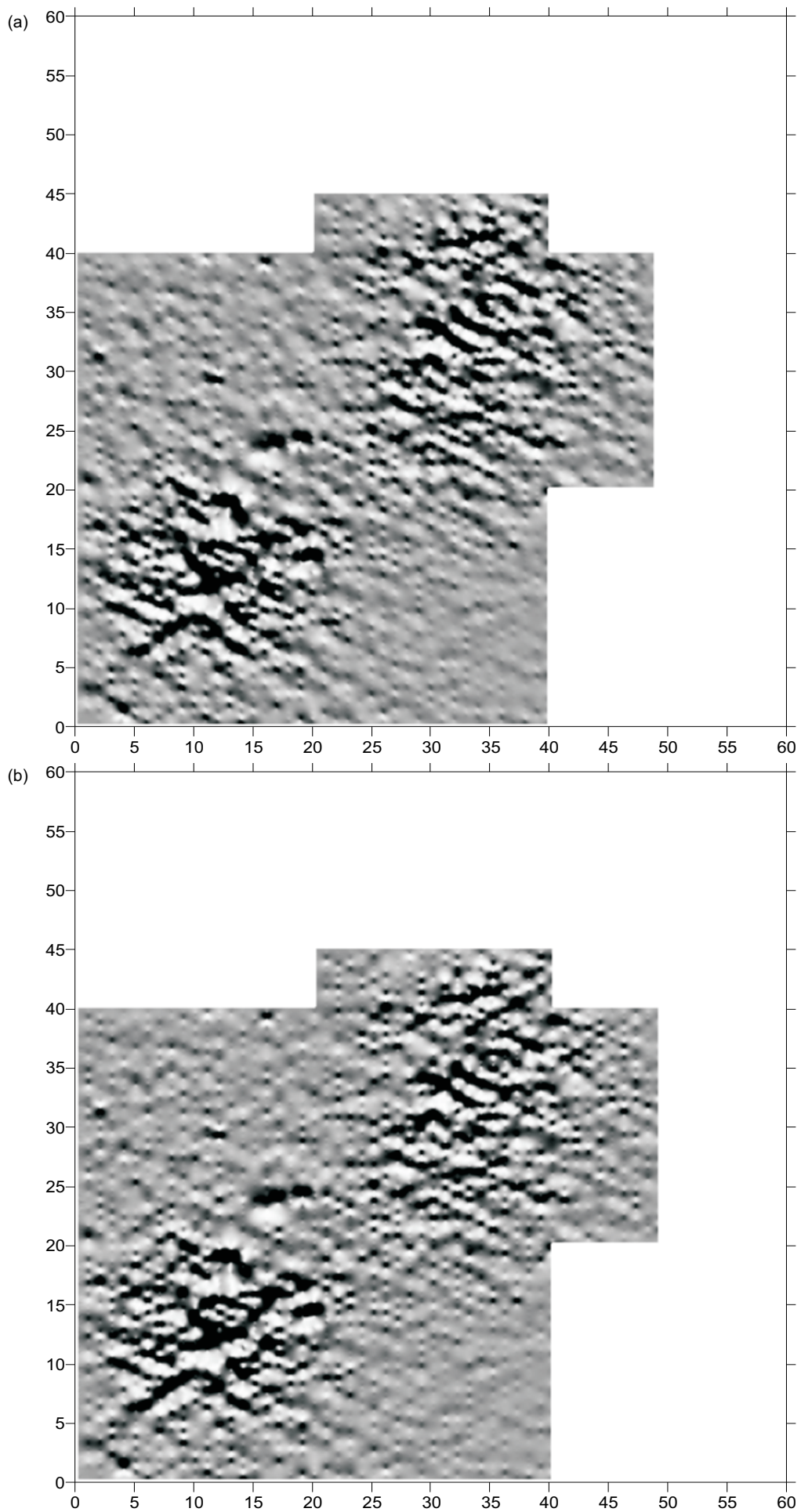


Figure 3. Shaded relief images of magnetic gradiometer data.
(a) illuminated from 215° , perpendicular to current ploughing and
(b) illuminated from 180° to minimise striping in dataset. Scale in metres, North to top.



Figure 4. Panoramic view of site from the SE. The pale soil in the middle distance is the hollow corresponding to the shale outcrop to the west of the mounds. The figures are standing immediately to the SE of mound 1; mound 2 lies to the right of the figures, below a row of buildings on the sky-line