Stormy Point, Alderley Edge, Cheshire

An Archaeological Evaluation

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Summary

The University of Manchester Archaeological Unit (UMAU) were commissioned by the National Trust to undertake an archaeological evaluation at Stormy Point, Alderley Edge, Cheshire (NGR SJ86037788).

The work comprised topographic, geophysical and XRF survey and the excavation of ten hand dug test pits followed by environmental analysis and AMS dating. The evaluation revealed that archaeologically deposits survive across the whole of the Stormy Point site including a Bronze Age prospection pit, a second prehistoric possible prospection pit, at least one previously unknown prehistoric mine working with a collapsed ceiling, a possible prehistoric smelting bowl and another prehistoric pit probably associated with ore processing. Evidence was found of intermittent periodic ore processing and dumping with a date range from the Earlier Bronze Age to the Medieval period. Quarrying activity could be dated from the Medieval period to the Mid 17th century and traces of evidence for possible Romano-British or Medieval iron smithing were recovered along with evidence for Medieval activity close by, probably at Saddlebole.

1. Introduction

1.1 The University of Manchester Archaeological Unit (UMAU) were commissioned by the National Trust to undertake an archaeological evaluation at Stormy Point, Alderley Edge, Cheshire (NGR SJ86037788). The work was carried out in accordance with a project design provided by UMAU and approved by Jamie Lund, National Trust Archaeologist for the north-west.

1.2 The work comprised topographic contour survey, geophysical magnetometer survey, XRF survey and the excavation of ten hand excavated test pits across the site in order to determine the potential, presence, extent, depth, state of preservation and importance of any archaeological remains and provide sufficient information for an assessment to be made on the impact of erosion on the archaeological resource. Based on the results of this evaluation a strategy could be formed for the management of this resource and the planning of measures to protect the resource from erosion.

1.3 The fieldwork was undertaken between the 12th June and the 27th July 2007 and this report represents the results of the fieldwork.

2. Background

2.1 Location

Stormy Point lies on the north-eastern edge of the Alderley Edge ridge 400m north of Engine Vein, 465m east-north-east of Castle Rock and 435m north-east of The Wizard Restaurant on Macclesfield Road opposite Artist’s Lane (**Figs 1 & 2**).

2.2 Topography and Current Land Use

Stormy Point comprises an open area within the woodland on the top of the ridge with a steep open north-east side overlooking the plain to the north and east of the ridge. It is an expanse of crushed rock with flat outcropping planes of bedrock to the north, west and south. It slopes downwards from the south-west at c 187m AoD to the north-east at c 180m AoD at which point it drops steeply to the base of the ridge. At the south and west is a raised plane of outcropping bedrock at c 190m AoD, with exposures of red and green marl below it, with a higher grassed mound (now fenced off) to the south-east.

The site is open to the public with part of the steep north-east slope and mound at the south-east fenced off. Much of this area is under threat from erosion caused by tourism and weather conditions (**Fig 3**).

2.3 Geological Background

The following geological description is taken directly from personal communication from Dr David Green, Manchester Museum.

The Alderley ore deposits lie near the north-eastern of the Cheshire Basin. This underlies much of Cheshire and northern Shropshire and is the most important geological feature in the region (Plant et al., 1999a). The basin opened along a line of weakness in the Earth’s crust in Permian and Triassic times, when east-west extensional forces pulled the rocks apart, allowing large blocks of Carboniferous and older Palaeozoic rocks to move downward along faults, creating a subsiding area in which sediment accumulated. As further downfaulting occurred, successive layers of sediment were buried and eventually lithified, becoming the Permian and Triassic conglomerates, sandstones and siltstones that we know today; these rest on limestone, sandstone, coal and (metal-rich) black shales of Carboniferous age and, locally, on older Palaeozoic rocks.

The rocks that form Alderley Edge are sandstones of Lower to Middle Triassic age which are assigned to a large and diverse group of sedimentary rocks known as the Sherwood Sandstone Group. These sandstones occur in a tilted block, 3km wide, that is bounded to the east and west by north/south-trending fracture zones. A third fracture zone which forms the northern boundary to a structure known as the Alderley Block, the interior of which is criss-crossed by numerous small faults with relative displacements of less than

10 metres and which are typically oriented north/south or east-south-east/west-north-west.

For most of the time since they were deposited the sandstones in the Alderley Block were buried beneath impermeable mudstones of the younger (Mid and Late Triassic) Mercia Mudstone Group, and post-Triassic deposits. It is only in the recent geological past that these rocks have been eroded away and the sandstones forming the core of the block exhumed.

To understand the origin of the Alderley mineral deposits it is worthwhile reviewing the way ore deposits form in general terms. Copper, lead and other valuable metals are, on average, present in minute concentrations in the rocks of the Earth's crust. To form ores that are rich enough to be mined, they must be concentrated by natural chemical processes. Compared with the size of the ore deposit, a large volume of rock is required as a source. The metals and other chemical elements that go to make up an orebody are usually physically dispersed and chemically bonded to the source rock. They are typically released by 'stewing' a large volume of the source rock in a solvent such as water for a long period of time. This produces a subterranean body of hot, metal-rich fluid, termed a hydrothermal solution. If this fluid flows along fissures to a site where conditions are favourable for mineral deposition, usually a cooler area, with suitable open spaces, ore bearing minerals may be precipitated from solution and form an ore deposit. This process occurs in many different ways and gives rise to many different types of ore deposit, but the general principle remains the same.

The Alderley ore deposits contain some vein-like bodies associated with faults, as at Stormy Point or Engine Vein, but the majority are disseminations in the host sandstones, with the ore minerals occupying the spaces between the sand grains. Once thought to be syngenetic, or formed contemporaneously with the host rocks (e.g. Dewey & Eastwood, 1925), they were subsequently regarded as epigenetic, or introduced after the formation of the host rocks (e.g. Taylor et al., 1964; Warrington, 1965).

The sediments that make up the rocks at Alderley Edge were rapidly buried, reaching a depth of more than 2km about 180 million years ago (Chadwick et al., 1999), late in the Early Jurassic (Gradstein et al., 2004). By this time, the rocks were extensively faulted and the Alderley Block had been tilted beneath and impermeable mudstone cap to produce a classic trap structure in which hydrothermal fluids could gather.

As the sediments were buried, the temperature of contained fluid increased and insoluble metals such as copper and lead began to come into solution. Eventually, a large body of hot, metal-bearing, hydrothermal fluid accumulated. The major faults running through the basin directed the flow of this fluid. When it entered the Alderley Block a range of sulphide ores were deposited. It seems likely that small faults within the Alderley Block acted as baffles to the flow of these fluids, ponding them in certain areas to produce some of the orebodies we see today, particularly in the Engine Vein and Woods mines. Additionally, mudstone beds in the succession also influenced fluid flow, resulting in smaller, more irregular mineral disseminations in, for example, the beds worked in Wood Mine, where mudstones are virtually absent.

Several episodes of mineralisation, requiring fluids with distinctly different characteristics, are required to account for the Alderley Edge ore deposits, the minerals in which can be divided into primary and secondary species. The primary minerals, including the sulphide ores galena and sphalerite, together with barite, iron-rich calcite and a few others, were deposited by hot, saline, metal-bearing, hydrothermal solutions. The secondary minerals were produced by the action of downward percolating oxygenated groundwater on some of the primary minerals, and include the attractive blue and green copper carbonates azurite and malachite.

Detailed investigations of outcrops in the mines, and studies of cut and polished sections have shown that the primary mineralisation is complex. The first primary mineral to crystallise was, in most cases, a pink coloured barite. This was followed by sulphide ore minerals, typically in the sequence pyrite - chalcopyrite - sphalerite – galena, and then by a second generation of barite, together with late stage, iron-rich calcite. Together with a number of uncommon sulphides, described at the end of this chapter, these make up the primary minerals.

Since fluid inclusion studies show that the minerals crystallised from hot, saline, hydrothermal fluids, it is reasonable to ask where these came from and what the source rock was. The passage of large volumes of fluid commonly bleaches sandstone rocks. The core from a borehole drilled at Alderley park, 200m east of the position of the Alderley Fault, as determined by the British Geological Survey, revealed highly faulted sandstone with pyrite and barite mineralisation. Parts of the Wood Mine Conglomerate and the whole of the West Mine Sandstone are bleached, indicating that this structure was a major fluid conduit. It seems likely, therefore, that the major faults that delineate the Alderley Block were conduits for the mineralising fluids.

The highly coloured secondary minerals such as malachite and azurite, that are so conspicuous in the mines today, are a more recent addition to the mineralogy and were produced by an entirely separate process. Uplift, beginning in earnest in the early Tertiary, some 65 million years ago, gradually removed the overlying sediments, allowing almost all the hydrocarbons trapped in the rocks to dissipate, and eventually bringing the primary orebodies above the water table. Oxidising groundwaters then began to react with the primary ore minerals, chemically changing them in a process known as supergene oxidation. This produced the unusual and brightly coloured minerals, such as malachite, azurite, pyromorphite and erythrite, for which Alderley Edge is known today. Although these secondary minerals have nothing to do with the original processes of ore formation, they are conspicuous in the rock outcrops and easily smelted to produce metals. It is likely that they first attracted Bronze Age man to the area.

2.4 Historical and Archaeological Background

2.4.1 Located approximately 13 miles south of Manchester, the town of Alderley Edge did not exist before the coming of the railway in the 1830s (Carlon 1979, 13). Alderley Edge itself is a natural rocky outcrop with views across both Greater Manchester and the Cheshire plain. Comprising a unique geology, Alderley Edge supported a variety of economic activities from early prehistory through to the twentieth century, the most notable being the prospection and mining of copper and lead ores during the Bronze Age and Romano-British period respectively, and the quarrying of sandstone and conglomerates in the Medieval and Post-Medieval period. From the late Middle Ages, the region was predominantly supported by agricultural production, although industrial extraction of copper, lead, and cobalt was re-established by the Alderley Edge Mining Company (1857-1878) (Casella & Croucher, in press). The final phase of Industrial activity on the Edge occurred during the 1950s.

2.4.2 **The Mesolithic**

Although it is likely that there was a human presence on or around Alderley Edge during the Palaeolithic, later glaciations have eroded all sign of such existence (Timberlake 2005, 6-7). The first limited signs of prehistoric occupation of the Edge therefore date to around 8500 BC during the Mesolithic. During this period, Alderley Edge appears to have been an important site on a route between the coast and the Pennine uplands, probably used over hundreds, if not thousands, of years (Timberlake 2005, 19). Although considered somewhat of a marginal upland location in relation to other Mesolithic sites in Cheshire, the Edge attracted activity on the tops of prominent outcrops and many sites have produced significant numbers of lithics including blades, flakes, scrapers and cores.

There are several sites of Mesolithic date on the edge. The first is Castle Rock, where a spread of flint flakes including flakes, knives, bores and scrapers, and some possible calcinated flint was found (Roeder and Graves 1905, 18). Elsewhere on the Edge, smaller flint scatters were located at Whitebarn Farm and Engine Vein with isolated examples to the east of Macclesfield Road, near the Old Alderley Quarry, at the Druid Stones circle, at Saddlebole, and near Stormy Point (Timberlake 2005, 8, 9). These examples have recently been re-examined and are thought to represent a small flint industry producing lithics probably used in the processing of furs and skins or in composite tools and weapons. It is suggested these tools were intended to supply the needs of a possible seasonal hunter-gatherer community of undetermined size (Swift 1991, 70; Timberlake 2005, 8-9).

All of the flint scatters were situated on large, flat areas of shallow-outcropping hard sandstone or conglomerate beds, the most prominent site being that of Castle Rock. These sites would have been carefully chosen and deliberately exploited by Mesolithic populations. They allowed views of the lowland areas, and consequently of game or people below, and facilitated the collection and storage of water. The outcrops would have provided shelter, and the sites would have been either treeless or relatively easy to clear, allowing the growth of consumable plant species. Finally, beds of Boulder Clay lying between the rock exposures would have provided material for the production of coarse stone tools (Timberlake 2005, 9).

2.4.3 **The Neolithic**

Evidence for the occupation or use of Alderley Edge from *c.*4000 BC is sparse. In the surrounding hinterland, temporary clearances of predominantly wooded areas for agriculture (pastoral and cereal cultivation) occur relatively late in the period and are undertaken on a small scale (Brayshay 1999; Timberlake 2005, 9). At least 28 Neolithic stone axes, some of which were polished, have been found within a few miles of the Edge. In addition, a single example of an imported polished jadeite axe was discovered at Lyme Handley near Prestbury. Finds from the Alderley Edge itself include stone axes of Lake District origin (Group VI) and hammer stones (Timberlake 2005, 9-10), and some Neolithic flints have also been found on the Edge (Prag 1994, 174), and a stone scraper was discovered in 1925 (Carlon 1979, 40). As there is very little distinction between Mesolithic and Early Neolithic lithics, it is possible that some of those classed as Mesolithic may be of later date (Cowell 2005, 29).

2.4.4 The Bronze Age

By *c.*1500 BC, phases of woodland clearance and regeneration appear to suggest the deliberate management of woodland in the areas surrounding Alderley Edge, as opposed to the piecemeal clearance seen during the Neolithic. A large number of burial mounds, including the scheduled barrow beneath the Armada Beacon, and the stone and metalwork examples from this area indicate its regional importance during the Early Bronze Age. There is a high incidence of Early Bronze Age barrows, burials and inurned cremations (Collared Urns) in the Alderley-Macclesfield area and these seem to coincide with the earliest period of copper mining activity at Alderley Edge, around 1900 BC. The Middle to Late Bronze Age around Alderley Edge is marked by a paucity of occupation-related remains from about 1500 BC onwards, possibly a reflection of the decline in arable agriculture caused by climate deterioration. Considerably fewer burial mounds were erected after *c.*1400 BC, although many were reused or added to until the beginning of the Late Bronze Age, *c.*1100 BC (Timberlake 2005, 15). However, Alderley Edge is currently devoid of confirmed or dated Bronze Age burial sites, pottery or flint finds (Timberlake 2005, 11-12), and although it is suspected that Bronze Age metallurgy may have been undertaken in the region, no conclusive evidence has yet come to light.

Alderley Edge, consisting primarily of sandstones, conglomerates and marls, also encompasses a unique selection of mineral deposits. It has attracted the prospecting and mining of many ores, in particular green malachite (copper), blue azurite (copper) and galena (lead) (Roeder 1902, 3-4). There are several Bronze Age mines or prospection pits on the Edge, opened initially for the extraction of copper ore. Roeder and Graves (1905, 22) noted the presence of rock-lined hearths set against the rock faces and pit sides to aid the extraction process, and small-scale excavation in 1997 confirmed their presence (Timberlake & King 2005, 42-4). Roeder and Graves also noted the presence of lumps of smelted copper at Engine Vein, but failed to pinpoint a location for this activity (1905, 23-4). However, it is possible they misidentified these remains (Timberlake & King 2005, 44-5).

The principal mines at Alderley Edge showing signs of probable Bronze Age prospection or extraction are Engine Vein, Dickens Wood (Pillar Mine and Doc Mine), Stormy Point, Brinlow/Brynlow, The Cobalt Mine and Windmill Wood[1] (The Hagg) as well as mines at the nearby Mottram St. Andrew. Most of these sites have been heavily disturbed by later activity. For example, the earliest phases of Engine Vein involved Bronze Age pitting[2] and opencast mining, followed by two phases of contemporary or later re-working. A shaft and tunnel were sunk during the Roman period, and two phases of seventeenth to nineteenth century mining are visible elsewhere along Engine Vein in the form of stemple holes, shafts and levels. The final phase of

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[1] So named because a windmill was once erected there for crushing ore (Roeder 1902, 30), see below.

[2] For example, in 1997 a small intact mining pit was excavated to the south of Engine Vein. The lowest contexts contained *in situ* deposits of crushed ore, wood, charcoal and hammer-stone fragments and a hearth, dated to the Early Bronze Age. It appeared to have initially been a prospection pit for malachite copper and was later used for discarding tools, as a fireplace, and for the deposition of mine spoil (Timberlake & King 2005, 33).

mining activity here included the widening of the opencast mine and the removal of pillars, probably undertaken between 1858 and 1879 (Carlon 1999, 99; Timberlake & King 2005, 36). It is probable that the mining of copper on the Edge had ceased by the end of the Early Bronze Age (Timberlake 2005, 16).

Early Bronze Age finds from the Edge associated with mining include a fragment of a broken axe-hammer discovered near Pillar Mine and several grooved stone hammers found buried in early mining spoil (Timberlake 2005, 12). Mid and Late Bronze Age finds comprise two palstaves (bronze axeheads), found in 1937 and 1991 near Common Carr Farm on the north side of the Edge, although they have no demonstrable connection to Bronze Age mining (Timberlake 2005, 15-16). One of the most notorious finds from the Edge was that of a Middle Bronze Age wooden shovel, discovered by a Victorian miner at Brynlow in 1875 and dated to 1888-1677 cal. BC (Prag 1994, 175; 2005, 4). Consequently, several stone hammers believed to have been found within the same context are probable evidence of considerable mining activity in the mines during the Bronze Age (Prag 1994, 175). Finally, a probable Late Bronze Age sword of Wilburton Type B (variant) commonly known as 'Merlin's Wand' was supposedly discovered on the Edge in 1871, although its exact provenance remains unknown (Timberlake 2005, 16).

In addition to the above features, a number of 'circles' – mounds or circular earthworks of unknown date, including one above Stormy Point, have been noted on Alderley Edge[3] (Roeder and Graves 2005, 26). There are also many trackways running across the Edge, some of which may date back several centuries or more. The oldest is thought to be the ancient ridge route, visible in several places along the crest of the ridge between Armstrong and Ridgeway farms, and possibly dating back to prehistoric times. Interestingly, the earth circles appear to be situated at high points along this route (Timberlake *et al.* 2005, 144-5). However, these features have yet to be firmly defined or dated to any period, and it has been suggested that some were 'follies' erected during the 1740s (Timberlake *et al.* 2005, 156).

Of final note here are the presence of at least nine wells on Alderley Edge, certainly still in use as places of offering in the early twentieth century (Roeder and Graves 2005, 26), and possibly for centuries, if not millennia, prior to this.

2.4.5 The Iron Age

From the mid first millennium BC onwards, occupation and land use in Cheshire appears to be fairly marginal and the decline is linked to climatic deterioration. Iron Age finds from the Edge are completely lacking, and nearby are limited to two rotary querns on Danes Moss and domestic pits found overlaying Early Bronze Age deposits at Oversley Farm (Timberlake 2005, 16-17). In addition, a possible 'log boat' was recovered form Baddily Mere and several bog bodies, including the Late Iron Age Lindow Man found 15km from the Edge, have been recovered from the Cheshire mosses (Timberlake 2005, 17).

2.4.6 The Romano-British Period

Although not on any main route, a Roman road reputedly passes immediately to the west of Alderley Edge, running between Stockport and Congleton along the current line of the A34

[3] There are also circles at Finlow Hill Wood, the Golden Stone, Church Quarry, Windmill Wood and the Seven Firs circle.

(Timberlake 2005, 17-18; Timberlake & Kidd 2005, 79). The Roman period appears to be the first time in which lead ore was mined from Alderley Edge.[4]

There is little sign on the Edge of any permanent Roman presence, but mine-workings from this period can be seen at Engine Vein in the form of Pot Shaft, a square-cut vertical shaft and the first to be found in Britain, and Pot Shaft Level, a horizontal tunnel running from it, both dating to the first century AD. This date, at a variance with later Roman finds from the surrounding hinterland, suggests small-scale prospection and mining on behalf of the military, although no remains of a Roman encampment or miners' habitation have yet been found (Timberlake & Kidd 2005, 79). At the base of the shaft, beneath a compacted working floor, were found three well preserved oak planks on the floor of the shaft. They have been interpreted as either a possible walkway above the waterlogged floor, or a means of surveying during the sinking of the shaft. The dating of the planks is more unusual, falling between the ranges of 360-280 BC or 250 BC –AD 15, meaning they are pre-Roman and therefore reused in this context (Timberlake & Kidd 2005, 88).

The deposition of an early fourth century AD coin hoard, of 564 bronze coins, in a coarseware pot in the top of Pot Shaft (long after the abandonment of the original mine-working) and four Roman coins reputed to have come from elsewhere on Alderley Edge show a wider date range, between the third and fourth centuries AD. This, alongside the discovery of a miniature fibula of Polden Hill type dating from *c.* AD 50-70, suggests a long period of Roman interest in the area (Timberlake 2005, 18; Timberlake & Kidd 2005, 89), although Pot Shaft itself was probably not in use for more than 20 or 30 years (Timberlake & Kidd 2005, 97).

2.4.7 The Medieval Period to the Twentieth Century

From the Medieval period onwards, the dual character of this geological region shaped the local economy. Hill farming of sheep provided the main agricultural activity on the Pennine uplands and the lush pasture lands of the Cheshire plains supported a dairy pastoral economy. The local Alderley region was therefore dominated by agricultural activity since the late Medieval period, most famously resulting in the production of 'Cheshire Cheese' (Casella & Croucher, in press). On the Edge itself, in 1719, the Armada Beacon was erected upon the highest point (650ft or 197m OD), the area at that time being open and treeless. It consisted of a small square room and, later, a pointed roof and stood there until 1931 when it was finally destroyed during a storm (Batty 2006). It appears to have stood upon the spot of earlier beacon fires lit during the Armada period of AD 1577-90 (Timberlake *et al.* 2005, 161), hence the name. The Edge remained open common land until it was enclosed by the Stanleys of Alderley in 1775 and the Traffords of Chorley in 1780 (Timberlake *et al.* 2005, 148). The trees which now stand upon it were planted in the eighteenth century, between 1745 and 1755 (Timberlake 2005, 14), apart from the beech trees which were planted around 1640 (Carlon 1979, 14). The archaeological remains on the Edge during this period comprise mainly of the remains of mining and quarrying of metals and stone, the majority of workings dating to the eighteenth and nineteenth centuries.

Other features of the Edge include the remains of marl (lime-rich clay) pits, spoil from the mining, associated features such as buildings and trackways, smelting sites, boundaries, enclosures and field systems, circular earthworks, 'ridge and furrow', rock shelters, ruined buildings and follies and the aforementioned wells. Little direct evidence for Medieval industry is found on the Edge, with the exception of remains of possible lead smelting, discovered at Saddle

[4] Although see the discussion in Timberlake & Kidd (2005, 95), where they suggest that other copper sulphide minerals or silver may have been their main object of interest.

Bole[5] (Roeder and Graves 2005, 27), which is now unidentifiable, and possible copper smelting beneath the Devil's Grave at Stormy Point (Timberlake *et al.* 2005, 139).

2.4.8 *Metal Mining and Stone Quarrying*

Following the period of Roman mining activity there are no records or indication of significant activity on the Edge until the Medieval period, when the area began to be exploited for stone rather than ore. Whilst Alderley Edge appears to have been an important source of stone from then onwards, little record of this industry survives prior to AD 1775 (Timberlake *et al.* 2005, 127). One example that does remain are the (short lived) workings of Mr. Abbadine, who extracted lead and copper ores from Dickens Wood and probably Engine Vein and Stormy Point in around AD 1708 (Carlon 1979, 46-7, 53). The Alderley Edge Mining Company was responsible for removing some 168,269 tons of copper ore from the Edge between 1857 and 1878, when it went into liquidation (Carlon 1979, 52, 71-2).

The remains of metal mining are often difficult to see, but include remnants of shafts, pits, opencast workings and levels and prospection features. The majority of rock removed in metal mining was done so between 1857 and 1878 and most traces of the mining are only discernable as earth-filled depressions, mounds and ridges or by a lack of vegetation.[6] The vestiges of metal mining can still be seen at Engine Vein, Canyon Mine, Pillar Mine and Stormy Point. The beginning of the eighteenth century saw some of the first re-workings of the prehistoric excavations and the sinking of additional shafts, as well as the opening of new mines. For example, at Engine Vein the Hough Level was constructed (Timberlake & King 2005, 39) and the mine was utilised periodically until 1919, although it was not sealed until 1981 (Dibben 2007). As Batty states,

> '[T]hroughout the 18th century and the first half of the 19th, the mines at Engine Vein, Stormy Point, Saddlebole and Brynlow were worked intermittently by various companies with James Ashton's company discovering cobalt around 1810. The most extensive period of mining occurred between 1857-78 when West Mine and Wood Mine were worked for copper and lead. These mines were worked on a small scale during the early part of the 20th century until the last episode of mining ceased in 1919' (Batty 2006).

Wood Mine was a new site opened for the extraction of copper and lead (and possibly cobalt), and was eventually sealed in 1964. The West Mine, in the area known as Sandhills, is the biggest mine on Alderley Edge, the main workings being carried out at the same time as those at Wood Mine (1857-1878) but is probable that this area was mined during the Bronze Age as possible evidence of fire setting was found whilst excavating the opencast during 1858. Following a life under various owners, it was finally abandoned in 1923 and sealed in the early 1960s (Timberlake & King 2005, 33; Dibben 2007). Both Wood Mine and West Mine were reopened with strictly controlled access by the Derbyshire Caving Club in 1970 (Carlon 1979, 90).

In 1991 the remains of eighteenth century shafts and shallow trench mining were discovered along the Brynlow and Beacon Lodge veins (Timberlake & King 2005, 36) and at Windmill Wood (The Hagg), the mine was reworked in the eighteenth and nineteenth centuries for lead and copper, as was the lower level of Pillar Mine (Roeder 1902, 6-7). Cobalt Mine (now located underneath The Wizard restaurant, formerly a public house, on Macclesfield Road) is believed to

[5] The word 'bole' refers to a pile of stones built around a fire to aid the process of lead smelting, usually on a west facing hillside (Carlon 1979, 45).
[6] This is due to a high level of metal contamination preventing vegetation growth, as seen at Engine Vein and Windmill Wood (Timberlake *et al.* 2005, 135).

have its origins in the early nineteenth century, probably between AD 1804 and 1810. It appears to have been forgotten and disused by the 1850s, when The Wizard was constructed (Dibben 2007).

The rounded shaft of the Devil's Grave mine at Stormy Point was probably connected to the cobalt mining of the nineteenth century, although it is likely that this and other small mines in the area were mined for copper before this date. Doc Mine was also worked prior to the nineteenth century, and extended in the late nineteenth century across Stormy Point (Dibben 2007). The sandstone outcrops at Stormy Point were also ideal for block or slot quarrying (small scale excavation and quarrying of outcrops – usually for local building material), probably dating to the Post-Medieval, if not the Medieval period, based on the typology of the pick marks. This type of working is likely to have ceased by the mid eighteenth century (Timberlake *et al.* 2005, 130).

The larger stone quarries of this period include Old Alderley Quarry, Church Quarry, Bradford Lane Quarry, Hayman's Farm Quarry and Alderley Red Moulding Sand Quarry. Old Alderley Quarry seems to have been hand-worked from at least AD 1775: beam slots and holes are visible in the walls and spoil tips are seen around the periphery At Church Quarry however, blasting was used to extract the rock in the late eighteenth or early nineteenth century (Timberlake *et al.* 2005, 131-2).

By the mid nineteenth century the easily extractable and good quality sandstone supply from the Edge had been exhausted and work focused elsewhere (Timberlake *et al.* 2005, 129). The last phase of quarrying to have taken place on the Edge was also the largest and occurred during the 1940s to 1950s at the Alderley Red Moulding Sand Quarry opposite Dickens Farm. The specialist sand extracted here was used in the casting of large objects, such as bells (Timberlake *et al.* 2005, 129-30).

2.4.9 *Other Features of the Edge*

Marl pits, depressions left where the marl was removed for agricultural purposes, date back to at least 1598, although the practice may date back to the thirteenth century, and was revived in the eighteenth and nineteenth centuries when the majority of marling took place (Timberlake *et al.* 2005, 133).

Mining spoil is a common feature of Alderley Edge, appearing in the form of small discrete piles of hand-cobbled copper ore, for example at Stormy Point, or large areas of spoil tip, seen at Windmill Hill and West Mine. At the latter sites, large areas of crushed and leached sand waste left over from the acid extraction and precipitation process of copper carbonate ores gave rise to the local name of 'Sandhills' (see above), although most of this material was removed for sandbags, road and runway building during the late 1930s and early 1960s (Timberlake *et al.* 2005, 139).

An eighteenth and early nineteenth century (unsuccessful) lead smelting house was known to have existed at Windmill Wood, possibly in the area of the former 'Hagg Lane'. Other examples of smelting from the Edge include lumps of glassy slag from Scout Hole, a Medieval/early Post Medieval iron bloomery site near Bradford Cottage, and Abbadine's 1708 lead and copper smelting house which once stood below the present Edge House Farm, some 46m from Engine Vein (Carlon 1979, 47; Timberlake *et al.* 2005, 140).

There are several other features associated with mining that remain on Alderley Edge. For example, building foundations and the remains of tramlines associated with the 1858-78 workings can be seen at West Mine and Wood Mine and building foundations are visible at Engine Vein (described above) and Cow Lane. The location (but no visible remains) of the ore-crushing windmill at Windmill Wood may still be recognisable (Timberlake *et al.* 2005, 140-3). Also of note are the large estate farms found on or around the Edge, dating back to at least the sixteenth century (Timberlake *et al.* 2005, 164).

The remains of five hollow ways or saddle roads can still be seen on the Edge, some of which may be Medieval in date and one of which, leading to Clockhouse Farm, was in use until at least the 1930s (Timberlake *et al.* 2005, 146). It is suggested that one such route, leading from the Hough to the Saddlebole ridge and up to Stormy Point may have been constructed for the haulage or lowering of sandstone blocks following their extraction from Stormy Point (Timberlake *et al.* 2005, 147). Also running from Stormy Point is the old Coach Road, probably postdating AD 1775, leading to Macclesfield Road (Timberlake *et al.* 2005, 148).

By the eighteenth century there became a need to divide up and define ownership of the land in order to avoid disputes between major landowners. As a result, boundary banks (sometimes incorporating large natural or quarried blocks known as merestones), ditches, walls, field boundaries, hedges and enclosures can be seen all over Alderley Edge. Although some date back to the Medieval period, most date from the eighteenth century. As a general rule, those which follow the line of topographical features are older in date, but some straight stretches of bank incorporated into the township and parish boundaries may be older (see Timberlake *et al.* 2005, 148-156).

Four areas of pre-nineteenth century ridge and furrow cultivation have been identified to the west of Macclesfield Road, the largest being 1-1.5 hectares in size. Other areas are identified against the north side of Artists Lane, to the west of Armstrong Farm and in Castle Stone Field (Timberlake *et al.* 2005, 160).

Finally, a ring of nine *in situ* boulders and two or three displaced stones forms the stone circle known as the Druid Stones or Druid’s Circle close to a main footpath on the Edge. The stones have evidently been quarried and placed here during the early nineteenth century, oral tradition stating that the first Lord Stanley built the circle for his wife (Timberlake *et al.* 2005, 162).

3. Methodology

3.1 The topographic survey (**Figs 4 & 5, Plate 1**) was undertaken in order to produce a detailed contour map of the eroding deposits. This was carried out using a Total Station Theodolite and datalogger and was ties into the National Grid utilizing the permanent stations marked with nails which were set out using survey grade GPS during the Alderley Edge Landscape Survey Project in 1996. The data was processed using appropriate survey and CAD software.

The XRF survey was carried out by the Waste Energy Research Group, University of Brighton (see **Appendix 1 & Fig 7**). The was undertaken to produce a geochemical of the Stormy Point deposits showing areas of high copper, lead, iron, arsenic and silver content and the relationship between the elements.

The geophysical survey was carried out using a fluxgate gradiometer in order to ascertain whether any areas of high magnetism could be located, possibly indicating smelters or furnaces (**Fig 6**). Conditions on site were unfavourable to magnetometry and so the survey comprised a single 30m by 20m grid set out using tapes and located in using a Total Station Theodolite.

3.2 Ten test pits were excavated by hand, located as shown on **Figs 6 & 7**.

Where appropriate test pits were recorded by hand drawn plans and sections. All plans were drawn at a scale of 1:20 or 1:50 with enumerated contexts and sections drawn at a scale of 1:10 or 1:20 with enumerated contexts. All plans and sections were related to the Ordnance Datum. Photography of all phases, features and structures was carried out in digital format. Where appropriate bulk environmental samples were taken for analysis but Archaeological Services University of Durham.

Test pit locations were surveyed using a Total Station Theodolite and datalogger, which was subsequently downloaded to a PC and processed using a CAD system.

All safety requests and requirements as identified by the client were upheld. UMAU carried out a Risk Assessment in accordance with UMAU, University of Manchester, HSE and SCAUM Health and Safety guidelines.

The work was monitored by the Jamie Lund, Archaeologist, National Trust.

3.3 **Key to Plans and Sections**

( ) = fill/layer/structure contexts
[ ] = cut contexts
All spot heights are in metres Above Ordnance Datum

4. Results

4.1 In this report all fills and layers are in rounded brackets (***) and features/cuts are in square brackets [***]. Features will be named and denoted by their principal cut number (see Appendix 1 for a summary list of the contexts). All AMS dates are given in calibrated BC or AD at 95.4% confidence level.

4.2 Geophysical Survey

The magnetometer survey showed only one anomaly, a single large spike in the vicinity of test pits 6, 7 and 10, which may represent either an in situ burnt deposit such as a furnace or bonfire, the presence of iron, or it may be the location of a large bonfire known from the 1970's. Test pits were placed around this anomaly on site but not over the exact location as the surface material in this area contained a large amount of burning from the bonfire and a number of iron nails. After excavation it is now felt that the anomaly is a result of the bonfire and the magnetometer did not, due to the conditions on site, pick up areas of archaeological activity uncovered during the test pitting.

4.3 XRF Survey

The red and green marls are mostly very similar with some red marls higher in iron, copper or barium than others. The sandstones differ greatly with green sandstones similar to the marls and yellow and beige sandstones having lower iron, nickel, copper, zinc, silver, rubidium and strontium. All sandstones have similar levels of lead and barium.

The ore and minespoil covering much of Stormy Point is not derived from the bedrocks in the immediate vicinity. It has much higher lead, copper, barium, manganese, iron, zinc, silver, molybdenum and mercury than the bedrocks and also contains antimony. There is a much higher level of lead than copper within the minespoil/ore material and silver is strongly associated with the lead. It also contains a very high level of arsenic, particularly when associated with lead. The copper and lead are derived from different materials. Although there is copper in the Stormy Point bedrocks it is chemically different from that within the ore/minespoil.

The soils underlying the ore/minespoil, where visible, are low in iron. The large spike in iron in the vicinity of test pit 6 is due to the presence of the iron slag. This is not in the same place as the geophysical anomaly caused by the 1970's bonfire and may represent ironworking activity, although it is unclear as to whether this is in situ or has been imported.

4.4 AMS Dating

The test pitting produced four samples which could be dated using Alternating Mass Spectroscopy (AMS). The first two dates came from pit fills within test pit 4. The first was within fill (168), thought to be the backfilling of a rock cut prospection pit [167] and produced a date range of 3320 +/- 35 BP, calibrated with 95.4% probability to 1690-1510 BC, within the Earliest Bronze Age. The second date was from the basal silting fill of recut [165] of the prospection [167]. This yielded a date of 9160+/- 35 BP, calibrated with a 95.4% probability to 8470-8280 BC. This date falls within the Early Mesolithic period, however, it is within a later context and most likely represents contamination of a Bronze or Iron Age deposit with material left over from earlier natural forest fires, a common occurrence with prehistoric dating (pers comm. Gordon Cook, SUERC). The remaining two dates both came from test pit 5. Both were from layers which were deposited colluvially between periodical phases of dumping of processed ore material. The lower layer (038) produced a date of 2220 +/- 35 BP, calibrated with a 95.4% probability to 390-200 BC, the Early to Mid Pre-Roman Iron Age. The second of these dates came from layer (032) and produced a date of 900 +/- 40 BP, calibrated with a 95.4% probability to 1030-1220 AD, within the Medieval period.

4.5 TP 1

Test Pit 1 measured 1m x 1m and was a maximum depth of 0.93m (**Figs 8 to 10, Plate 2**). It was overlain by a layer of colluvial silting; up to 0.41m deep, of mid to dark brown semi-compact silty sand with abundant sub-angular sandstone and sub-rounded pebbles (001). It included layers (002), (012), (010) and (011) and was the same as (012). Layer (002) was a mottled light to mid brown lens of similar material to (001), measured 0.2m by 0.3m+, and was less than 0.41m deep. Layer (010), of mid brown mixed and semi-compact sand with abundant sub-angular sandstone fragments, was situated within the top of (012) (the same as (001)) and measured 0.2m by 0.17m and was 0.08m deep. It contained lens (011), which was a rich mid brown fine sand with no inclusions measuring 0.1m by 0.09m and 0.02m deep.

Layer (001) overlay several dumps of material of possible mine spoil - (007), (006), (014) and (015). Layer (007) was immediately below (001) and comprised light yellowish brown gritty sand with very abundant sub-angular sandstone fragments and was up to 0.15m in depth. It sloped from east to west downwards towards the rock outcrops of the Edge. It appears to be banked up upcast from mining following the clays beneath the outcrop and runs in the same direction as Devil's Grave. Natural red clay is visible to the north of the test pit, where it disappears. This layer is the same as (009) and includes lens (008), which is a mid to dark brown gritty sand.

Layer (006), beneath layer (007), was also mining upcast and comprised dark brown soft sand with moderate inclusions of sub-angular sandstone and sub-rounded pebbles and was a maximum depth of 0.38m. It included lens (003), a soft mid greenish brown gritty sand, lens (004) of dark brown soft sand and lens (005), a light to mid yellowy brown gritty sand. Layers (006), (003), (004) and (005) all contained small pieces of unprocessed galena.

Beneath layer (006) was layer (014) which was dark brown gritty firm sand with abundant sub-angular sandstone fragments and part of an upcast mound. This layer was covered the test pit and was between 0.03m and 0.10m in depth. It lay above (015) which was light yellowy brown gritty sand with very abundant sub-angular sandstone fragments. It was 0.04-0.2m in depth, and was the bottom layer of the upcast mound. Beneath this was (013), the sandstone bedrock, the upper layer of which was very fragmented.

4.6 TP 2

Test Pit 2 measured 1m x 2m and was excavated to a maximum depth of 1.5m below the overhanging rock and *c*.0.5m below the current ground level (**Figs 11 to 14, Plate 3**). Each layer appears to have silted into the test pit from the south. The uppermost layer (051) was a maximum of 0.12m deep and comprised dark greyish brown loose fine compact sand. It was the fill of cut [055], visible as a thin band of black silty sand without a defined edge to the north end of the test pit. Beneath this was (052), a very loose patchy mid to dark brown silty sand layer containing clay pipe fragments dated 1660-80 (**Plates 30 & 31**) at a deeper level of the fill. It was a maximum of 0.4m thick. Layer (052) contained (059/060) and possibly (061). Layer (059/060) contained a high percentage of large angular sandstone fragments ranging from 0.2m to 0.4m in size, some of which were very friable. Beneath (052) was layer (056), an uneven layer of yellowish brown crushed sandstone with a maximum thickness of 0.27m. Layers (057) and (058) lay underneath (052) and were intermixed. Layer (057) was brownish yellow silty sand with abundant small pebbles and crushed sandstone fragments and (058) was a slightly lighter yellow sand with crushed sandstone fragments and discoloured blackish patches. The maximum depth of this combined layer was *c*.0.35m. To the northwest end of the test pit was layer (061), which may have been the same as (052). This was mid greyish brown compact sand with a high percentage of fragmented sandstone. It was *c*.0.2m deep and lay above layer (057/058) and an area of large sandstone fragments, some of which were 'burnt' reddish black in colour and very soft. The edges of (061) were not clearly discernable.

Below (057/058) was layer (053), only visible in the northeast and northwest facing sections to a depth of 0.09m. This consisted of mid brownish yellow silty sand and crushed sandstone, which formed small pockets within the layer. The lowest layer at the southeast end of the test pit was (063), a mid yellow crushed sandstone and sand layer lying above the bedrock up to 0.11m deep. In the shallow northwest facing section only, a steep sided cut [062] could be seen, cutting through (053) and (063) and filled with (054), which comprised dark mixed greyish black compact silty sand containing small pebbles and angular sandstone fragments.

4.7 TP 3

Test Pit 3 measured 1m by 2m and was excavated to a maximum depth of 0.58m at the northwest end (**Figs 15 to 18, Plates 4 & 5**). The uppermost layer covering the whole test pit was (101), a very thin colluvial wash of mid yellowish brown friable sand with frequent small pebbles, hardly visible after the initial clean. This layer lay above layer

(102) which was an uneven layer of mid greyish brown silty sand deposit with a few small medium-sized rounded pebbles and fragmented angular sandstone fragments a maximum depth of 0.21m. The base of this layer was above (113), a small lens of greyish brown sand with occasional medium sized stone inclusions, *c*.0.04m deep. It was discernable as a slightly darker material between (102) above and (103) below and was not visible during excavation. Layer (103) lay below (102) and was *c*.0.17m deep. It consisted of mottled light greyish yellow friable sand with small to large angular sandstone fragments 0.02m to 0.4m in size and frequent small sub-rounded pebbles. Some darker patches of manganese staining were visible within it and lenses of abundant sub-rounded pebbles and one large piece of galena were found towards the base of the layer.

Beneath (103) was (104) which was between 0.05m and 0.15m thick. It was a mid reddish brown friable sandy layer with several small rounded pebbles *c*.0.01 to 0.02m in size. It was very similar to (013), but slightly redder in colour and appeared to have been a colluvial wash, following the slope of the bedrock. A lens of mid brownish grey sand (009), containing a few medium stones and patches of manganese staining, lay below this. This in turn lay above (110), a light yellowish brown sandy layer very similar to (104), containing frequent small pebbles with a maximum depth of 0.2m and also deposited through colluvial action.

Both (104) and (110) were deposited after layers (108), (105), (111) and (112), which were seen to the south corner of the test pit. Layer (108) was immediately below (104) and comprised dark brownish grey firm silty sand with frequent small sub-rounded stones and sub-angular fragmented sandstone. It was a layer of manganese staining between 0.01m and 0.1m in depth. Lying below (108) was a very mixed layer (105) of mid to dark greyish brown friable sandy and marl, a maximum of 0.15m deep. It contained frequent small stones with patches of red sand and green marl throughout and a lens of mid brownish grey silty manganese staining (111), the same as (108). The lowest excavated layer was (112) which comprised mid reddish brown friable sand with a few small sub-rounded stones and sub-angular sandstone fragments. It lay directly above natural light greyish green compact marl (106) and mid brownish red compact clay (107), both of which in turn lay above the bedrock.

4.8 **TP 4**

Test Pit 4 measured 2.3m by 1.2m and was a excavated to a maximum depth of 1.34m below the uppermost (northeast) corner (**Figs 19 & 20, Plates 8 to 12**). The earliest phase was a pit [167] measuring *c*.2m in diameter and *c*.0.6m in depth, cut into the natural bedrock (150) and containing fills (168), (169), (170) and (171). The basal layer comprised of a 0.8m+ long layer some 0.02-0.17m deep of very light greyish brown fine sand mixed with abundant sub-angular sandstone fragments (171), possibly the result of the excavation and slight backfilling of the pit. After this a fire was lit within pit [167], represented by a layer of light leached grey charcoal-rich fine sand 0.8m+ long and 0.05m in depth (170). Following this the pit was left open for a short period of time resulting in the colluvial deposit of mid to dark grey leached fine sand to a depth of *c*.0.05m and measuring 0.86m+ in length (169). The pit was then deliberately backfilled with mid greyish brown fine silty sand with moderate small sub-angular and occasional medium sub-angular sandstone fragment inclusions (168) which yielded an AMS date of 1690-1510 calBC, firmly within the Earlier Bronze Age, from charcoal and small burnt twigs visible within the layer during excavation. This layer measured *c*.0.5m at it deepest point by *c*.2m in diameter. All of these layers contained tiny stone flakes identified during the excavation as possibly hammerspall.

Layer (168) was later recut at an unknown date on the north edge, the cut [165] being gradually sloping on the south side with a flat base and the north side following the line of the bedrock. The depth of the remaining cut was 0.29m, as the upper level had been truncated by bench quarrying [151], and it extended 1.15m out from the bedrock to the north and was 1.1m in width. It contained the fills (164), (166), (172), (173) and (174). The basal layer of cut [165] was leached out mid to dark greyish brown fine sand (174), measuring 0.01m in depth and 0.48m in length. Although not visible during excavation environmental analysis revealed that this layer contained some dateable burnt material which yielded an AMS date of 8470-8280 calBC. This very early date, however, probably represents contamination by remains of a much earlier forest fire that has remained in the area undisturbed for several thousand years, quite a common occurrence with prehistoric dating. Above this was a 0.25m long by 0.01m deep layer of light greyish brown leached out fine sand (173) which itself was covered by a 0.25m long (0.02m deep) layer of colluvially deposited mid to dark greyish brown leached out fine sand (172). These layers were covered by a layer of deliberate backfill of light to mid greyish brown leached out fine silty sand including moderate small, and occasional medium, sub-angular sandstone fragments and occasional small sub-rounded pebbles (166). This backfill measures 1.15m in length by 1.1m in width and was up to 0.23m deep. The uppermost remaining fill of cut [165] was light yellowy brown fine gritty crushed sandstone with moderate small sub-angular sandstone fragments measuring 0.84m in length and with a maximum depth of 0.06m (164). It is interesting to note that while all the fills of cut [167] contained possible hammerspall none of the fills of recut [165] contained any hammerspall whatsoever.

Cut [165] and layer (168) were truncated by bench quarrying during the Late Medieval or Post Medieval period. This resulted in a horizontal cut through the earlier layers of the pit some 2.3m in length, 1.1m in width and 1m deep [151] and can also be seen in the level of the surrounding surviving outcropping bedrock (150). Following this truncation and subsequent activity, the pit gradually filled up with layers (152) to (163). The lowest fill (163) was a thick colluvial wash of mid to dark greyish brown fine silty sand 0.03-0.16m deep and 2.3m in length. This was followed by a second colluvial wash of light yellowish brown fine sand *c*.0.05m deep and 2.3m long (162). Above this were a third wash, 0.03m deep and 2.3m long, of dark brown fine sand (161) and another above of light yellowish brown fine sand measuring 0.02m in depth by 2.3m in length (160). A final colluvial wash of mid reddish brown fine sand *c*.0.03m deep and 2.3m long (159) was covered by a thick layer of more recent material (158) dumped prior to 2001 (Dave Standon pers. comm.). This deposit was 2.3m long by 1.1m wide and 0.37m in depth and comprised mixed orangey brown gritty sand containing very abundant small to large sub-angular fragmented sandstone and ore. This layer also contained organic remains including heather, Yorkshire Fog grass, the remains of moss which was still green and a cigarette filter tip *c*.0.12m from the top of the deposit. This was clearly not the result of animal burrowing activity.

Above layer (158) was a colluvial deposit of very dark greyish brown fine sand measuring 1.4m in length and 0.06m in depth (157). Above this lay another colluvial wash 0.37m in length and 0.05m deep of mid to dark greyish brown fine sand (156). This layer lightened to a reddish brown at the top and bottom due to iron panning. The next phase of activity involved the dumping of a layer of light yellowy brown sand and fragmented sandstone (155). This layer measured 1.32m in length and 1.22m deep and possibly resulted from bench quarrying immediately above [151]. The final three layers above this were all colluvial deposits. The first was (154) a layer measuring 0.45m long and 0.06m deep of black gritty semi-compact sand. There followed a 0.22m long and 0.06m deep wash of light yellowy brown powdery sand with root disturbance (153). Finally, covering the whole area above and around the test pit, was a wash of mid brown fine gritty silty sand containing abundant sub-rounded pebbles (152).

4.9 **TP 5**

Test Pit 5 measured 0.8m by 2.35m and was excavated to a maximum depth of 1.2m without reaching bedrock (**Figs 21 to 24, Plates 6 & 7**). It comprised layers of colluvially deposited sand alternating with deposits of crushed sandstone.

The lowest excavated layer comprised 0.37m of light yellowy brown fractured sandstone (043) which was the remains of the upper layer of bedrock (044). The bedrock was visible in the base of cut [040] sloping down westwards following the bedding plane of outcropped bedrock to the east. Above this several layers of colluvial wash and dumped deposits built up before being cut through to the north [040]. The first layer above (043) was a 0.35m+ band of colluvially deposited very dark reddish brown compact sandy clay up to 0.05m thick (039). This was covered with a layer of colluvially deposited red firm sand 0.1-0.26m thick (038) which yielded an AMS date of 390-200 cal BC, the Early to Mid Pre-Roman Iron Age. This lay below another colluvial deposit of red sandy clay which was fine and semi-compact and measured 0.01-0.04m in thickness (037). Overlying context (037) was a dumped layer of mine spoil comprising light yellow coarse and semi-compact sand with abundant crushed sandstone fragments to a depth of 0.02-0.03m (036). Above this, layer (035) comprised fine, semi-compact red sandy clay some 0.02-0.04m in depth, deposited colluvially between dumping episodes (034) and (036). Layer (034) was a 0.05-0.1m thick band of light yellow gritty semi-compact sand with abundant crushed sandstone fragments, probably resulting from mining activity. This lay below a layer of red compact colluvially deposited sandy clay 0.02-0.03m deep (033). Above this, in the southwest corner of the test pit, was a small patch of very dark reddish brown semi-compact clayey sand, measuring 0.57m+ in length, 0.37m+ in width and *c*.0.02m deep (032) which gave an AMS date of 1030-1220 calAD, the Medieval period.

To the north end of the test pit could be seen the remains of a cut [040]. This cut through (043) and probably cut through some of the layers above it. It had a rounded top break of slope with a *c*.45° angle on the south side, leading to a rounded bottom break of slope and a flat level. This in turn had a rounded top break of slope to a *c*.45° slope with a sharp top break of slope to a flat base. The east side of the cut followed the bedrock (044). The cut contained fills (041) and (042) and is of unknown function. The lowest fill (042) measured 0.8m+ by 0.93m+ with a depth of between 0.2m and 0.34m and comprised mixed red coarse loose sand with abundant sub-angular sandstone fragments. The upper fill (041) was of mixed, mottled light to mid yellowy brown coarse sand with abundant sub-angular sandstone fragments. Above these layers was a thick layer (038), as seen to the south of cut [020]. The south edge of cut [040] had been obliterated at some point in the past by cut [020]. This also cut through layers (033) to (036), (038), (039) and (043), obliterating their relationship to [040].

Above layer (038) in the north of the test pit, and (032)/(033) in the south half, was layer (019) which was 0.1-0.3m deep and comprised a dumped layer of light yellow gritty loose sand with very abundant sub-angular crushed sandstone fragments. Above this, covering the test pit, was a band of dark red fine silty sand from 0.02-0.16m in depth, showing banding resulting from water deposition (018). In the northern end, between layers (018) and (019) were two others, (045) and beneath it (046). Layer (045) measured 0.7m+ in length and was *c*.0.04m deep. It was of crushed yellow sandstone. Layer (046) measured 0.85m+ in length and was up to 0.1m deep and consisted of pink silty sand.

Cutting through the deposits from the level of (018) the cut for a steep-sided pit with a flat base [020], seen in the east facing section. The south side was at a *c*.45° angle at the top half with a sharp break of slope becoming nearly vertical. The north side was nearly vertical, being a very sharp break of bottom slope leading to a flat base. It was filled with layers (021) to (031). The pit was backfilled almost immediately, virtually reversing the deposits it cut through. The cut appeared too neat and straight to be of any antiquity and was probably post-medieval or modern in date. It extended *c*.0.04m into the test pit from the western edge and was 0.36-1m in width, 0.93m deep and orientated east/west. The lowest fill of [020] was mixed light yellow soft, loose sand some 0.19-0.23m deep with abundant sub-angular sandstone fragments (031). Above this was a layer of fine red sand, *c*.0.03m deep (030) which in turn lay below a 0.1m deep layer of mixed light to mid yellow coarse, loose sand containing abundant sub-angular sandstone fragments (029). Above (029) was a band of fine red sand some 0.01-0.05m deep (028). The next layer above this was (026), which comprised light yellow mottled coarse gritty sand with abundant sub-angular sandstone fragments, 0.08-0.16m deep. Within this was a lens of fine colluvial red sand less than 0.02m in depth (027). The fill above (026) was 0.06-0.14m of red loose sand with occasional sub-angular sandstone fragments and green marl (025). This lay beneath (023), which consisted of pink gritty, firm sand containing very abundant sub-angular sandstone fragments and very abundant green marl with a depth of 0.09-0.14m. Above this was (022) which comprised mixed light yellow gritty loose sand with very abundant sub-angular sandstone fragments to a depth of 0.1m. The upper fill, (021), comprised pink gritty sand with occasional sandstone fragments and green marl some 0.08m thick. The final fill (024) was seen in the southern upper edge of the pit and was the result of possible slumping of this edge during backfilling. It was red compact claggy sand 0.04m deep containing moderate flakes of green cupric marl.

The uppermost deposit in the test pit was a highly mineralised layer of yellowy green compact sand with abundant small sub-rounded pebbles (016). It was 0.02m in depth and was probably the remains of a dumped deposit of processed material. This material sat upon a colluvial deposit of pink fine silty sand containing abundant small sub-rounded pebbles covering [020] and (018), to a depth of 0.02-0.15m (017).

4.10 **TP 6**

Test Pit 6 measured 1m by 2m and was excavated to a depth of 0.59m at the northern end (**Figs 25 to 28, Plates 13 & 14**). The uppermost layer on the north side of the test pit was (117/118). This was a thin, dark blackish brown silty sand spread containing numerous small sub-rounded pebbles and sub-angular sandstone fragments with a few larger sandstone pieces. It also contained a high percentage of slag, coal and burnt material. The maximum depth of this layer was 0.08m and the slag material may have mixed and washed into context (116) below it on the south side of the test pit, and (119) on the north. Context (116) covered the whole test pit and comprised a colluvial deposit of mid yellow and greyish brown silty sand containing frequent large sub-angular sandstone fragments and small rounded pebbles. It was thicker at the west end of the test pit where it reached *c*.0.32m in depth.

Contexts (117/8) and (116) were separated on the north side of the test pit by (120), a layer of mixed reddish brown colluvial silty sand with frequent small stones, only visible in the section after excavation to a depth of 0.15m. Also above (120) and to the south of (117/118) were (119), (127) and (128). Layer (119) was a colluvial deposit of mid yellowish brown sand up to 0.1m thick with abundant small stones, multi-coloured pebbles and rare pieces of slag. Context (127) was of mid reddish brown silty sand containing frequent rounded pebbles and sub-angular sandstone fragments and was 0.08m deep. It lay above context (128), which was a maximum of 0.07m deep and comprised mid yellowish brown sand with several small and a few large sub-rounded stones.

Beneath (116) was a layer of very mixed loose red and green silty clay and marl (121). It contained occasional small rounded stones and is interpreted as a 0.10-0.18m deep mixed re-deposited spread of natural material. This layer was cut by an irregular V-shaped feature [048] which contained a semi compact red clay fill (122). It had been cut from just below layer (116) and also cut through layer (123). Below layer (121) was context (123), a fairly compact layer of mid red clay with small areas of green marl within it and was a maximum of 0.2m in depth. It was mixed with lenses of very light brownish yellow clay, a sign of possible disturbance or re-deposition. Below (123) were found small, very thin patches of dark greyish brown sandy silt (124), which were immediately above a very thin layer (*c*.0.01-0.02m) of light pinkish yellow sandy crushed bedrock (125). These layers were mirrored at the south-west side of the test pit by layers (049) and (050).

4.11 TP 7

Test Pit 7 measured 1m by 3m and the maximum depth excavated was 1m (**Figs 29 to 31, Plate 15 & 16**). The lowest excavated layers were fractured and broken sandstone bedrock (074) in the west of the test pit and greenish grey fractured sandstone (075) to the east. These were the remains of the collapsed roof of a mine. The lowest deposit was (073), in the east end of the test pit. This comprised greenish grey sandstone with large sandstone bedrock fragments and was the same as (075) and *c*.0.2m deep. Above (073) was a band of dark red loose silty clay with little or no inclusions (071), which had washed down the slope of the bedrock to the west to a depth of 0.05-0.12m. Still in the east end of the test pit, layer (072) lay above (071). It comprised a layer of mid yellow very loose fragmented crushed sandstone and sand with inclusions ranging in size from *c*.0.1m to 0.3m in size and was a maximum of 0.35m deep. Above this layer and running to approximately the centre of the test pit was a layer of pale brownish white fine sandstone between 0.05 and 0.22m deep, with fragments ranging from 0.3m to 0.4m in size (065). Above this, the uppermost layer (064) was 0.02-0.15m deep, and comprised discoloured blackish brown loose silty sand with small pebbles and crushed sandstone fragments and larger sub-rounded sandstone pieces. The edge was ill-defined.

In the central portion of the test pit, above (074) and (075) and below (072) and (068) was a very friable mix of green marl and red clay there being a higher percentage of red clay (85%) and smaller pockets of green (070). This was interpreted as backfilled natural deposits ranging from 0.02 to 0.45m in depth. The upper eastern edge of (070) was covered with (068) which was a dark reddish compact sandy clay containing small sub-rounded pebbles and pieces of malachite. There were also traces of green friable marl within this layer. Layers (068) and (070) were truncated on the western edge by a shallow unclear cut [069], which was *c*.2.5m deep and contained a deposit (067) of mid reddish brown/black silty sand and small sub-rounded pebbles. This layer was very mixed and was comprised of sand, silt and clay. It contained ceramic pipe fragments, small pottery sherds and a lump of iron (possibly a nail) of eighteenth or nineteenth century date. It also contained floral debris, including twigs and matted leaf fibres, and roots were visible throughout. This may be a colluvial deposit washed into a natural gully formed by the bedrock. The lowest deposit in the western end of the test pit, below (067), was (076), which was the same as (070) but with a higher reddish clay content.

4.12 TP 8

Test Pit 8 was roughly 'triangular' in plan with a small square extension to the south for access (**Fig 32, Plates 17 to 19**). It was excavated between a right-angle in the natural bedrock, the longest section being the non-rock face at 1.5m. It was partially covered with a very thin colluvial wash of mixed sand and very small sub-angular stones (129). Otherwise, it consisted of one context (130) which was removed to a depth of 1m without reaching the bottom. It comprised a mid to dark greyish brown friable sandy loam with abundant small rounded stones, which had often been cut in half, and some larger sub-angular sandstone fragments. It contained several pieces of ore including galena and malachite and a few pieces of malachite were retrieved from the bottom of the excavated depth. The deposit is interpreted as a deliberate recent dump of modern material, possibly as a health and safety measure during the mid to late twentieth century. The context contained one small piece of 19th century clay pipe stem in the upper third, and a piece of Medieval pottery (**Plates 26 to 29**) at a depth of *c*.0.5m.

4.13 **TP 9**

Test Pit 9 measured 1m by 2m and was excavated to a maximum depth of 1m (**Figs 33 to 35, Plate 20**). The uppermost layer (182) comprised a 0.1m thick spread of mid reddish brown colluvial silty sand with abundant sub-rounded pebbles. Under this lay context (183), a thin layer of mid orangey brown coarse sand with some small sub-rounded pebbles. This layer lay above (184), which was a dark reddish brown layer of fine colluvial sand, up to 0.05m deep. Beneath (183) and (184) was layer (185) which was of red fine colluvial sand between 0.5m and 1.5m thick. At the base of (185) were a very thin lens of mid to dark brown fine colluvial sand (186) and another of light yellow fine colluvial sand (187), the latter being some 0.4m wide. Part of (185) overlay (175) to the east of the test pit, a 0.17m deep deposit of red clay intermixed with green marl, and (176) to the north side, which was a 0.19m deep deposit of gritty coarse light yellow sand. Context (185) also lay above layer (178) to the south of the test pit. This was a layer of mixed mid brown gritty sand with a maximum depth of 0.5m.

Immediately beneath layer (175) was a deposit of mixed coarse fractured sandstone and yellowy sand (181) with a maximum depth of 0.15m. This lay above (190) which comprised mid orangey brown coarse sand containing abundant sub-rounded pebbles and was up to 0.15m deep. Below this lay a layer of mid to dark greyish brown fine sandy colluvial silt (191). At the base of (191) was a thin lens, up to 0.04m in depth and 0.7m in width, of dark orangey brown fine sand with moderate small sub-rounded pebbles (192). This lay above (193), a layer of mid grey moist fine sandy silt, which was above the basal layer of mid to dark grey sandy silt with abundant sub-rounded pebbles (194).

4.14 **TP 10**

Test Pit 10 measured 1m by 2m and was excavated to a depth of 0.8m (**Figs 36 to 40, Plates 21 to 25**). The lowest layer in most of the test pit was (078)/(084), which was a patchy deposit of mid orangey brown loose sand with pockets of red silty clay and orange sand, similar to (089). This was cut by [083], a shallow sided cut with moderately sloping sides and a rounded base. The basal fill of [083] was (089), a 0.16m deep very mixed loose deposit of grey, red and yellow sand, similar to (078), with greyish brown, yellow and red lenses. Above this layer (088) comprised a very mixed deposit of reddish orange sand with greyish silty clay lenses. These colluvial washes had no distinct boundary between them and formed a general layer 0.22m deep. Above this, to the west of the test pit, was a thin band *c*.0.05m thick of orangey yellow sand (087), and a deeper layer of mid orangey brown loose sand to the south (078). The latter contained pockets of red silty clay and orange sand and was very similar to (089). Above these was a band of very mixed brownish red clayey sand (085) with sandstone, greenish marl and crushed sandstone inclusions, only visible in the west end of the test pit. Above (085) lay another band of material the same as (078). A possible pit [082] was cut into this layer. It had a gradual break of slope and a diffuse boundary with (078). It was a maximum of 0.38m deep with an excavated diameter of 0.5m. The basal fill was 0.36m deep (086), comprising brownish yellow sand with frequent angular sandstone and galena inclusions up to 0.15m in diameter and pockets of reddish sandy clay. Above this was a thin layer, 0.02m deep, of mid brownish yellow loose sand containing small pieces of malachite and azurite (077). In the south and east facing sections the upper fill, covering the test pit, was reddish firm clay with black patches of silty clay and inclusions of sub-angular fragmented sandstone (081). These deposits were separated from that in the eastern end of the test pit by a layer of crushed sandstone. This single layer, (080) was of mid yellowish very loose sand with *c*.0.15m pieces of sub-angular fragmented sandstone, galena, beavorite, malachite and azurite with some darker patches of possibly rotting floral material.

4.15 Environmental Analysis

The environmental samples contained very little material. Pine was present within layer (174) in the recut of the Bronze Age prospection pit in test pit 4. Alder or Hazel was present within Medieval layer (032) in test pit 5.

4.16 Slag Analysis

The slag observed and collected in the vicinity of test pit 6 was eroding out of the ground surface rather than having been washed into it. It was unclear whether this was in situ or not but it is unlikely to have traveled very far and is likely to be from the immediate area. This was examined and found to be iron slag of a type associated with smithing rather than smelting. The form of it was pre-industrial and its high iron content and the presence of coal in some of the pieces suggests a Roman or Medieval date. Some of the pieces resembled parts of a smithing hearth base and it was associated with hammerscale found with it in all contexts.

5. Discussion

5.1 TP 1

Layers (006), (007), (014) and (015) appear to be the remains of upcast from excavations between the bedding planes of the outcropping rock against which the test pit lies. This may indicate the removal of the clays from between the bedding planes and suggests a further early mine, similar to Devil's Grave but in a plane below it, exploiting the clays for nodules of malachite and azurite.

5.2 TP 2

The remains within this test pit appeared to be that of a small stone quarry which had been partially backfilled with unwanted stone fragments after it went out of use and had then silted up gradually over time. The upper silting layers had been partially eroded downhill to the north-east. The exact date of this and a series of other small quarries along the outcrop is not known but clay pipes found in one of the upper silting layers can be dated to 1660-80, suggesting that the initial backfilling with stone was carried out in or before the mid 17^{th} century.

5.3 TP 3

These remains probably represent a series of colluvial deposits washed over the green and red marls (106) and (107) which overlie the bedrock. These follow the bedding plane downwards to the south-west, probably running under the of outcropping bedrock at the north-west side of Stormy Point.

5.4 TP 4

The pit [167] had been cut along the fault, probably located by following the seams of barite visible on the surface. This was most probably the remains of a Bronze Age prospection pit which did not reach the copper bearing clays below and was abandoned. The partial backfilling and lighting of a fire within it is consistent with Roeder's observations of Bronze Age pits at Engine Vein. The finely crushed material and the fire lighting may indicate processing of material from other more productive pits and excavations in the area.

Although the date and function of recut [165] remains unclear it is likely that is also a prehistoric feature, probably of Bronze Age or Iron Age date, although the lack of hammerspall within the fills suggests that it had nothing to do with prospection or ore processing.

The upper colluvial layers lie above the relatively recent context (158) demonstrating that these layers can be deposited over a very quickly over a very short period of time.

5.5 **TP 5**

The banded series of layers within test pit 5 suggests periods of dumping of crushed ore material, probably resulting from intermittent periods of mining and processing, interspersed with periods of inactivity where layers of colluvial material are deposited over them creating the banding observed within the test pit. The date range suggest that this activity was happening sporadically over a long period of time, from at least the Iron Age through to the Medieval period.

The fills of pit [040] were sealed by layer (038), an Iron Age context, making the cut prehistoric, and possibly associated with mineral prospection or processing.

Pit [020] appears to be the very edge of a cut feature that had just been clipped by the test pit and was not visible in plan. This had been cut from directly below the colluvial wash covering the area and its form suggests it is of a recent date.

The green cupric material originally seen eroding of the surface material lay within the relatively recent colluvial wash and was a very thin deposit. This indicates that mineral rich material eroding out of the ground surface is not necessarily an indicator of archaeologically significant material.

5.6 **TP 6**

Cut [046] represents a shallow scoop or bowl cut into the bedrock. This contained a thin band of sandstone (125) at the base with inwashed sandy layers above it. These layers are also mirrored to the south-west ((049) & (050)), possibly the same layers eroded out in the middle. The feature could be associated with ore processing, however, no evidence of burning was uncovered and so may have been used for a process that did not involve a fire or embers.

Feature [046] is overlain by a series of colluvially deposited layers. At the north-east end of the test pit, visible only in section, layers (121) and (123) were cut by an irregular V-shaped feature [048] which was filled by red clay (122). The function of this feature is unknown but the stratigraphy suggests that it was not associated with cut [046], being of a later phase.

This test pit lay within the area picked up on by the XRF survey as being rich in iron and the upper colluvial layers ((117), (118) and (119)) contained a large amount of pre-industrial iron smithing slag and hammerscale. Layer (118) also contained iron slag that resembled parts of a vitrified smithing hearth base. Although this material is not associated with feature [046] they can only have come from close by suggesting iron working within the immediate vicinity.

5.7 **TP 7**

This was felt to represent inwashed sands, silts and clays overlying shattered bedrock resulting from the collapse of the ceiling of an early mine along a plane below that of Devil's Grave. This possible lower working is also suggested by the evidence within test pits 1 and 9 and suggests that the rock outcrop along the southern side of Stormy Point originally extended further to the north-east.

5.8 **TP 8**

The material filling this area was not bottomed at c 1m deep and is very different from any other material observed during the evaluation. The fine loose garden soil is not derived from Stormy Point and has been imported from elsewhere. However, it is unlikely that it has been brought very far. The presence of the Medieval pottery, although not in its original context, is important and it has long been suggested that there is Medieval activity at Saddlebole, very close to Stormy Point and a likely source of this infilling material.

The rock face at the south-west edge of the excavation was very smooth and along the fault line, whilst the northern rock face had been cut away along the fault running north-west/south-east. This very strongly resembled a cutting within Engine Vein mine with one side cut and the other the smooth face of the fault. It may be that this is a mine working or entrance that has been filled in with soil (130) for safety. The bedding plane of the bedrock to the east was observed dipping down towards this outcrop within test pit 3 suggesting that clay existed below the outcrop in a similar way to those at the south and south-west.

The green cupric material observed eroding out of the upper levels of this area was within the imported material and not indicative of a processing site. Similarly the rough line of stones observed on the surface were only a single course deep at the top of the deposit and had been laid within the imported material.

5.9 **TP 9**

This test pit, like test pit 7, revealed evidence of a series of dumps and silting layers above the fractured and tilted collapsed ceiling of an early working into the clays between the outcropping bedrock. Here the visible rock is a large block that had flipped over during the collapse with the conglomerate below the sandstone rather than above it as seen in the outcropping rock to the immediate south.

5.10 **TP 10**

The main structural element to the feature within this test pit was (078)/(084) which was built up from clay and large lumps of galena and sandstone. This structure along with cut [083] appeared to be a large sub-circular bowl, the edge of which was observed within the test pit. The north-eastern edge (078)/(084) followed the line of a band of sandstone, galena and other ores forming a possible revetment along the north-east edge of the mound containing the feature. This suggests a possible diameter of 3-3.5m. The clays and rocks within the structure all appeared to have been discoloured by heating or chemical processes. No charcoal was found within the structure, however, only the edge of this feature was within the test pit and the base at the centre could be much deeper down.

The recut [082] may be a re-use of the structure and its fill (086) was also discoloured by heat or chemical processes but also contained, at this point, no charcoal.

If the evidence from test pits 1, 7 and 9 does represent a collapsed ceiling from a below ground working and the southern outcropping rock did extend further out then this structure would be situated just below the foot of projected line of the outcrop.

5.11 Geophysical Survey

It is clear from the evaluation that the site conditions are unfavourable for geophysical survey, the underlying geology masking any results that may otherwise have been picked up. The only anomaly picked up during the survey was probably that caused by a large bonfire during the 1970's. No anomalies were picked up in areas which later showed signs of activity during the test pitting.

6. Conclusion

6.1 The Bronze Age prospection pit is similar to those excavated at Engine Vein and is also possibly associated with the prehistoric cut found within test pit 5, possibly also a prospection pit. If these pits are being situated over the faults by following seams of barite visible on the surface then it is likely that there will be more across the Edge and the barite could be used to predict the locations. The function of the recut of the prospection pit is unknown.

6.2 The evidence of test pits 1, 3, 7, 8 and 9 suggest that further early workings of the metal rich clays within the faults exist below the Devil's Grave working and also below the outcrop to the north-west, and that the ceiling of working below Devil's Grave had collapsed in antiquity placing the outcrop originally further to the north along a line with the north-west edge of the fenced off mound to the north. The collapse of this ceiling does not, however, write this side of the site off for archaeologically significant remains as test pit 6 contained features on the top of the collapsed ceiling and within the deposits above it.

6.3 It is unclear as to the precise date and function of the structure within test pit 10 but it contained evidence of either heating or chemical processes. Although no charcoal was found it may be lower within the feature or it may have been completely raked out at this point. Also it is possible that it was used for a process which did not involve heating. The structure is situated at a spot that would have originally been at the foot of the projected line of the rock outcrop prior to the collapse of the ceiling of the early working. The front edge of the structure was built from rocks and lumps of unprocessed ore including galena. As this galena contains valuable lead it is unlikely that it would not have processed by miners who knew its value, possibly indicating that the structure is of a Bronze Age or earlier Iron Age date. Similarly the date and function of the shallow bowl found within test pit 6 are unknown. This also contained no charcoal but had thin deposits of crushed sandstone and is likely to have been used for some kind of early ore processing.

6.4 The series of dumps interspersed with colluvial deposits observed in test pit 5 indicate that the site was used for mining and processing intermittently with people exploiting the area as and when it was needed and with periods of inactivity between. This appears to have carried on for a very long period of time, from the earlier Bronze Age through to the Medieval period and later. The area may have gained a reputation for metal processing with originally locally derived ores being processed and later material being brought in from elsewhere. The XRF analysis shows that the crushed spoil material on the surface of the site was not derived from the bedrock at Stormy Point and has therefore been brought in from elsewhere, possibly for processing on site. The discovery of iron smithing slag, pieces of hearth base and hammerscale was unexpected. Although probably not in situ the material is unlikely to have come from very far away and so it can be assumed that a Romano-British or Medieval smithing hearth existed within the local area. Roeder noted evidence of Medieval lead smelting at Saddlebole, next to Stormy Point, and it could be that the iron smithing was associated with this. Saddlebole is also the nearest source of the type of soil found filling in the working in test pit 8, which contained a sherd of Medieval pottery. It may be that by the Romano-British and Medieval periods the metal processing reputation of the site was so well established that smithing was occasionally occurring in the area using iron brought in from elsewhere. It is also possible that as well as processing ores for metal people were attracted to Stormy Point in order to exploit the bright red, green and yellow clays and marls for pigments (pers comm. Jerry McDonnell, University of Bradford). This could push the date range back to the Palaeolithic, Mesolithic and Neolithic and may have been the beginning of the reputation of the area for mineral exploitation.

6.5 The ore on the site was shown in the XRF survey to contain high levels of copper and lead, both from different sources. Strongly associated with the lead was silver and arsenic.

6.6 The small quarries visible on outcropping bedrock to the north-west of the site can be dated to a period prior to the mid 17th century. This is likely to have been intermittent small scale quarrying by local people.

6.7 The various small areas of mineralised material observed eroding out of the ground surface prior to the evaluation proved not to be indicators of archaeologically significant activity, with the exception of that around test pit 10. This may lessen the value of detailed geological and geochemical mapping of the site unless the colluvial upper layers were removed as part of a controlled excavation. However, if further excavation is carried out it would be essential to undertake detailed XRF analysis of deposits within features associated with ore processing or the resulting waste materials.

6.8 The evaluation has shown that intact archaeologically significant remains from the Earlier Bronze Age through to the Early Post-Medieval period exist in situ across the site with preservation of features, structures and deposits preserved beneath the current ground surface. The site contains remains that could be potentially be considered to be of at least national importance, the study of which could hugely increase our knowledge of mining and ore processing from the Earlier Bronze Age through to the Medieval period. These deposits are under very serious and constantly increasing threat from erosion and require action to preserve or record them. Complete excavation of the entire site would not only prove prohibitively costly but could also be seen as ethically unsound and only to be considered as a final option when no alternative actions were possible. Another option would be to preserve the site in its entirety with physical protection (such as Terram matting with neutral deposits put down over it and adequate drainage installed ,etc) and statutory protection (Scheduling of the site). This however would mean that at the same time as recognising the site as extremely archaeologically important, particularly within an area of archaeology about which little is known, it would then preclude any further archaeological investigation into the site. A possible alternative would be the physical protection of the site from erosion whilst setting up a basis for future investigation on a smaller seasonal scale, targeting key areas of the site for study.

This could be undertaken periodically over a number of years and could include further small scale excavation of key features and areas combined with detailed XRF survey, geochemical mapping, etc. On a larger scale it may be possible to re-evaluate data from the original 1996/7 survey, in conjunction with that from this and future studies, using more up to date methods now available and to expand surveys of the area to include other sites within the region (for example chemical analysis of the bronze crucible fragments found within the Iron Age ditch at Mellor in order to attempt to source the copper residues within them to Alderley Edge). Whichever method is adopted it must be kept in mind that this is an extremely important type site for an area of archaeology about which little is known and surviving in situ evidence is very rare, both locally and nationally.

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10. Figures

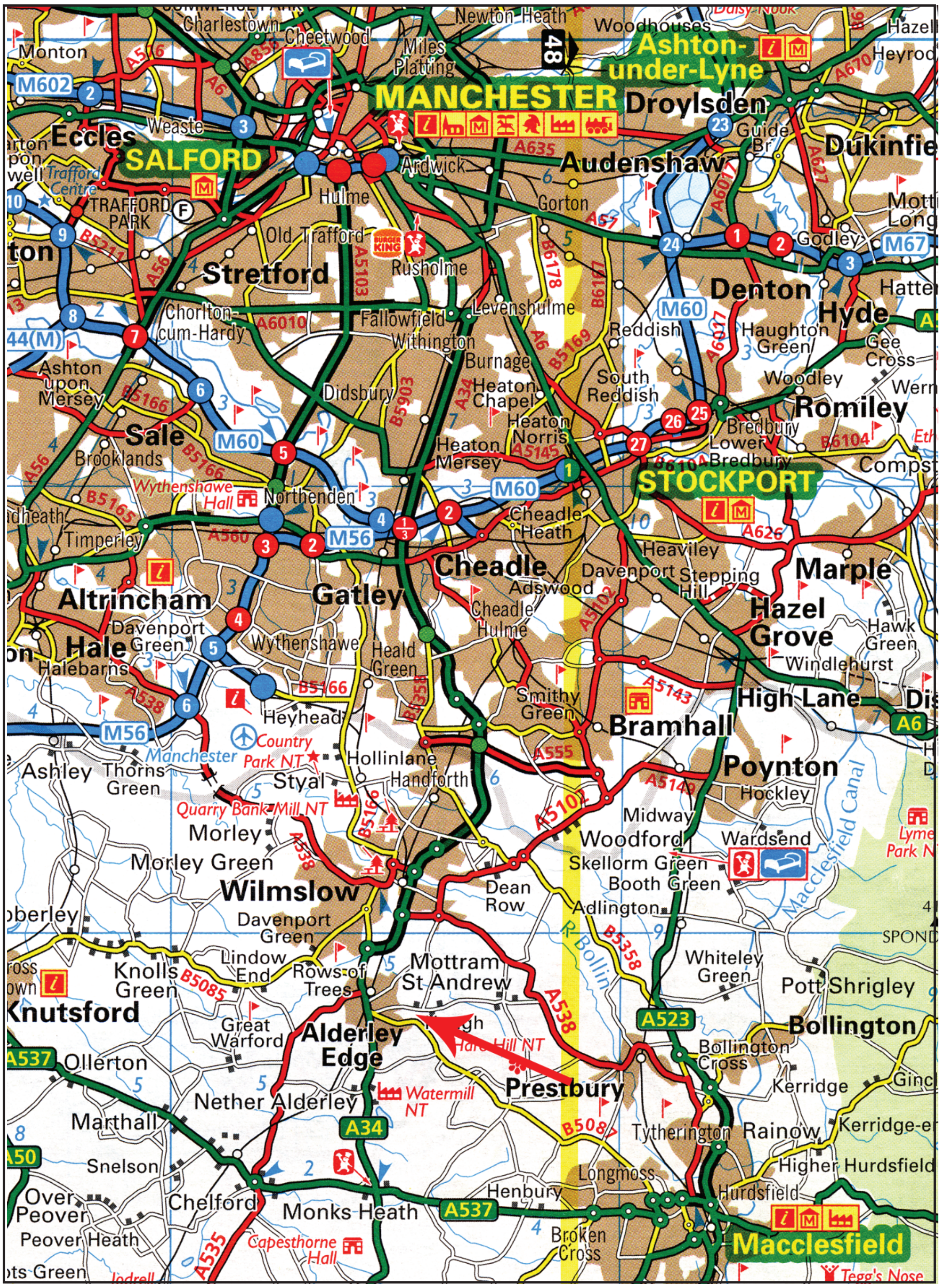

Figure 1: Alderley Edge location map (based on AA Road Atlas of Britain 2001). Site indicated by red arrow.

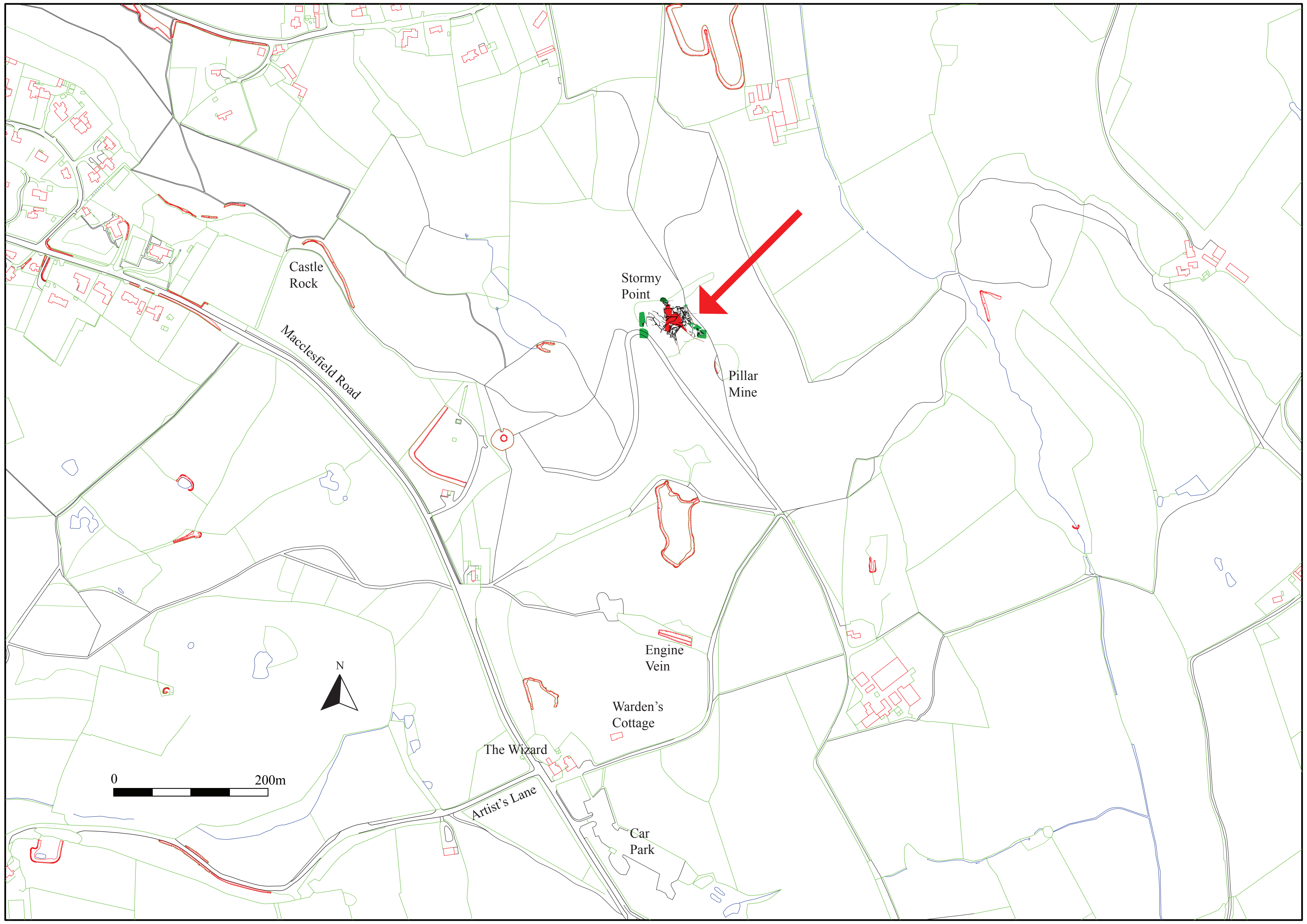

Figure 2: Stormy Point site location evaluation area (arrowed)

Fig 3: Area under highest immediate threat of erosion (highlighted in red)

Figure 4: Topgraphic survey without contours

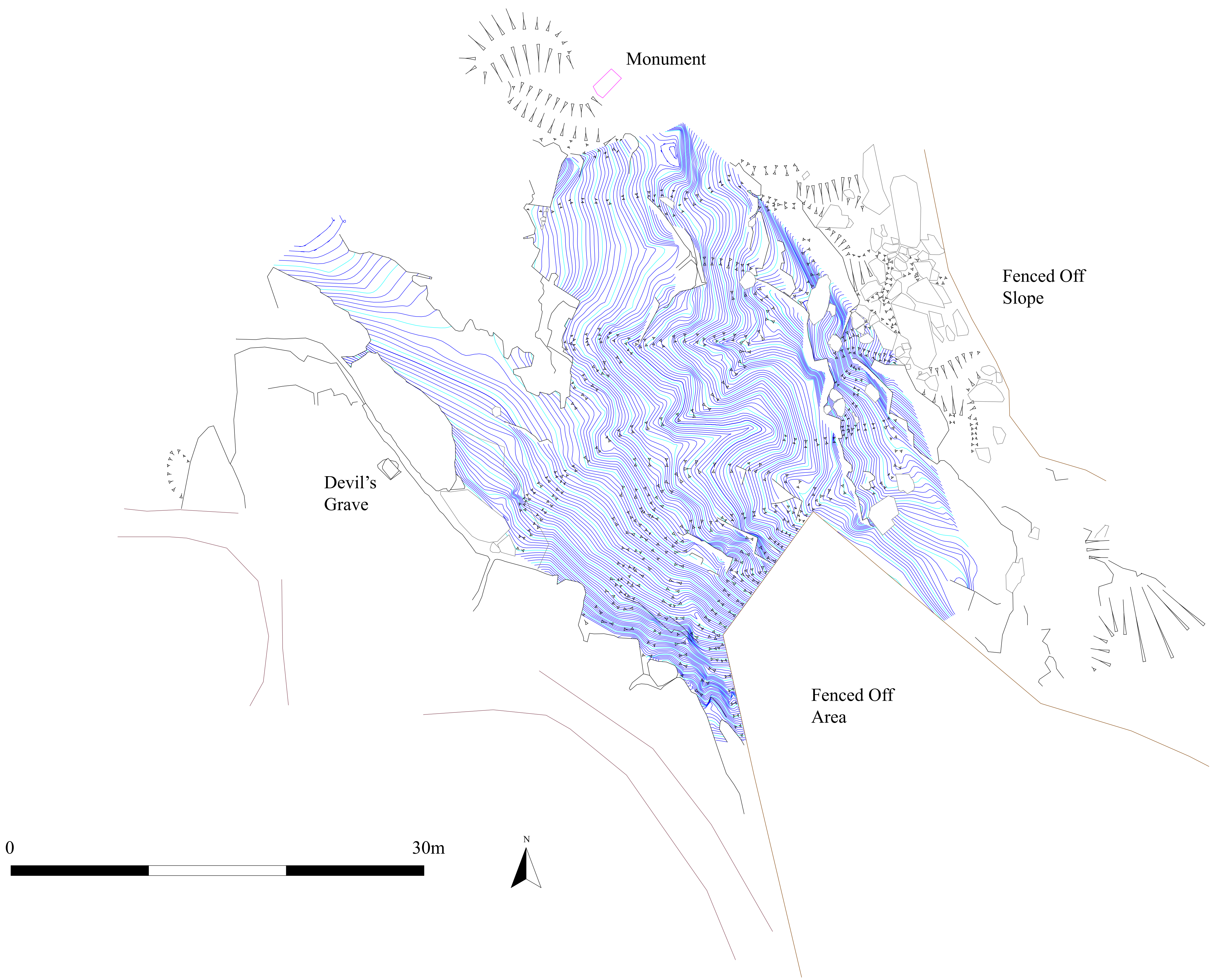

Figure 5: Topographic survey with contours

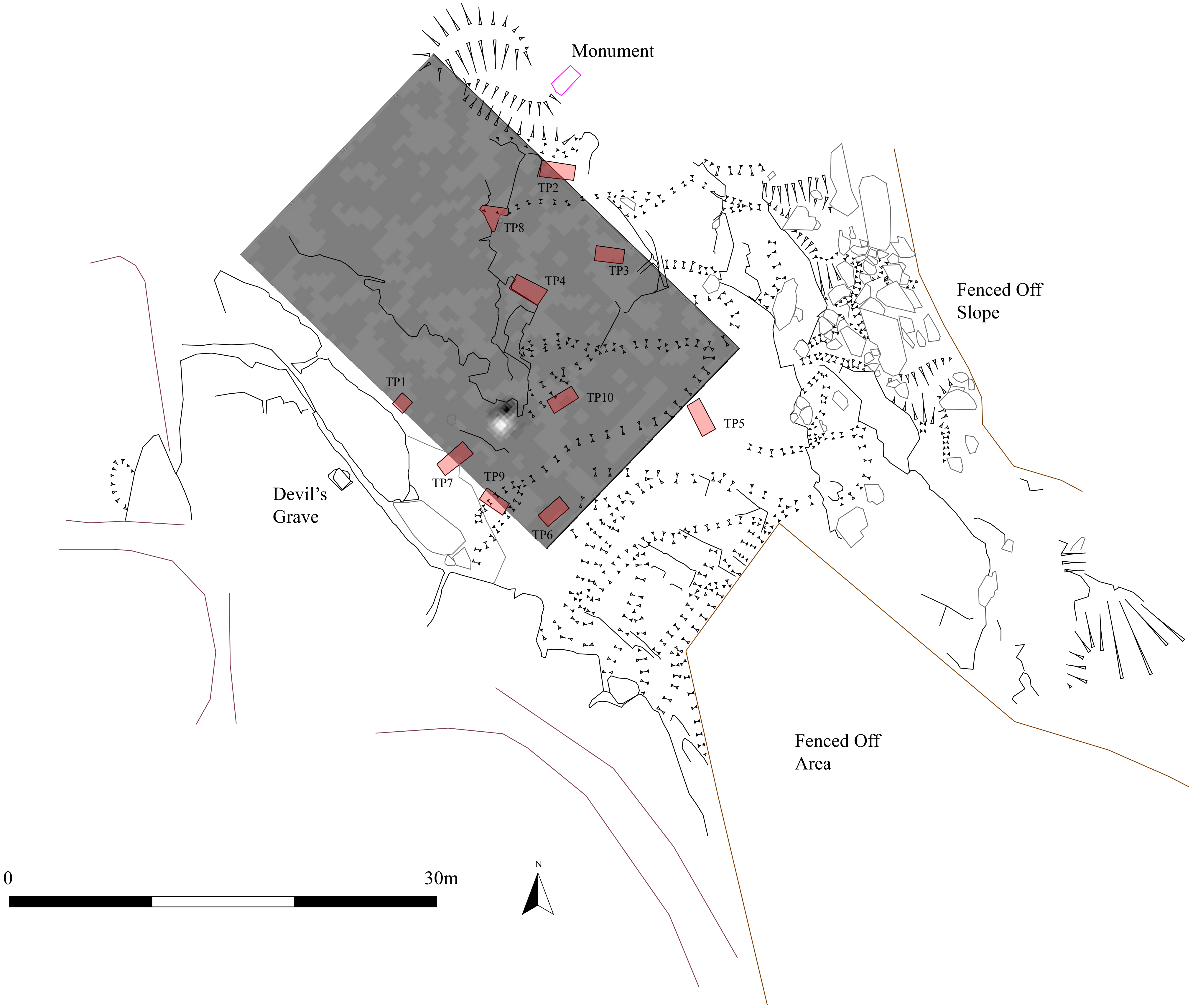

Figure 6: Location of test pits (highlighted in red) and geophysical survey plot

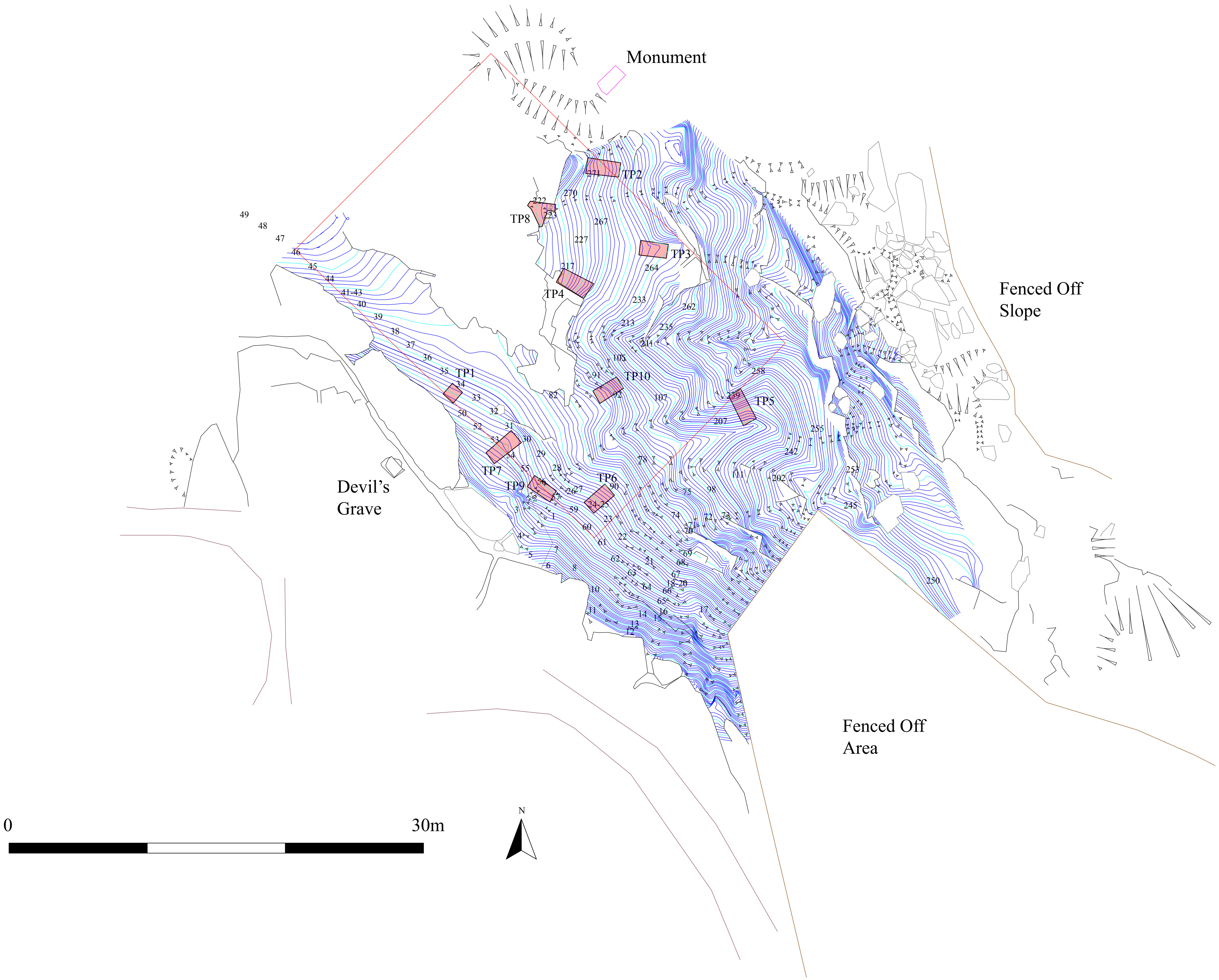

Fig 7: Location of XRF measurement points in relation to the test pits (test pits highlighted in red)

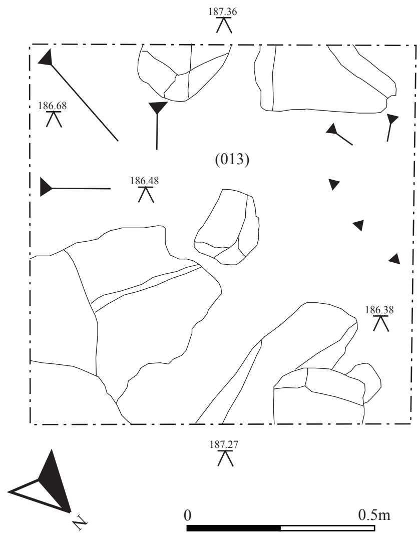

Fig 8: Test pit 1 Plan

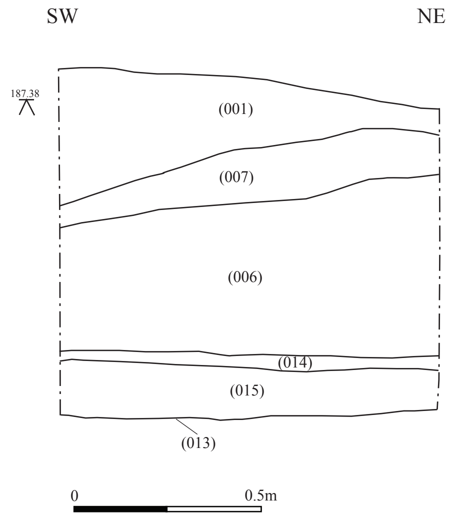

Fig 9: Test pit 1 south-east facing section

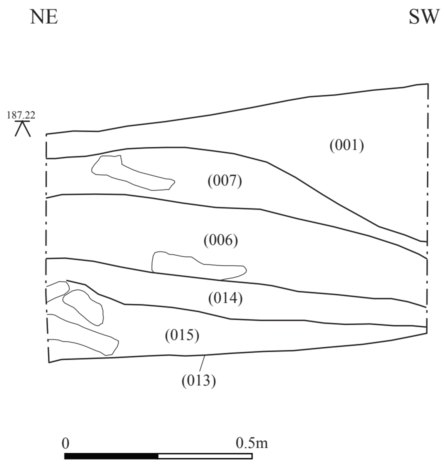

Fig 10: Test pit 1 north-west facing section

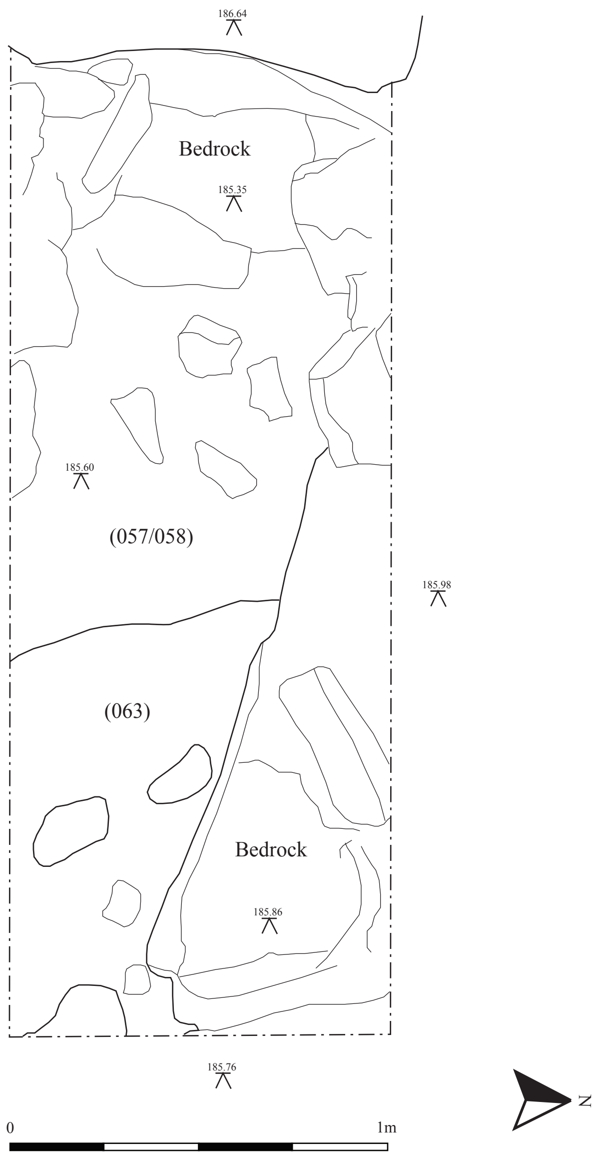

Fig 11: Test pit 2 plan

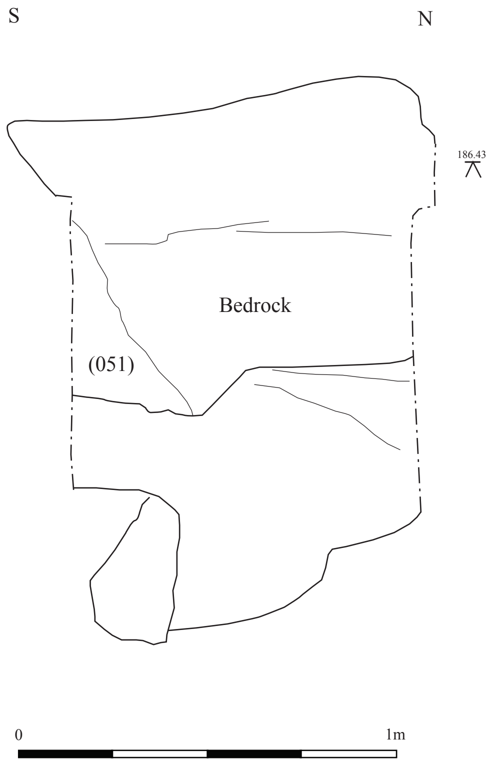

Fig 12: Test pit 2 east facing section

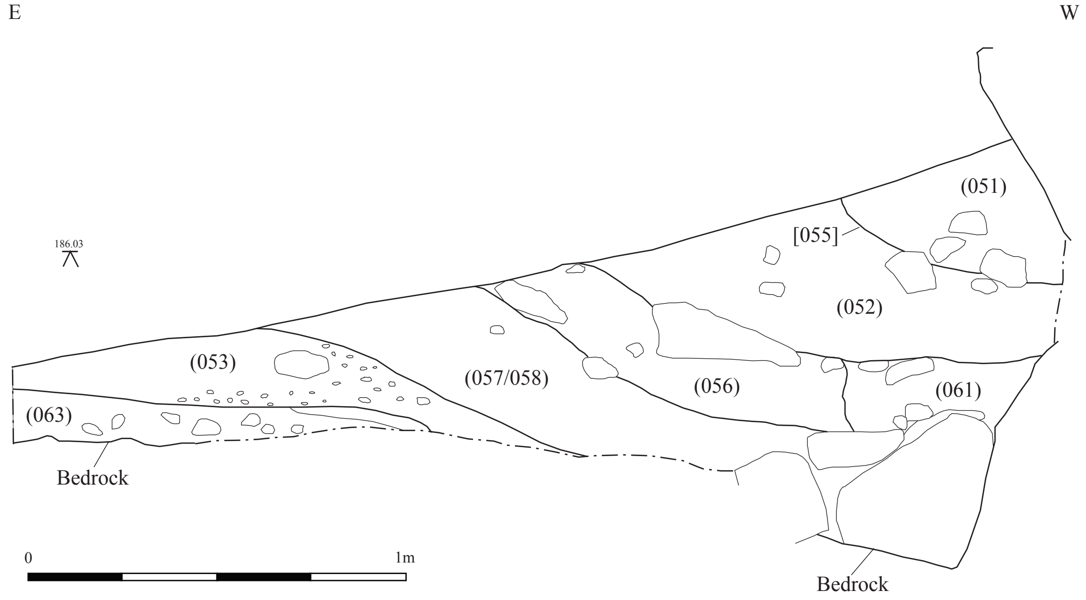

Fig 13: Test pit 2 north facing section

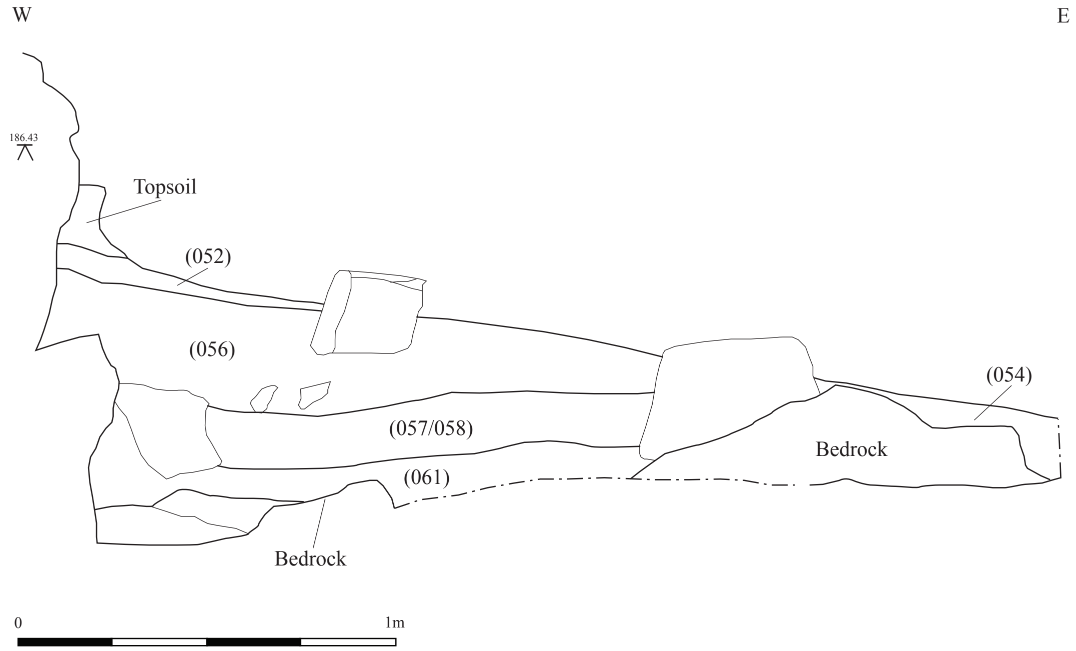

Fig 14: Test pit 2 south facing section

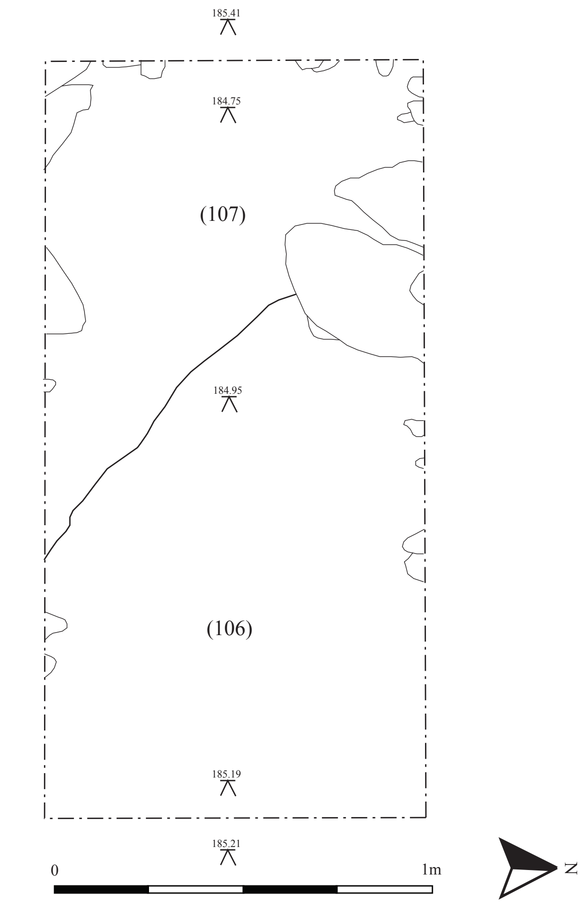

Fig 15: Test pit 3 plan

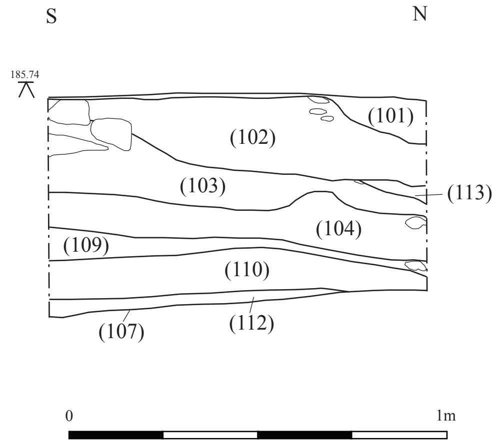

Fig 16: Test pit 3 east facing section

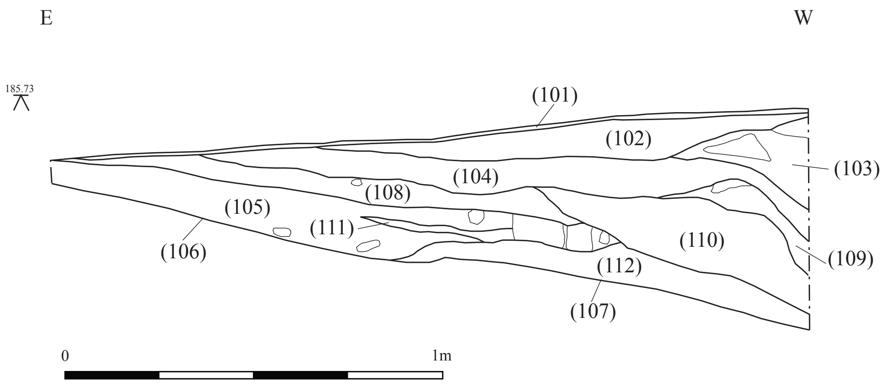

Fig 17: Test pit 3 north facing section

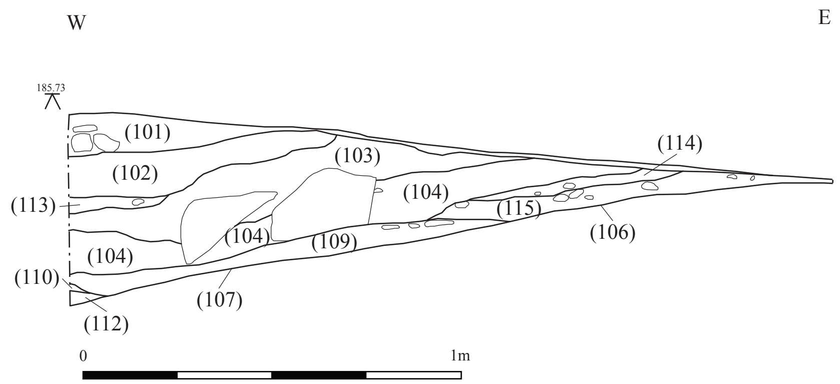

Fig 18: Test pit 3 south facing section

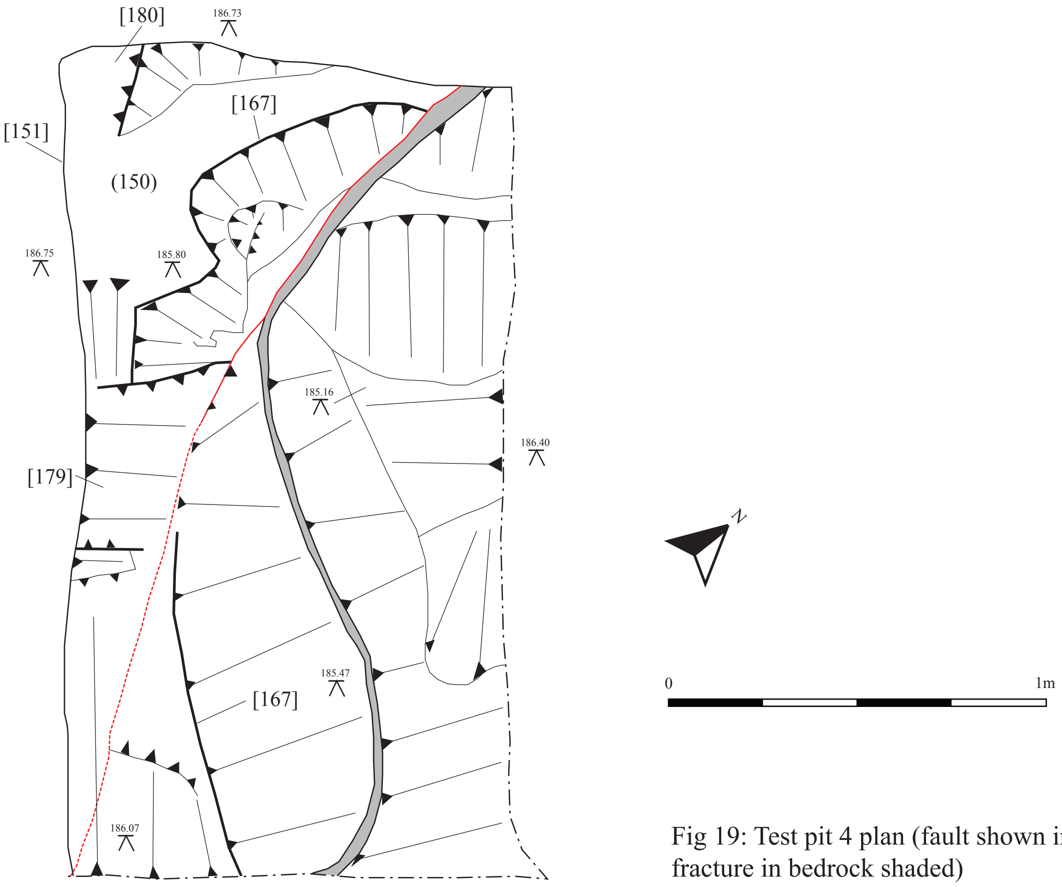

Fig 19: Test pit 4 plan (fault shown in red, fracture in bedrock shaded)

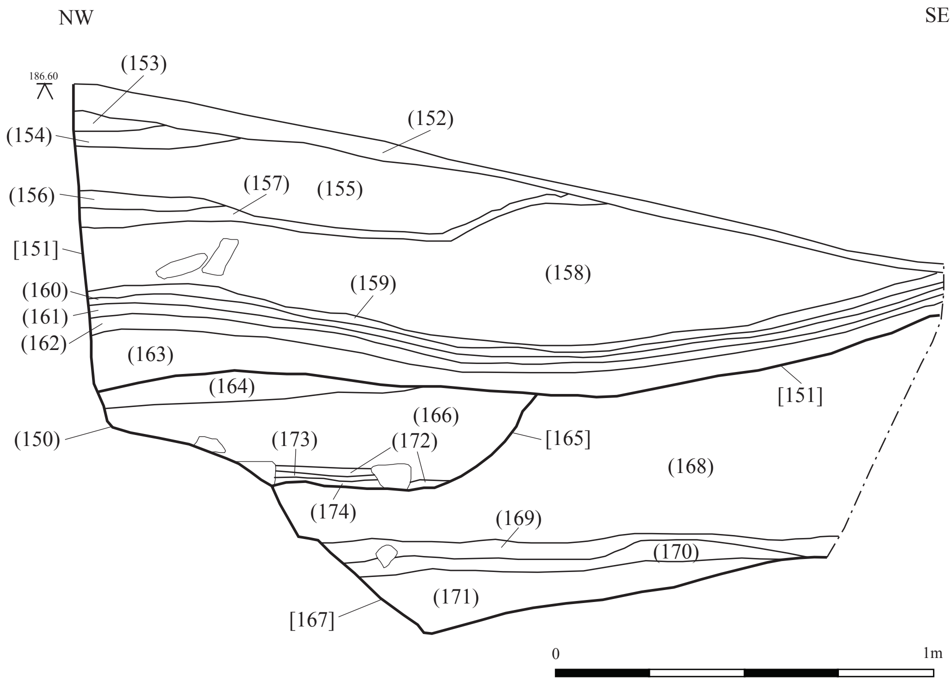

Fig 20: Test pit 4 south-west facing section

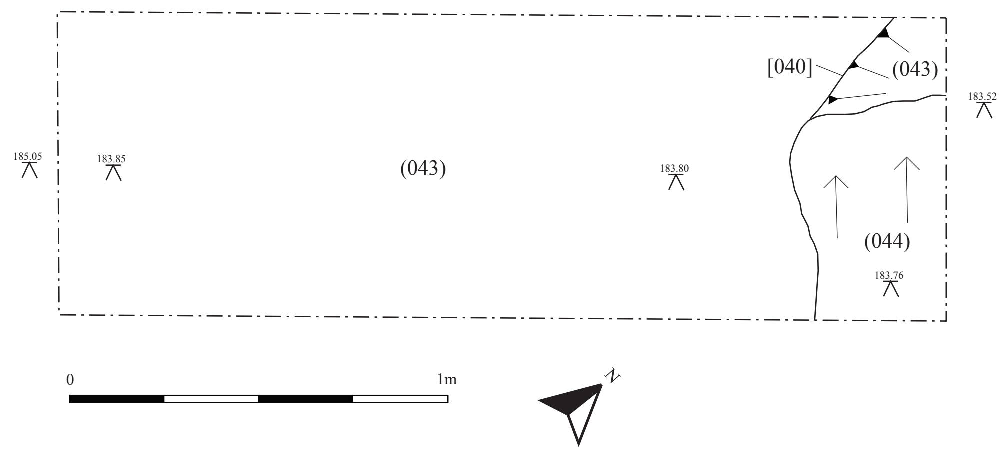

Fig 21: Test pit 5 plan

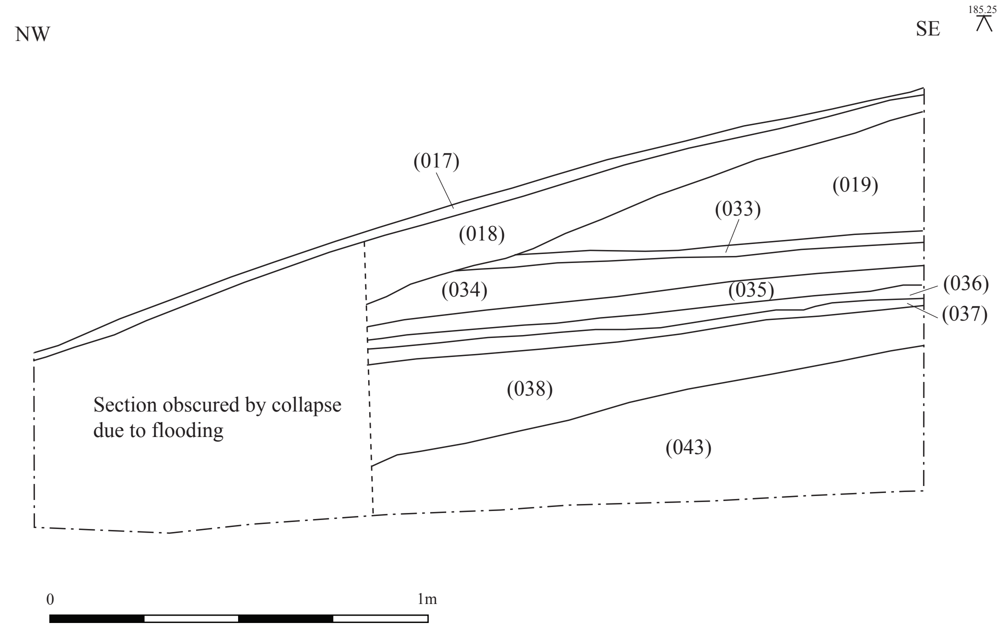

Fig 22: Test pit 5 south-west facing section

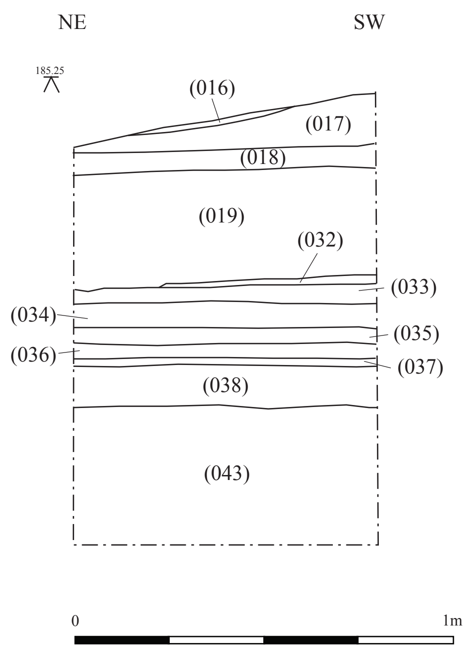

Fig 23: Test pit 5 north-west facing section

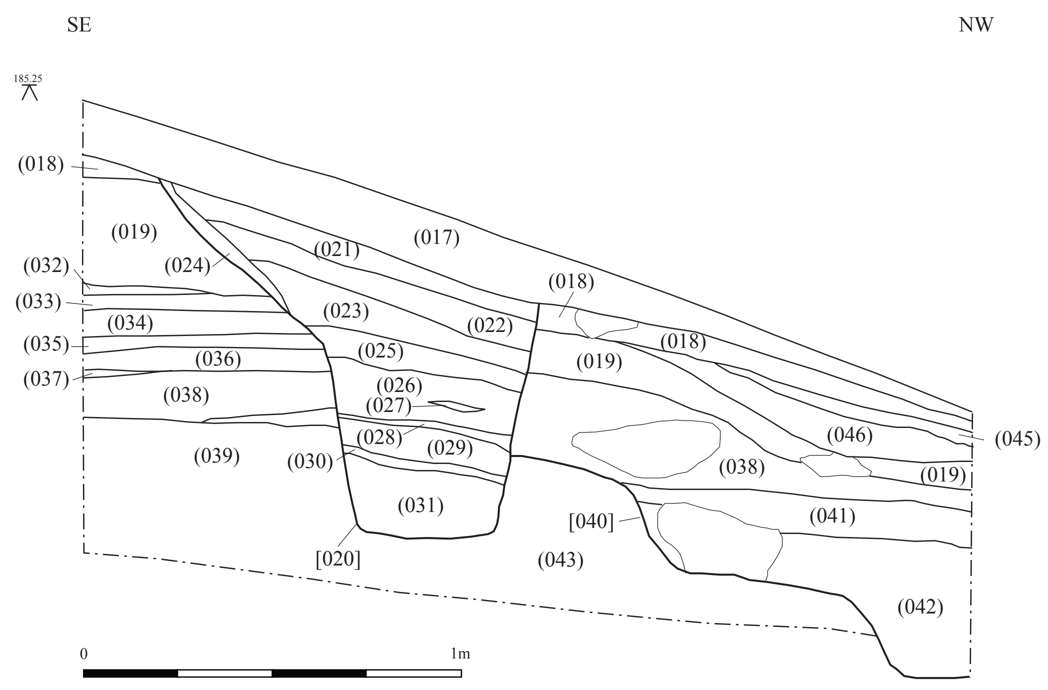

Fig 24: Test pit 5 north-east facing section

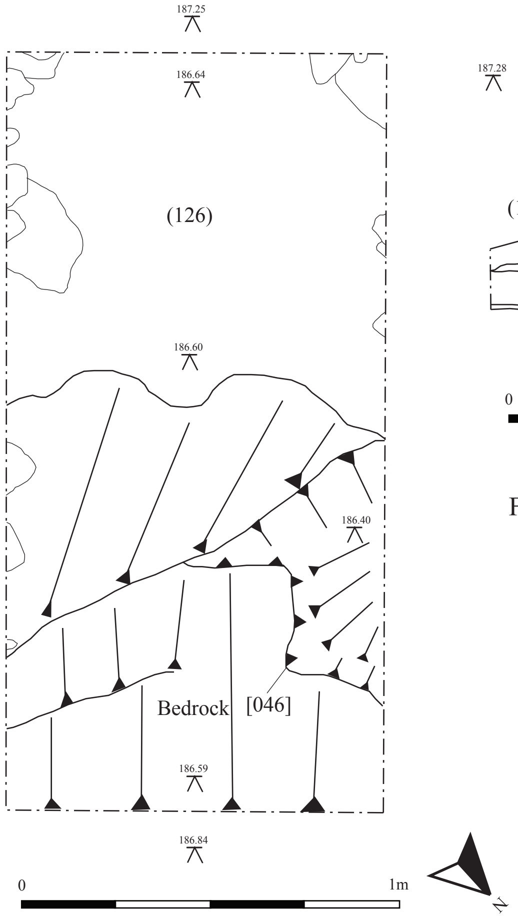

Fig 25: Test pit 6 plan

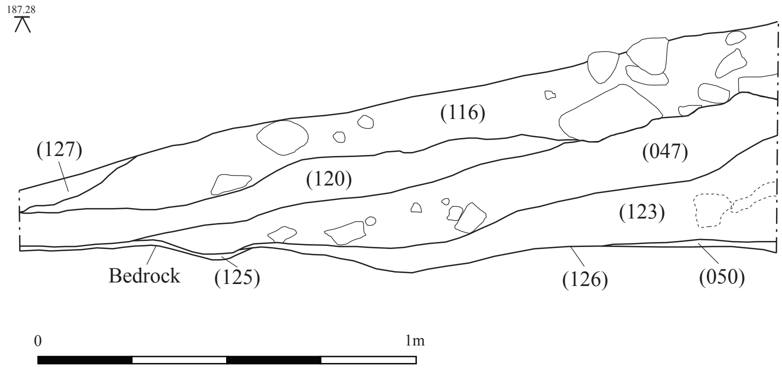

Fig 26: Test pit 6 north-west facing section

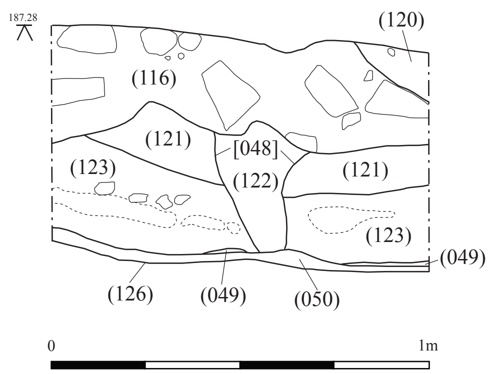

Fig 27: Test pit 6 north-east facing section

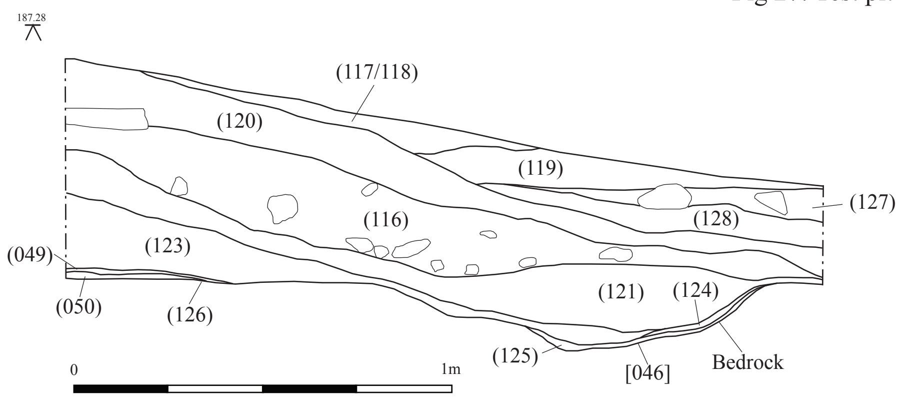

Fig 28: Test pit 6 south-east facing section

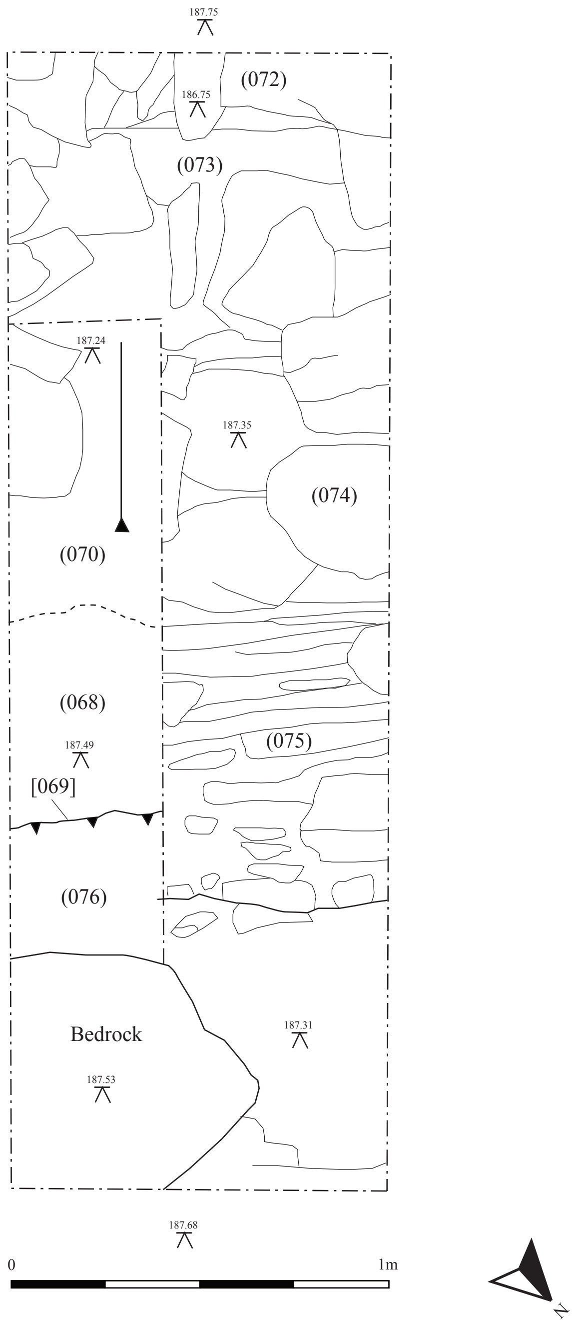

Fig 29: Test pit 7 plan

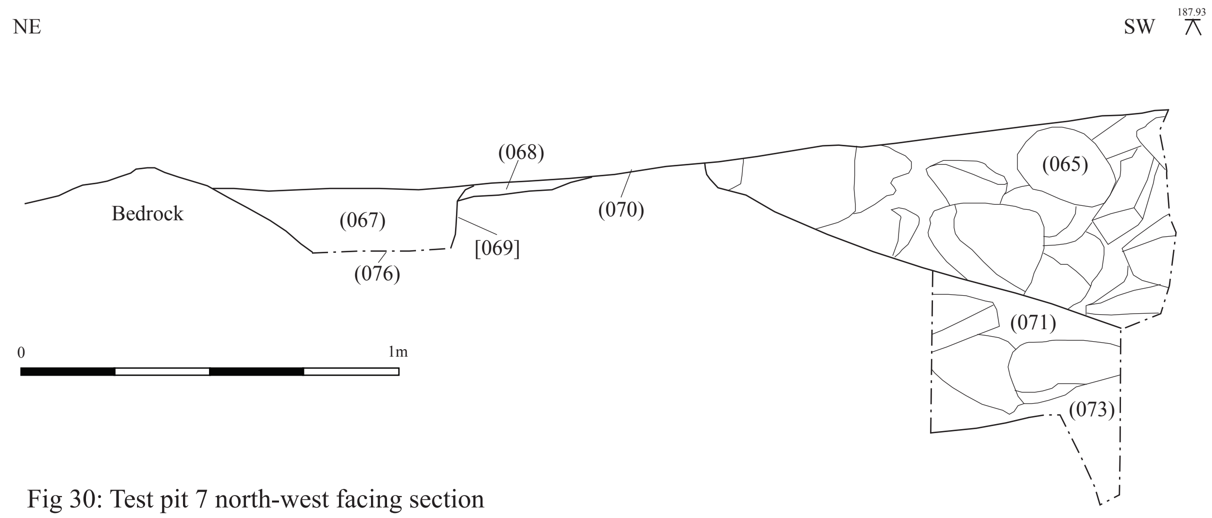

Fig 30: Test pit 7 north-west facing section

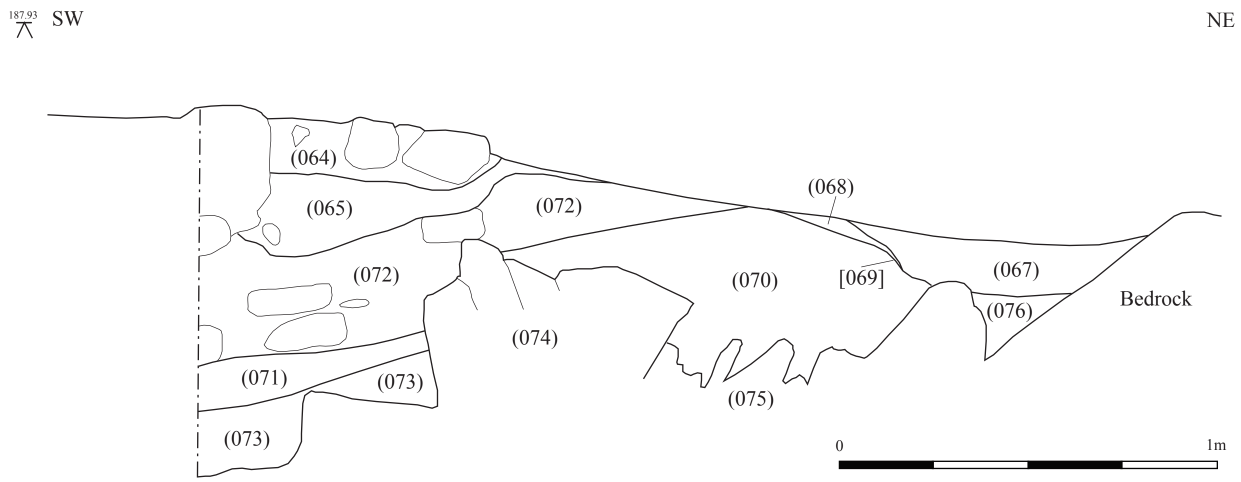

Fig 31: Test pit 7 south-east facing section

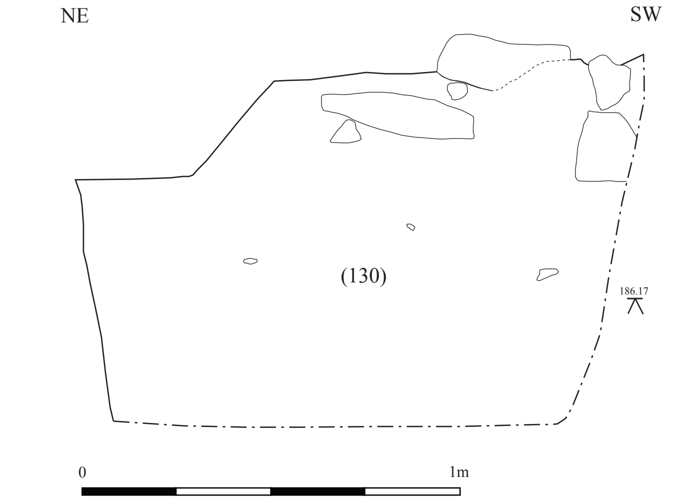

Fig 32: Test pit 8 north-west facing section

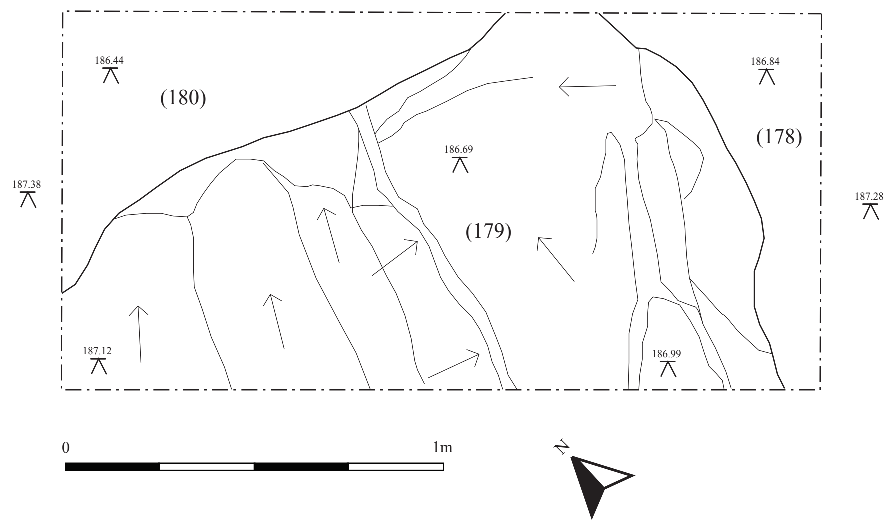

Fig 33: Test pit 9 plan

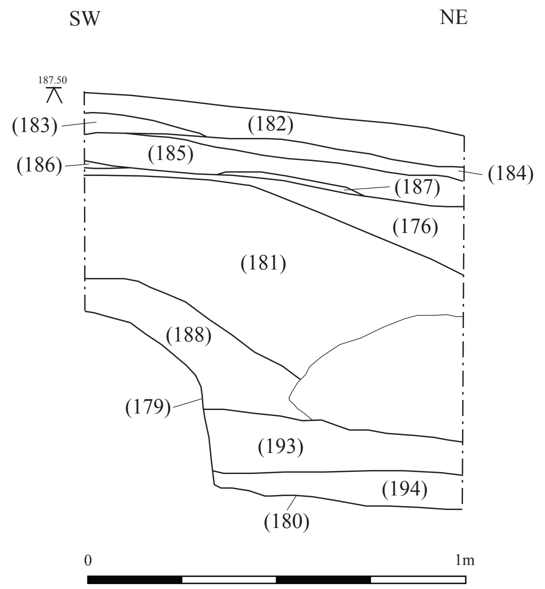

Fig 34: Test pit 9 south-east facing section

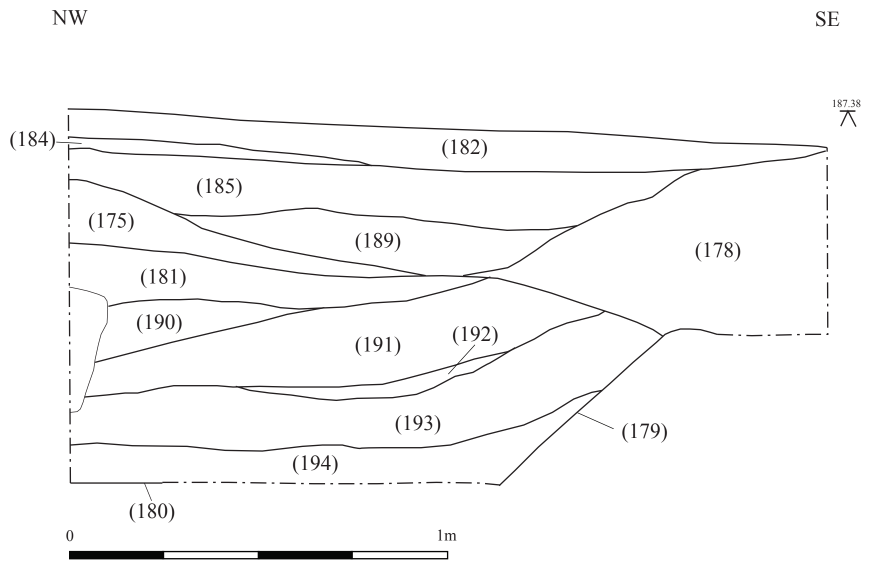

Fig 35: Test pit 9 south-west facing section

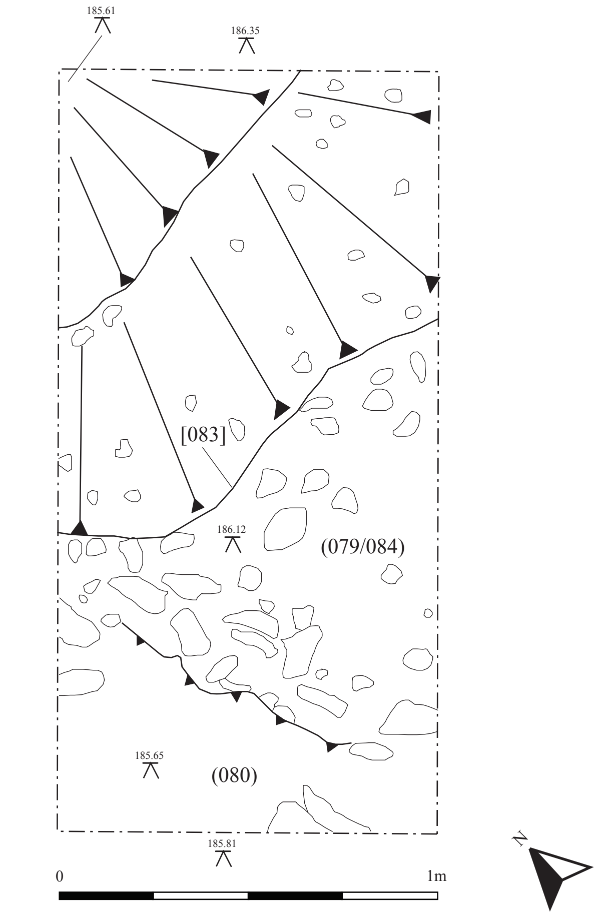

Fig 36: Test pit 10 plan

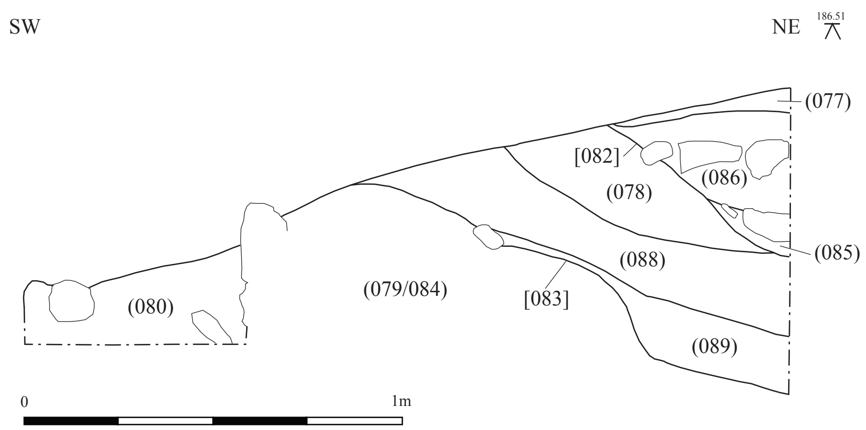

Fig 37: Test pit 10 south-east facing section

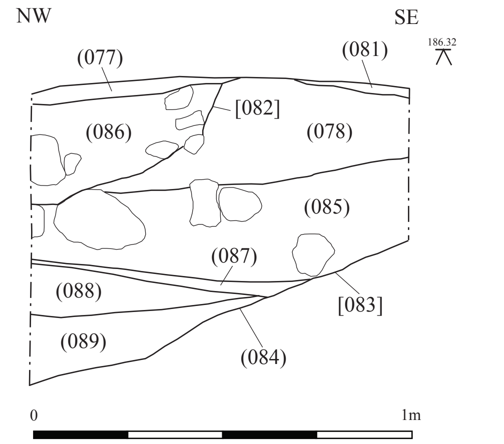

Fig 38: Test pit 10 south-west facing section

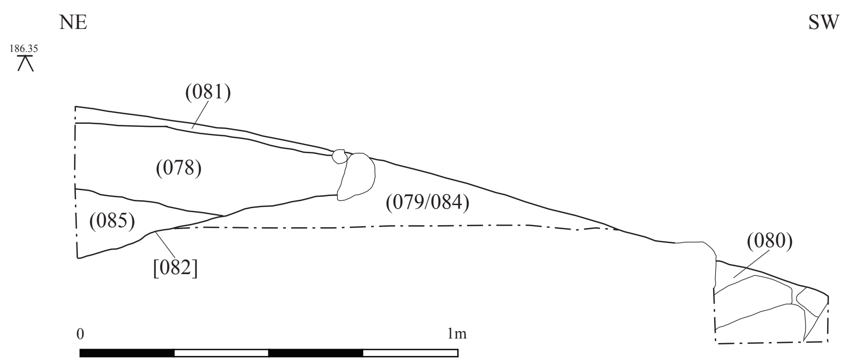

Fig 39: Test pit 10 north-west facing section

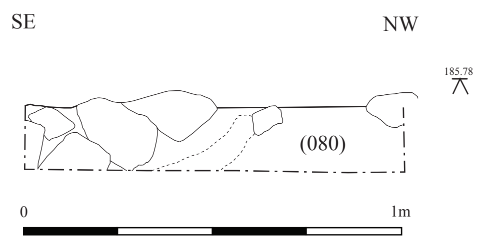

Fig 40: Test pit 10 north-east facing section

10. Plates

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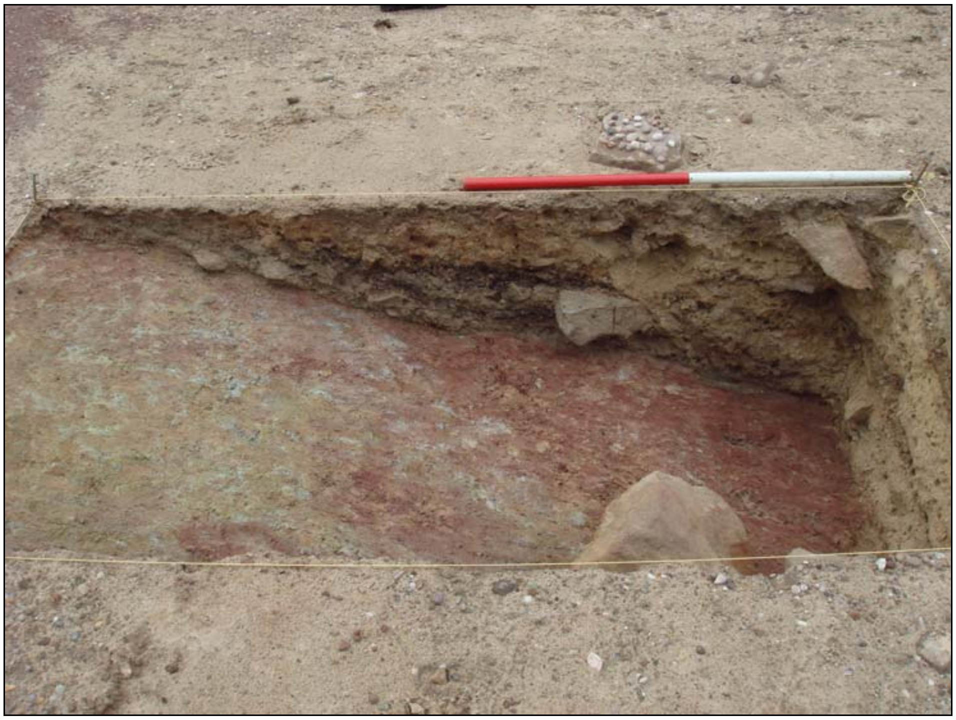

Plate 5: Test pit 3 north facing section looking south

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Plate 11: Test pit 4 detail of quarry cut looking north-west

Plate 12: Test pit 4 looking south-east

Plate 13: Test pit 6 looking north-east

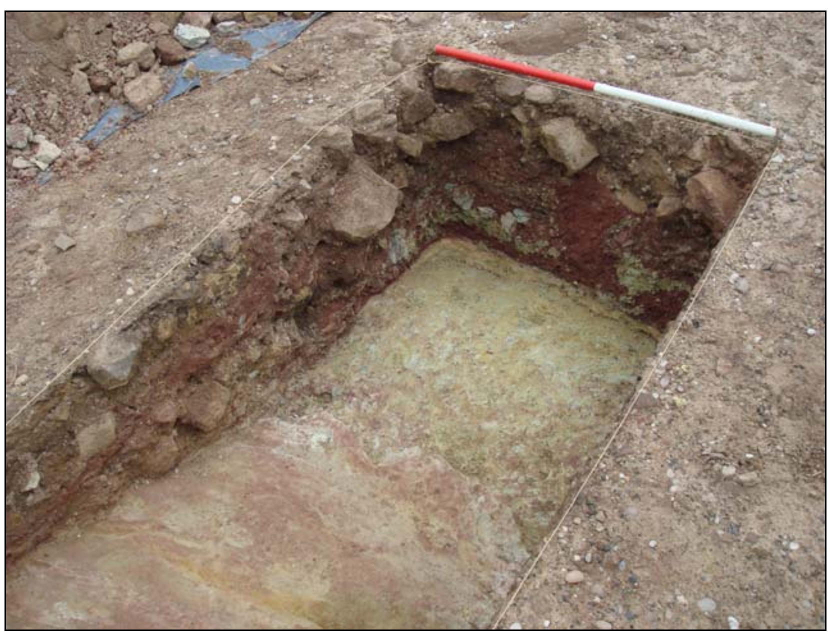

Plate 14: Test pit 6 looking south

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Plate 30: 17^{th} century clay pipe from test pit 2

Plate 31: 17th century clay pipes from test pit 2

Appendix 1: XRF Report

In situ PXRF geochemical survey of the Bronze Age mining/smelting site at Stormy Point, Alderley Edge, Cheshire

Final Report* - August 2007

Dr Norman Moles, Firooz Firoozmand & Robert Swabey

The Waste & Energy Research Group
University of Brighton

University of Brighton

WERG
Waste & Energy Research Group

* This version supersedes a draft version of the report supplied in July 2007 that contained maps with approximate locations of analyses, based on compass and tape measurements. This final version of the report contains accurate maps based on Total Station data. References to compass orientations that were incorrect in the draft report have been corrected in this version.

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Summary

Using a portable x-ray fluorescence spectrometer (PXRF) for *in situ* elemental analysis, during a two day survey period 193 measurements were collected at 178 sites across an area measuring approximately 45m by 25m of exposed ground at Stormy Point. Of these sites, 32 were bedrock (marl and sandstone) and 146 soil including ore-rich material. Useful data was obtained for 16 elements namely Ti, Mn, Fe, Co, Ni, Cu, Zn, Rb, Sr, Zr, Ba, Ag, Cd, Mo, Sn and Pb. Maps are included in the report for 11 of these elements. Statistical analyses and distribution maps show that the bedrock is variably enriched in metals and that a variety of ore or spoil material is incorporated into soils exposed at the site, much of which is probably not derived from bedrock in the immediate vicinity.

The geochemical maps confirm that the area of most interest for copper ore processing is in the north / northeast of the site. Here, a layer has been exhumed of ore-rich soil overlying a thin dark soil presumed to be an ancient land surface. A small area of lead- and barium-rich ore, with very high metal levels, has been exhumed in the central western part of the area. Along the base of the conglomerate bluff bounding the southwest of the site, metal levels are locally high, and at one point abundant charcoal was found along with glassy, iron-rich slag at a shallow depth, possibly indicating the presence of a small furnace.

The report concludes by recommending further work including enhanced data processing, comparison of geochemical and mineralogical data which may allow probable sources of the ore material to be identified, and further geochemical surveying of the site during excavation and of adjoining areas currently covered by vegetation.

Introduction

This report presents the results and initial interpretations of a survey in July 2007 to map metal concentrations in surface materials at the Bronze Age mineral dressing and possible smelting site at Stormy Point near Alderley Edge in Cheshire. The ground is not vegetated and in recent years has undergone severe erosion such that all topsoil and much of the sub-soil has been removed by rainwash, exposing ancient land surfaces rich in metalliferous minerals and in some places, slag and charcoal. Also exposed are quarried faces in the sandstone bedrock that appear to be artifacts of ancient mineral processing and smelting activity at the site.

The *in situ* geochemical survey reported here was carried out before the start of intrusive investigations (pitting and trenching) which would disrupt the eroded surface. This was achieved during two days of fieldwork by using a field-portable x-ray fluorescence spectrometer (PXRF). This instrument, illustrated on the cover page, is capable of measuring the concentrations of a range of elements including transition element metals (Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn), alkali earth elements (Rb, Sr, Zr, Ba) and heavy metals (Ag, Cd, Mo, Sn, Sb, Hg, Pb) with a level of precision comparable to laboratory-based analyses.

The advantages of using the *in situ* PXRF method for this type of survey include:

(i) No removal of material from the site;

(ii) Flexibility in survey design: as data is displayed during measurement, the operator can decide whether to take further measurements or adjust the spacing of survey points;

(iii) Minimal analytical costs, with time being the only limitation on the number of survey points analysed;

(iv) High quality data as the instrument employs a calibration system (Compton Normalisation) which enables element content to be measured over a wide range of concentrations (tens of parts per million to tens of percent), and corrects for a variety of matrix interference effects.

During the two day survey period, 193 measurements were collected at 178 sites across an area of approximately 45m by 25m, elongated NW-SE (**Figure 2**). Most sites are on NW-SE transects with a spacing of 1.0m, 1.5m or 2.0m, providing a density of typically 1 per $2m^2$ increasing to 1 per $1m^2$ in areas of particular interest. The surveyed area is irregular in shape corresponding to the area of exposed soil and 'spoil' material and marl bedrock. It is bounded almost entirely by areas of sandstone bedrock, except to the southeast where a fence bounds the exposed area. Two transects extend outside the central area; one along the base of the conglomerate bluff at the southwest edge of the site, and the other along the path extending southeast, on the northeast side of the bounding fence.

Analytical equipment and survey method

The instrument deployed is an Innov-X Alpha Series™ portable x-ray fluorescence spectrometer manufactured in 2004. The x-ray source is a battery-powered, 35 keV, Ag anode x-ray tube. It features a high-resolution detector and Pocket PC software platform.

Detection limits are in the order of 1-5ppm for heavy elements and 10-50ppm for lighter metals (**Table 1**). Detection limits are higher for light non-metallic elements, which the PXRF is capable of determining, but which were not analysed in the current survey.

WERG has undertaken trials of the Innov-X instrument with certified reference materials (CRMs) of soils and sediments to investigate possible interference effects from overlapping fluorescence signals and matrix effects. These trials found no evidence of interference due to overlapping fluorescence (Pb-As, Cu-Zn, Mn-Fe) or matrix effects (Zr-Sr). It was concluded that the factory-installed calibrations are excellent for most elements investigated, in the compositional range of the CRMs investigated. However the calibrations may become inappropriate where materials of widely differing composition are analysed, for example if Fe (iron) is >20%, or where high concentrations of heavy elements e.g. Ba or Pb occur in the materials.

Instrumental precision as measured by the relative standard deviation of several measurements of the certified standards, is 1-5% for concentrations >100 ppm. For concentration <100ppm, each element has a different performance characteristic. For concentrations >1000ppm, it is generally better than 3% and for elements Cu, Fe, Pb and Zn, the precision is <1%. The precision for measured elements is shown in **Table 1** and compared with the Environmental Agency's Performance Specification for metal analysis. The instrument performance is comparable to lab-based flame atomic absorption spectroscopy and inductively coupled plasma – mass spectroscopy (ICP-MS).

Fieldwork was undertaken on 9th and 10th July 2007 during generally dry weather conditions. At each measurement site, an area of approximately 80mm by 30mm was cleared of pebbles or water-deposited sand (colluvium) so that the 'nose' of the PXRF could be placed in direct contact with the ground surface for analysis. The actual area of the analysis window is 12mm diameter. The cover photograph shows an analysis in progress at a site comprising exposed bedrock site, where minimal preparation is necessary. **Figure 1** shows the area of a soil site where the soil material comprises sand with charcoal; at such sites material in a volume of approximately 80mm by 80mm by 20mm deep was mixed to ensure that the analysis was representative of the area. At several sites where the surface materials appeared to be heterogeneous, e.g. comprising varying proportions of different materials such as soil, bedrock material and spoil or ore material, multiple measurements were made. These are reported in the results section.

Compass and tape methods were used to record the relative location of sites, and site locations were also recorded using a Total Station. Numbers written on pebbles were used to temporarily label sites: these correspond to the sequential numbers assigned by the PXRF for each analysis (**Figures 1 and 2**). Gaps in the numbering are due to instrument calibration readings and some deleted analyses. 112 measurements (including calibrations) were completed on 9th July and 94 on 10th July. As the PXRF software restarts numbering each day, measurements obtained on 10th July were incremented by 200 to avoid confusion; i.e. the first soil analysis on the 10th July, taken after the initial calibration measurement, is numbered 202 and the last soil measurement is numbered 291 (**Figure 2**).

Element			Detection Limit	Precision (%RSD)		
Atomic Number	**Symbol**	**Name**	**DL (ppm)**	**For conc <100 ppm**	**For conc >100 ppm**	**EA specification***
16	*S*	*Sulphur*	*4965*			
17	*Cl*	*Chlorine*	*235*			
19	*K*	*Potassium*	*195*			
20	*Ca*	*Calcium*	*300*			
22	Ti	Titanium	200			
24	Cr	Chromium	22	10	5	5
25	Mn	Manganese	25	10	3	5
26	Fe	Iron	120[a]	1[b]	1[c]	5
27	Co	Cobalt	50	25	25	5
28	Ni	Nickel	24	15	5	5
29	Cu	Copper	10	5	3	5
30	Zn	Zinc	5	4	2	5
33	As	Arsenic	3	8	3	7.5
34	Se	Selenium	2			7.5
37	Rb	Rubidium	5		1	
38	Sr	Strontium	4	1		
40	Zr	Zirconium	5	2		
42	Mo	Molybdenum	4	10	3	5
47	Ag	Silver				
48	Cd	Cadmium	30	15	8	5
50	Sn	Tin	40	20	5	
51	Sb	Antimony	41	25		7.5
56	Ba	Barium	60	20	6	5
80	Hg	Mercury	7	12[d]		5
82	Pb	Lead	4	2	1	5

Elements with atomic number <22 (Ti) were not determined in the Stormy Point survey.
120[a] Fe >3,000ppm, 1[b] Fe >10,000ppm, 1[c] Fe >100,000ppm, 12[d] Hg <50ppm
* Environment Agency precision levels for certification of laboratories undertaking analysis of soils.

Table 1: Portable XRF instrumental performance (detection limits and precision) based on measurements of duration 150 seconds (count time) of a range of soil and sediment compositions (certified reference materials). Data generated by WERG in 2005-06.

Figure 1: Site 24 showing the numbered pebble and charcoal-bearing sandy soil prepared for analysis by the PXRF. The rectangular depression on the smoothed soil surface was created by the 'nose' of the instrument. To the left and top of the view are colluvium deposits of sand and pebbles that were removed to expose the underlying soil for analysis.

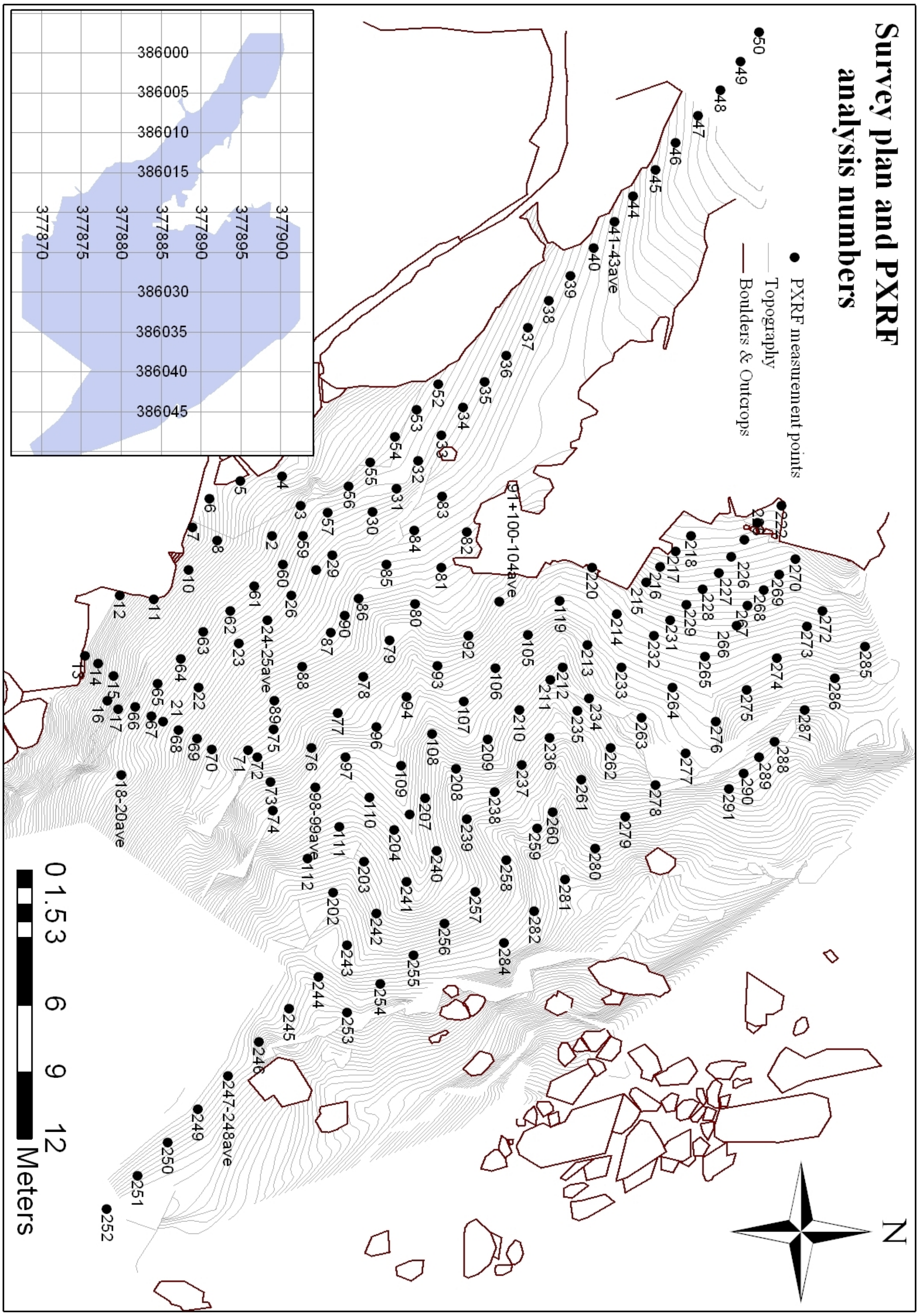

Figure 2: Survey plan and PXRF analysis numbers. Site locations are located accurately with respect to topographical features. Inset map shows OS grid coordinates for the surveyed area.

Results

‘Duplicate’ measurements and small-scale heterogeneity

At nine sites analysed during the survey, more than one measurement was taken, ranging from 2 to 6 measurements within a distance of up to 100mm from each other. **Figure 3** shows the locations of these sites and the results are presented in **Table 2**. The main purpose of these ‘site duplicate’ measurements was to investigate the range in composition within small areas of around 200mm^2. This range is important because:

(a) the materials present at the Stormy Point site are heterogeneous and much more varied than in a ‘typical’ area of soil;

(b) the data provides an indication of the reproducibility of the survey, if measurements had been obtained at different but nearby locations.

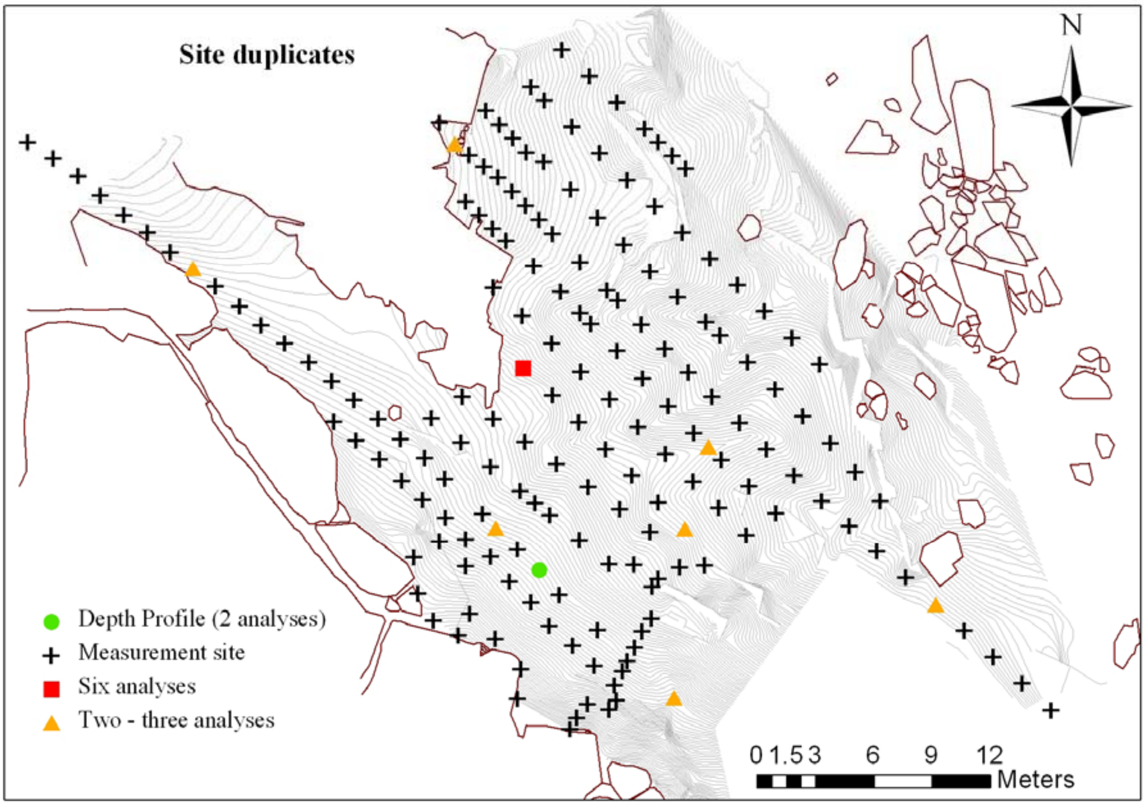

Figure 3: Location of ‘site duplicate’ measurements. See Fig. 2 for site numbers.

The site at which 6 measurements were taken (91, 100-104) is rich in coarse pieces of ore material (‘spoil’) and was expected to show considerable heterogeneity. This is confirmed by the analyses (**Table 2**) which show variations in the order of a factor of two between highest and lowest values for Fe, As, Rb, Sr, Mo, Sn and Hg, and a factor of up to three for Ni, Cu and Ba. Lead (Pb) shows a factor of 1.7 between lowest and highest values (48,964 and 82,814 ppm). Zn values show less variation with a factor of 1.4 between lowest and highest. One analysis shows relatively high manganese (672 ppm) whereas in other analyses Mn values are below detection limit (~50 to ~80 ppm in this material). Similar variation is apparent from other sites where ‘site duplicate’ data was obtained, which generally suggests that the concentrations for many elements are ‘precise’ to within a factor of plus/minus 50% of the value obtained. It is stressed that this measure of ‘precision’ is largely due to small-scale heterogeneity of the soil materials at the site, rather than analytical uncertainty.

Two measurements at site 24-25 were taken to compare the compositions of near-surface soil rich in charcoal (site 24, **Figure 1**) with the charcoal-free sandy substrate (analysis 25). The near-surface material is greatly enriched in iron and manganese, but has similar concentrations of Cu, Zn, Pb, Ba and other elements to the deeper soil material. The iron enrichment may be due to the abundance of slag material derived from smelting.

Site	Material	Ti	Mn	Fe	Ni	Cu	Zn	As	Rb	Sr
18	spoil	2401	<23	11966	42	448	210	<LOD	58	72
19	spoil	3294	<23	10304	<11	338	201	<LOD	87	86
20	spoil	5300	<30	22805	81	581	410	128	101	103
24	sandy soil with charcoal	<455	447	24576	<11	853	217	129	41	112
25	sandy soil at 10cm depth	<495	140	4990	42	849	181	<LOD	53	137
27	sandy soil/colluvium	<425	65	3247	<8	703	54	122	32	88
28	sandy soil/colluvium	<397	195	6354	38	344	202	97	60	90
41	redmarl/sandy soil mix	3113	178	16464	135	924	1530	<LOD	88	142
42	redmarl/sandy soil mix	3210	230	19410	118	850	1309	75	114	122
43	redmarl/sandy soil mix	<584	182	8045	40	888	461	<LOD	49	138
91	brown sandy soil with spoil	<1859	672	14990	161	1124	486	<LOD	24	446
100	brown sandy soil with spoil	<2219	<84	15903	203	837	569	1612	<LOD	506
101	brown sandy soil with spoil	<1809	<65	13406	146	844	461	580	<LOD	439
102	brown sandy soil with spoil	5594	<56	26675	81	2414	666	1009	52	264
103	brown sandy soil with spoil	5977	<54	25795	87	2370	632	1253	58	256
104	brown sandy soil with spoil	<1213	<53	26377	102	2399	635	1274	55	261
98	sandy soil with red marl	1114	85	5599	64	345	851	<LOD	59	55
99	sandy soil with red marl	1126	51	4244	29	371	475	<LOD	67	60
205	sandy soil with spoil	<727	388	12739	77	6584	687	245	50	231
206	sandy soil with spoil	2349	165	15638	88	7146	744	897	62	231
223	mound of green spoil	<593	272	18554	135	25036	9194	<LOD	88	70
224	pure green mineral	<882	217	34449	380	92803	22973	<LOD	109	46
247	brown sandy soil	3093	141	7503	52	694	250	<LOD	83	163
248	brown sandy soil	<785	129	8412	41	884	267	88	81	203

Site	Material	Zr	Mo	Ag	Cd	Sn	Sb	Ba	Hg	Pb
18	spoil	46	<LOD	109	<LOD	143	<LOD	2072	<LOD	11633
19	spoil	125	<LOD	117	<LOD	152	<LOD	2948	<LOD	11827
20	spoil	145	<LOD	197	45	106	<LOD	3054	<LOD	17774
24	sandy soil with charcoal	58	6	131	54	107	<LOD	4632	<LOD	3651
25	sandy soil at 10cm depth	74	7	89	<LOD	170	<LOD	5775	<LOD	3760
27	sandy soil/colluvium	69	<LOD	87	<LOD	134	<LOD	5494	<LOD	4228
28	sandy soil/colluvium	69	<LOD	36	<LOD	111	<LOD	3618	<LOD	3178
41	redmarl/sandy soil mix	108	14	147	<LOD	195	<LOD	4998	<LOD	7318
42	redmarl/sandy soil mix	124	<LOD	102	<LOD	159	<LOD	4243	<LOD	3736
43	redmarl/sandy soil mix	118	<LOD	142	<LOD	117	<LOD	8579	<LOD	6743
91	brown sandy soil with spoil	42	21	550	<LOD	428	<LOD	38190	<LOD	66355
100	brown sandy soil with spoil	<LOD	23	588	94	448	<LOD	47059	175	82814
101	brown sandy soil with spoil	<LOD	22	482	68	252	<LOD	40215	114	56962
102	brown sandy soil with spoil	38	13	423	75	235	<LOD	17518	83	50488
103	brown sandy soil with spoil	36	<LOD	381	<LOD	243	<LOD	16790	131	49041
104	brown sandy soil with spoil	39	<LOD	425	81	292	<LOD	17672	142	48964
98	sandy soil with red marl	85	<LOD	67	<LOD	79	<LOD	1012	<LOD	779
99	sandy soil with red marl	80	<LOD	53	40	74	<LOD	772	<LOD	495

Site	Material	Zr	Mo	Ag	Cd	Sn	Sb	Ba	Hg	Pb
205	sandy soil with spoil	108	59	259	<LOD	74	520	11390	<LOD	10568
206	sandy soil with spoil	87	87	257	<LOD	<LOD	837	11046	<LOD	6457
223	mound of green spoil	55	<LOD	179	<LOD	112	<LOD	2954	<LOD	15369
224	pure green mineral	37	<LOD	228	<LOD	122	<LOD	1888	<LOD	27340
247	brown sandy soil	98	<LOD	191	<LOD	160	<LOD	8620	<LOD	7334
248	brown sandy soil	117	<LOD	206	<LOD	205	<LOD	15969	<LOD	8994

Table 2: PXRF data (in ppm) obtained from sites where 'duplicate' measurements were taken.

Bedrock geochemistry

Although the primary emphasis of the survey was to analyse soil compositions, a decision was made during the survey to analyse bedrock exposed at the site. At many sites throughout the area, the soil is a mixture of bedrock-derived materials and introduced material (ore or spoil), and so analyses of the local bedrock can inform interpretations of the soil geochemistry. Other questions of interest include:

(a) Are variations in bedrock composition related to rock type, including colour? Red and green coloured marls interbedded with sandstones are a prominent feature of the site (**Figure 5**).

(b) Are there variations along strike at one particular stratigraphical horizon? To test this, some measurements were made in the south of the area along the uppermost marl bed exposed, underlying the NE-SW trending conglomerate bluff.

(c) Are variations related to stratigraphical position? To test this, a transect of measurements was made through the marl and sandstone sequence at the south side of the site (**Figures 4** and **5**).

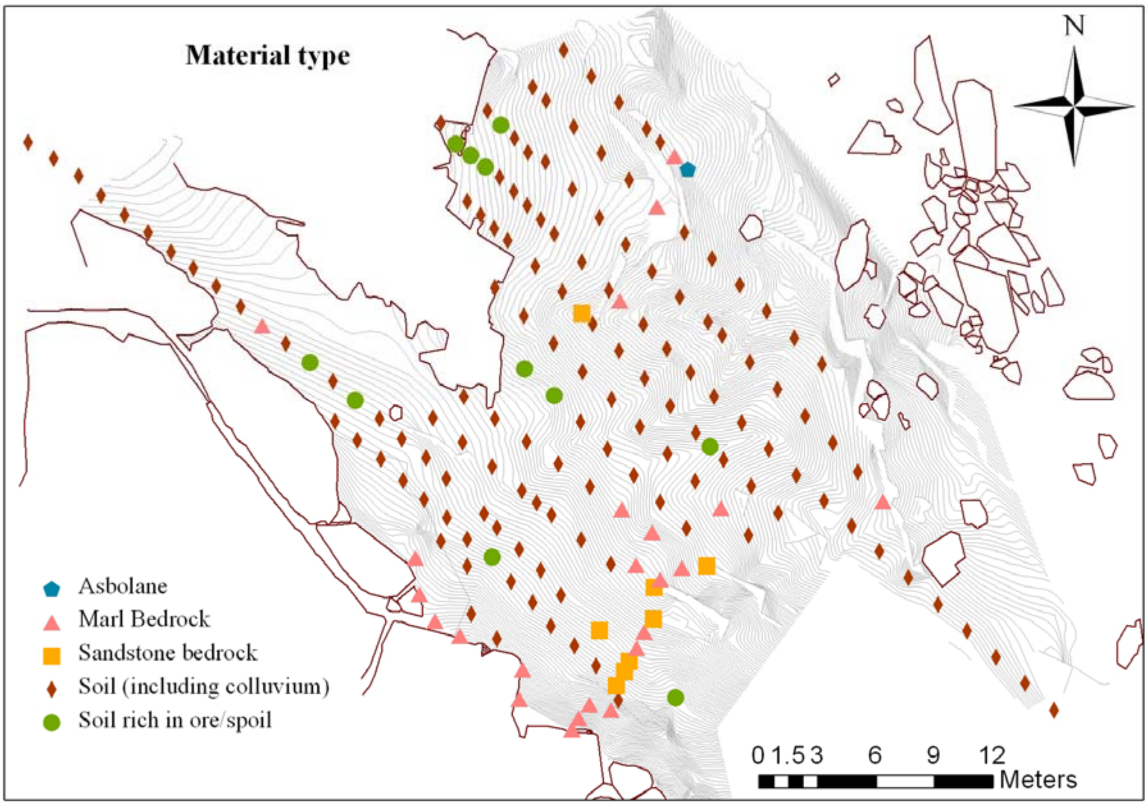

Figure 4: Type of material analysed at each site. Asbolane is a mineral coating (Figure 25).

Averages of 19 measurements of red marl bedrock, and 4 of green marl bedrock (**Table 3**), show no obvious differences: red and green marls are geochemically indistinguishable for most elements analysed. Some red marls are relatively Fe-rich, Cu-rich or Ba-rich compared to other red and green marls. Analyses of the uppermost marl bed (sites 3 to 7, 11 to 13) indicate that the marl is geochemically variable along strike. Indeed this set of analyses shows a similar degree of variation to the entire set of marl analyses.

From a small number of analyses of the sandstone bedrock (**Table 3**), it is concluded that sandstones are geochemically heterogeneous. Green sandstones are geochemically similar to marls, with generally higher Fe contents and in one case high Fe, Cu, Ni and Zn. Yellow or beige sandstones appear to have much lower Fe, Ni, Cu, Zn, Ag, Rb and Sr concentrations than marls or green sandstones. However Pb and Ba concentrations appear to be similar in both categories of sandstone.

Figure 5: View southwest showing the conglomerate bluff underlain by alternating beds of sandstone and red- and green-coloured marls, partially covered with colluvium and spoil.

Material	Parameter	Ti	Mn	Fe	Ni	Cu	Pb	Zn
Red marl	average(19)	4313	182	25906	119	1201	3401	1386
	stdev(19)	*1003*	*68*	*8225*	*66*	*1187*	*2091*	*1265*
Green marl	average(4)	4636	123	21480	111	1071	2303	924
	stdev(4)	*1038*	*23*	*2119*	*32*	*283*	*1337*	*399*
Sandstone	average(4)	2023	120	3594	31	244	1979	170
	stdev(4)	*1124*	*75*	*583*	*6*	*27*	*1000*	*45*
Green sandstone	average(4)	3833	76	15197	151	3499	1877	1440
	stdev(4)	*857*	*74*	*10512*	*215*	*6182*	*1334*	*2455*

Material	Parameter	Ag	Sn	Ba	Rb	Sr	Zr	As	Cd
Red marl	average(19)	103	98	2513	122	118	133	98	60
	stdev(19)	*32*	*26*	*1734*	*26*	*25*	*28*	*65*	*14*
Green marl	average(4)	83	96	844	152	121	121	36	72
	stdev(4)	*9*	*21*	*264*	*17*	*16*	*20*	*4*	*30*
Sandstone	average(4)	41		1812	60	53	129	264	
	stdev(4)	*14*		*1271*	*8*	*3*	*78*	*151*	
Green sandstone	average(4)	68		2036	120	110	131		
	stdev(4)	*35*		*1479*	*59*	*58*	*21*		

Table 3: Averages and standard deviations for analyses of various rock types in the survey area. All values are in ppm.

The SW to NE transect of analyses from sites 13 to 16 and 66 to 73 (**Figures 2** and **4**) were to assess stratigraphical variation in compositions through a thickness of approximately 6m of bedrock, visible in **Figure 5**. **Figure 6** shows the trends for four elements of interest, with concentrations plotted on a logarithmic scale (vertical axis) against site sequence (roughly equally spaced; horizontal axis). Iron and copper show a similar pattern with lower concentrations in the sandstone units, whereas lead and barium show dissimilar trends which are apparently unrelated to the bedrock type.

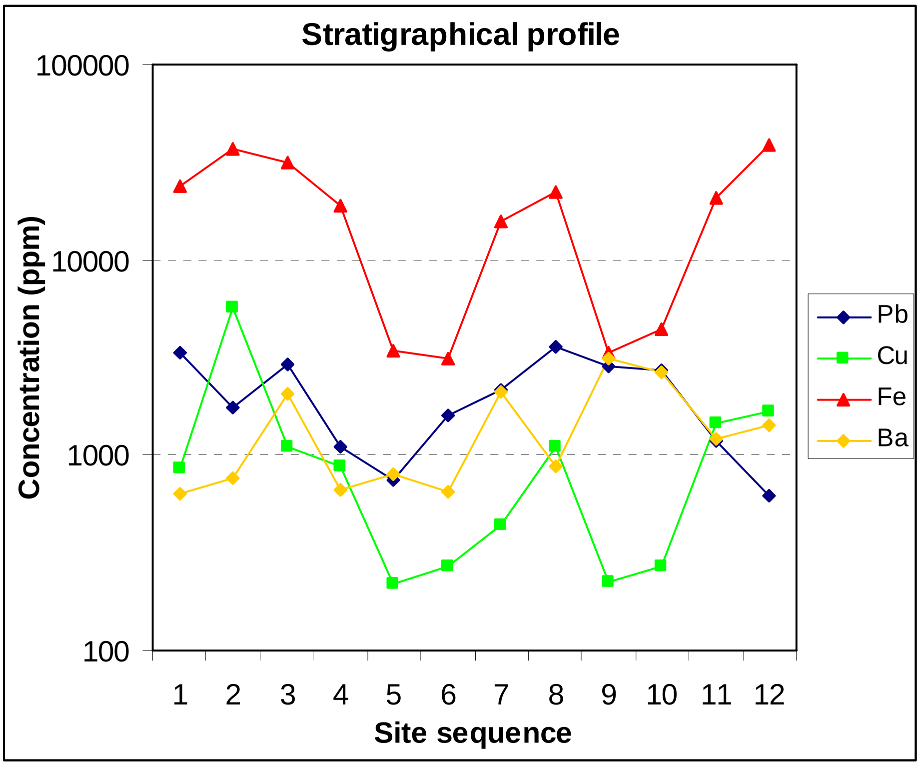

Figure 6: Variation in the concentrations of selected elements in bedrock (vertical axis, ppm on logarithmic scale) with stratigraphical height (horizontal axis, top at left: 1-4 are sites 13-16, 5-12 are sites 66-73). Data from the southern part of the Stormy Point site (Figure 5).

Ti	1												
Mn	0.27	1											
Fe	**0.57**	**0.57**	1										
Ni	-0.14	0.08	0.38	1									
Cu	0.28	0.22	0.46	0.17	1								
Pb	0.23	-0.09	0.18	-0.03	-0.09	1							
Zn	-0.11	0.04	0.45	**0.90**	0.21	-0.03	1						
Ag	-0.02	0.42	-0.01	0.03	0.07	0.30	0.03	1					
Sn	0.05	-0.36	-0.10	-0.15	-0.08	0.16	-0.03	0.12	1				
Ba	-0.32	0.29	-0.40	-0.32	-0.31	-0.03	-0.44	**0.60**	0.00	1			
Rb	**0.60**	0.46	**0.68**	0.11	0.25	-0.01	0.11	-0.13	-0.34	-0.37	1		
Sr	0.20	0.37	-0.16	-0.39	-0.24	-0.21	-0.45	0.47	0.03	**0.69**	0.16	1	
Zr	0.18	0.07	-0.17	0.18	-0.31	-0.13	-0.02	0.09	-0.06	0.30	-0.15	0.31	1
	Ti	**Mn**	**Fe**	**Ni**	**Cu**	**Pb**	**Zn**	**Ag**	**Sn**	**Ba**	**Rb**	**Sr**	**Zr**

Table 4: Pearson Correlation Coefficients for selected elements in the set of 23 analyses of marl bedrock. Values from 0 to +1 (shown black) are positive correlations, from 0 to -1 (shown red) are negative correlations. Interesting correlations are highlighted in bold.

For the set of 23 analyses obtained of marl bedrock, correlation coefficients have been calculated (**Table 4**). Coefficients are shown between 13 elements for which data was above detection limits in all analyses. The matrix shows strong positive associations between three groups of elements namely Fe-Ti-Mn-Rb, Zn-Ni and Ba-Sr-Ag. Cu shows a moderate positive association with Fe (+0.46), as does Pb with Ag (+0.30). Apart from this, lead is not associated with other elements – a feature also concluded from the stratigraphical profile. The Fe-Ti-Mn-Rb association is interesting as relatively high concentrations of these elements appear to be characteristic of marl bedrock.

Soil geochemistry

For the purpose of this report, soil is defined as any surface material that is not bedrock. Therefore 'soil' includes varying amounts of mineralised material (ore or spoil), material derived from the adjacent bedrock, organic material, and colluvium transported down-slope from topographically higher soil and bedrock. Regarding the terms ore and spoil: 'ore' is untreated mined material whereas 'spoil' is the coarse-grained material remaining after processing of ore to recover minerals of value: these are not readily distinguishable at the site. In practice, at Stormy Point there is a continuous range or blend of compositions with no distinct boundary between ore-rich and ore-poor soils.

Soil compositions at Stormy Point determined with the PXRF are summarised statistically in **Table 5** and inter-element correlation coefficients are shown in **Table 6**.

		Ti	Mn	Fe	Ni	Cu	Pb	Zn	Ag	Sn	Ba
All 146 sites	min	1120	48	2397	25	115	545	24	38	62	505
	max	4749	2710	37652	201	25036	59104	9194	475	321	29574
	average	**2524**	**284**	**7873**	**64**	**1634**	**6876**	**336**	**156**	**139**	**8500**
	stdev	*777*	*413*	*5403*	*31*	*3639*	*7428*	*789*	*64*	*50*	*4507*
106 sites with Cu+Pb+Ba <2%	min	1120	48	2397	25	115	545	24	38	62	505
	max	4749	2683	24576	169	2524	13745	1260	220	214	14531
	average	**2496**	**200**	**6756**	**57**	**644**	**4197**	**240**	**129**	**128**	**7001**
	stdev	*815*	*281*	*3807*	*24*	*465*	*2469*	*257*	*39*	*36*	*3158*
		Rb	**Sr**	**Zr**	**As**	**Mo**	**Cd**	**Sb**	**Hg**	**Cr**	**Co**
All 146 sites	min	23	57	39	49	6	39	89	17	97	61
	max	125	362	307	1146	87	80	679	129	193	492
	average	**67**	**168**	**99**	**202**	**16**	**48**	**253**	**38**	**139**	**176**
	stdev	*16*	*60*	*47*	*192*	*18*	*11*	*242*	*34*	*31*	*211*
106 sites with Cu+Pb+Ba <2%	min	41	57	43	49	6	39		17	97	61
	max	125	347	307	234	14	54		25	193	492
	average	**70**	**151**	**98**	**127**	**8**	**45**		**21**	**137**	**209**
	stdev	*15*	*46*	*49*	*55*	*2*	*6*		*3*	*30*	*245*

Table 5: Statistical data for analyses of soils in the survey area. Two sets are presented: statistics for all 146 sites; and for a set of 106 sites in which the total of Cu, Pb and Ba values are less than 2.0% (i.e. soils incorporating relatively low amounts of ore/spoil material). All values are in ppm.

In order to explore the compositional effect of ore mixed with soil, statistics are shown for a sub-group of 106 sites at which the combined total concentration of the ore-indicator elements Cu, Pb and Ba are less than 2.0% (at 40 sites the total exceeds this level). This was found to be a better indication of the presence of ore than visual records. Comparing the averages for the 146 sites (shown brown) and 106 sites (shown black), it can be seen that Ti, Ni, Sn, Rb, Sr, Zr, Cd and Cr have similar values (these elements are not enriched in ore material) whereas Mn, Fe, Zn, Ag, Mo and Hg appear to have higher averages in the ore-enriched soils, in addition to Cu, Pb and Ba as expected. Antimony (Sb) is calculated only in the ore-enriched soils, and strangely, cobalt (Co) appears to have a higher average value in the ore-depleted soils: these are probably artefacts as in many analyses Sb and Co were less than the detection limit for these elements.

Ti	1												
Mn	-0.06	1											
Fe	**0.52**	0.05	1										
Ni	0.31	0.08	**0.74**	1									
Cu	-0.11	0.01	**0.62**	**0.68**	1								
Pb	0.13	0.42	**0.57**	**0.51**	0.38	1							
Zn	0.13	-0.01	0.38	0.42	**0.66**	0.19	1						
Ag	0.09	0.40	0.40	0.42	0.32	**0.77**	0.09	1					
Sn	0.20	0.27	0.24	0.27	0.12	**0.54**	-0.03	**0.54**	1				
Ba	0.06	0.31	0.13	0.21	0.08	**0.53**	-0.11	**0.80**	**0.57**	1			
Rb	**0.57**	-0.12	0.03	-0.09	-0.18	-0.31	0.09	-0.28	-0.04	-0.33	1		
Sr	0.13	0.26	-0.07	0.03	-0.08	0.30	-0.19	**0.72**	0.42	**0.89**	-0.20	1	
Zr	**0.60**	-0.05	0.03	-0.14	-0.14	-0.18	-0.09	-0.11	-0.02	-0.03	0.38	0.06	1
	Ti	**Mn**	**Fe**	**Ni**	**Cu**	**Pb**	**Zn**	**Ag**	**Sn**	**Ba**	**Rb**	**Sr**	**Zr**

Table 6: Pearson Correlation Coefficients for selected elements in the total set of 146 analyses of soil. Values from 0 to +1 (shown black) are positive correlations, from 0 to -1 (shown red) are negative correlations. Interesting correlations are highlighted in bold and very strong correlations are boxed.

Inter-element correlations in the set of 146 soil analyses (**Table 6**) show strong positive associations between three groups of elements, namely Ti-Fe-Rb-Zr, Fe-Ni-Cu-Pb-Zn, and Pb-Ag-Ba-Sr. Ti-Fe-Rb-Zr are 'lithophile' elements associated with rock-forming oxides and silicates. The absence of significant correlations between Cu and Pb, and between Cu and Ba-Sr, support the idea that copper and lead are derived from different materials. The overlap of lead (Pb) in the element groups Fe-Ni-Cu-Pb-Zn and Pb-Ag-Ba-Sr suggests that lead may be associated with two materials: (a) Cu-and Pb-enriched bedrock and copper ore, and (b) Ba- and Sr-rich ore material also enriched in Ag. A more reliable analysis of inter-element associations would require Principal Components Analysis which is beyond the scope of this report (see Recommendations).

Spatial distribution of elements in soil and bedrock

Copper

High levels of copper form a distinct cluster ('hotspot') in the northern part of the area (**Figures 7 & 8**), where green ore is abundant in the vicinity of the carved sandstone embayments (**Figure 9**). Here, a bed of copper-rich material estimated to be around 0.3m in thickness has been exposed by erosion of the overlying copper-poor soil. Localised high copper values over 0.5% occur at five other sites including the possible 'hearth' area in the south (site 24; **Figure 1**). The high copper value at site 74, in the central southeast of the surveyed area, is an analysis of a green coating on sandstone bedrock. Moderately high copper values in the range 0.1–0.25% are characteristic of the marl bedrock analysed in the south of the area.

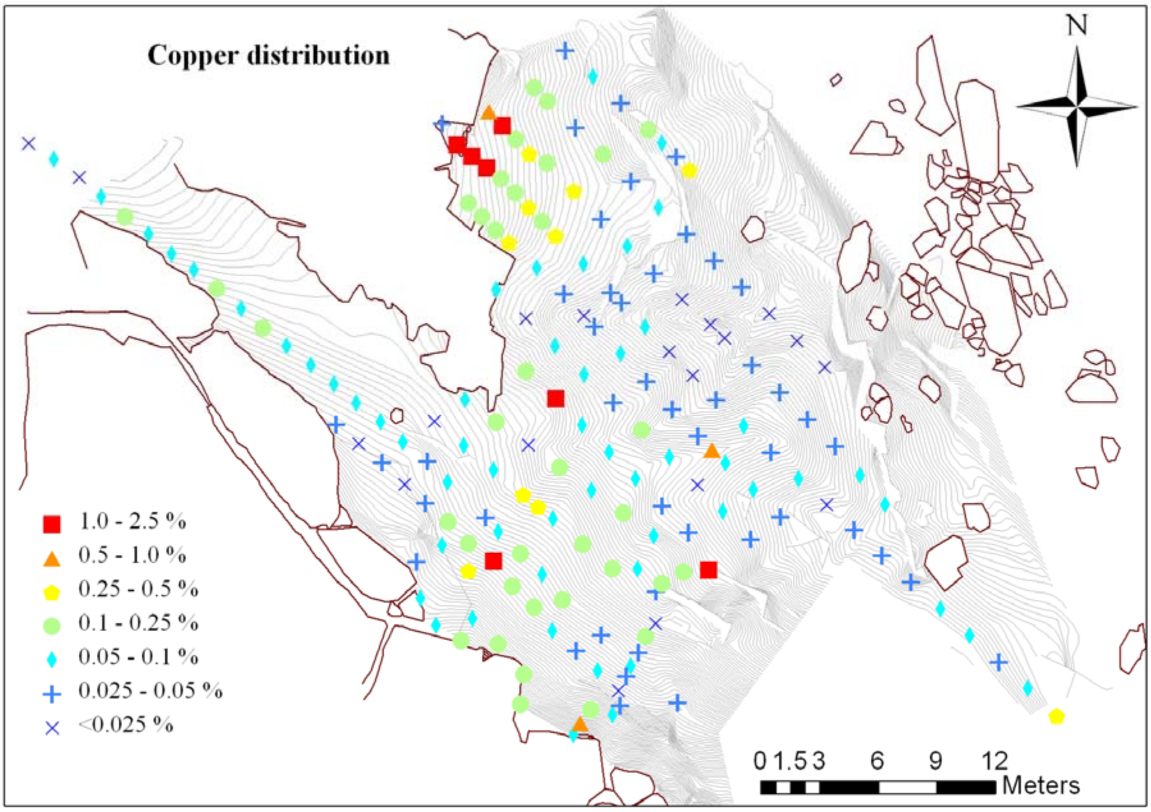

Figure 7: Spatial distribution of Cu values in the survey area (see Fig. 2 for site numbers, Fig. 4 for type of material analysed at each site).

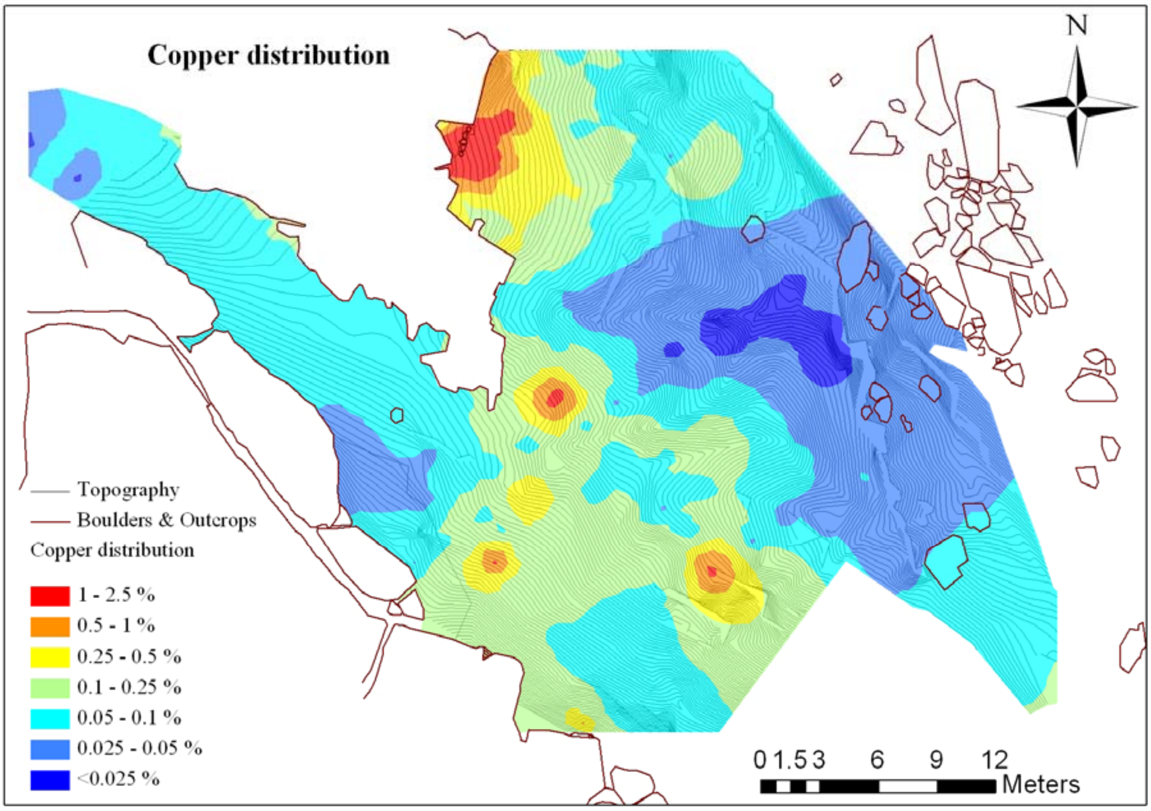

Figure 8: Inverse distance weighted interpolated contour map of Cu in the survey area.

Figure 9: Copper-enriched soil containing green ore minerals at site numbers 222-227, at the northern corner of the surveyed area.

In the **left** photograph, the rich green soil and ore material (analyses 223 and 224 respectively containing 2.5 and 9.3% Cu) is exposed under a capping of brown soil which has low copper content (452 ppm at site 222 in the top corner).

In the **right** photograph, note the dark soil, enriched in organic material, being analysed at site 227: this is interpreted as the floor of the layer rich in ore, although copper values in the underlying soil (sites 228 to 232) remain moderately high at 0.1–0.5%.

Lead

The maps of lead distribution (**Figures 10 & 11**) show that elevated concentrations of Pb are more widespread than Cu in the surveyed area. Very high Pb values occur in the ore-rich soil exposed at site 91 (duplicated in analyses 100-104) and 92 (**Figure 12**). High Pb values also occur in the northern area of copper enrichment, and in eroded remnants ('outliers') of ore-rich material in the centre of the area. High Pb values are also found in the north-western and south-eastern transects, where copper levels are generally low. The lowest levels of lead (less than 0.1%) occur in the northeast and southeast of the area away from areas of ore-bearing soil.

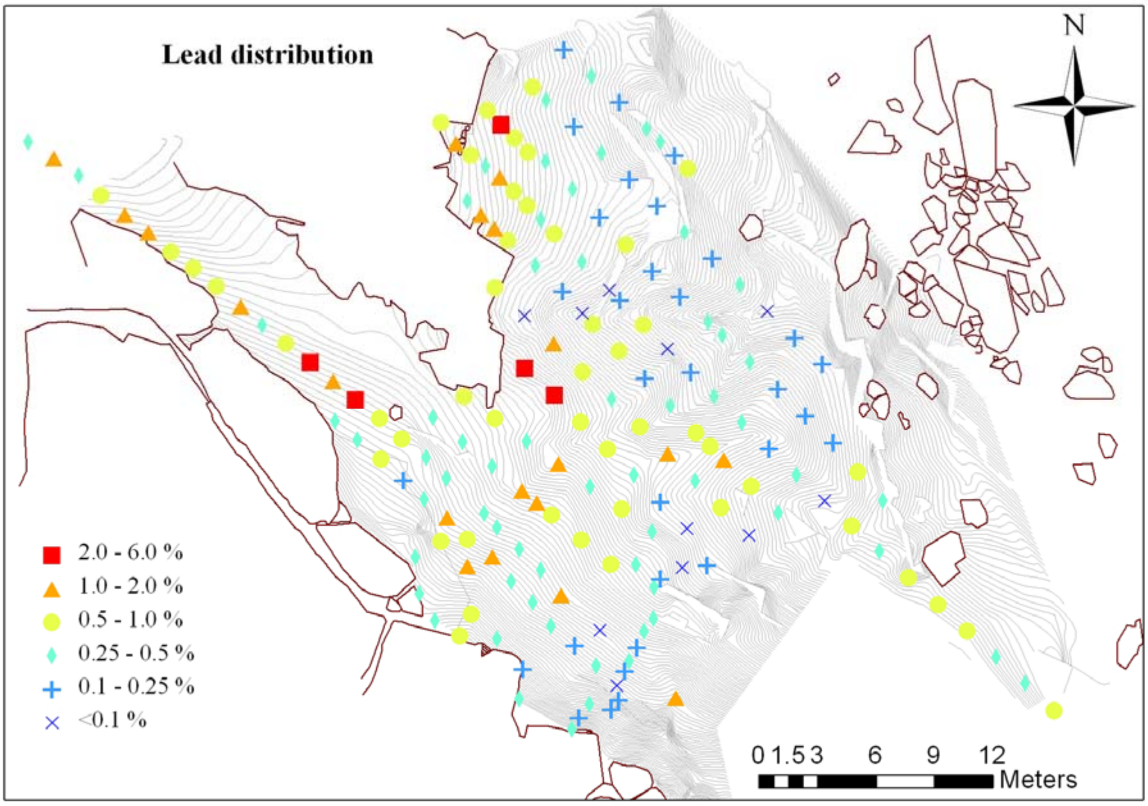

Figure 10: Spatial distribution of Pb values in the survey area.

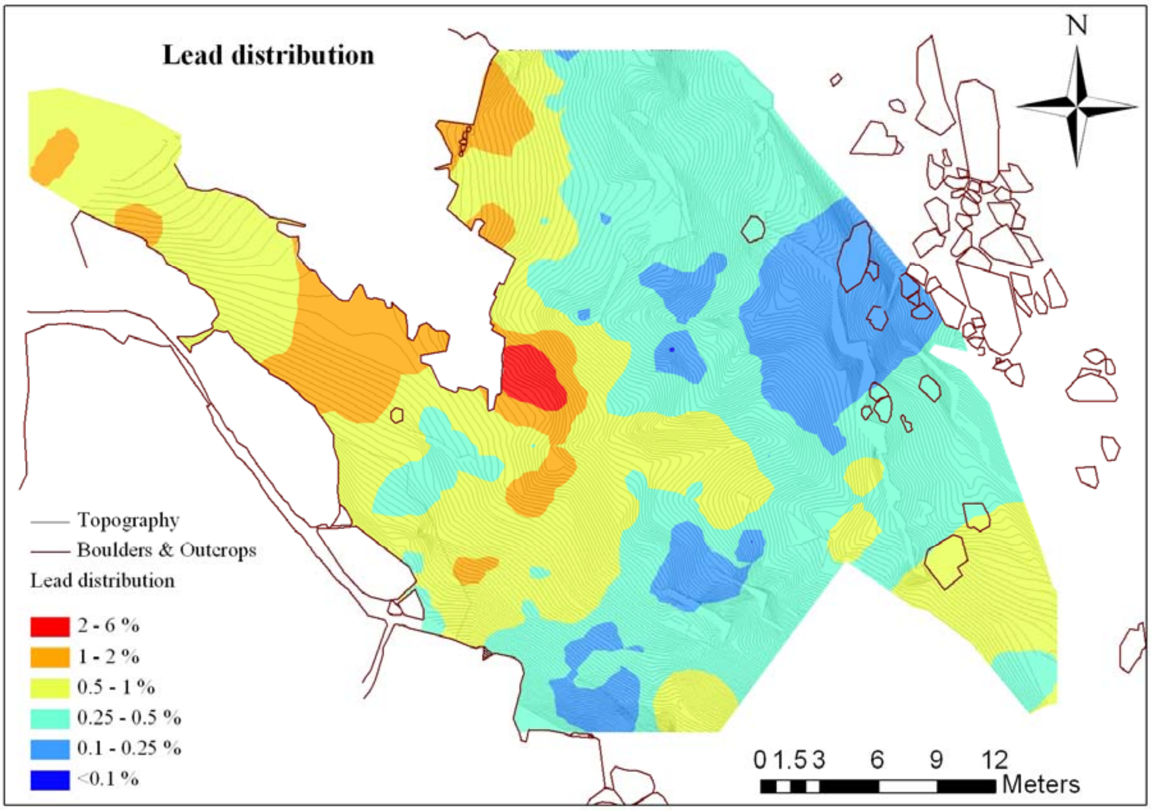

Figure 11: Inverse distance weighted interpolated contour map of Pb in the survey area.

Figure 12: Site 91 (marked by the small cairn and stick) at which high concentrations of Pb, Ba and other metals are related to an exposure of lead-rich ore material (khaki green coloured soil). Note the overlying pebbly soil (upper left) which is mainly colluvium from the conglomerate bedrock upslope, and the underlying brown subsoil that contains sandstone cobbles.

Iron

Iron values (**Figures 13 & 14**) are relatively high (>1%) in the two materials: marl bedrock (see **Figure 4** for distribution) and ore/spoil material. Iron enrichment at site 24 is probably be due to incorporated slag material, since trail analyses of pure slag from this site showed that it is extremely rich in iron, possibly in excess of 50% Fe. Low iron concentrations (>0.4%) are found in beige sandstone bedrock and in soil dominated by sandstone or by colluvial material washed onto the area. Low iron concentrations are also a feature of the soil underlying the copper ore-rich layer at the northern corner of the site (cf. **Figure 9**, right photograph).

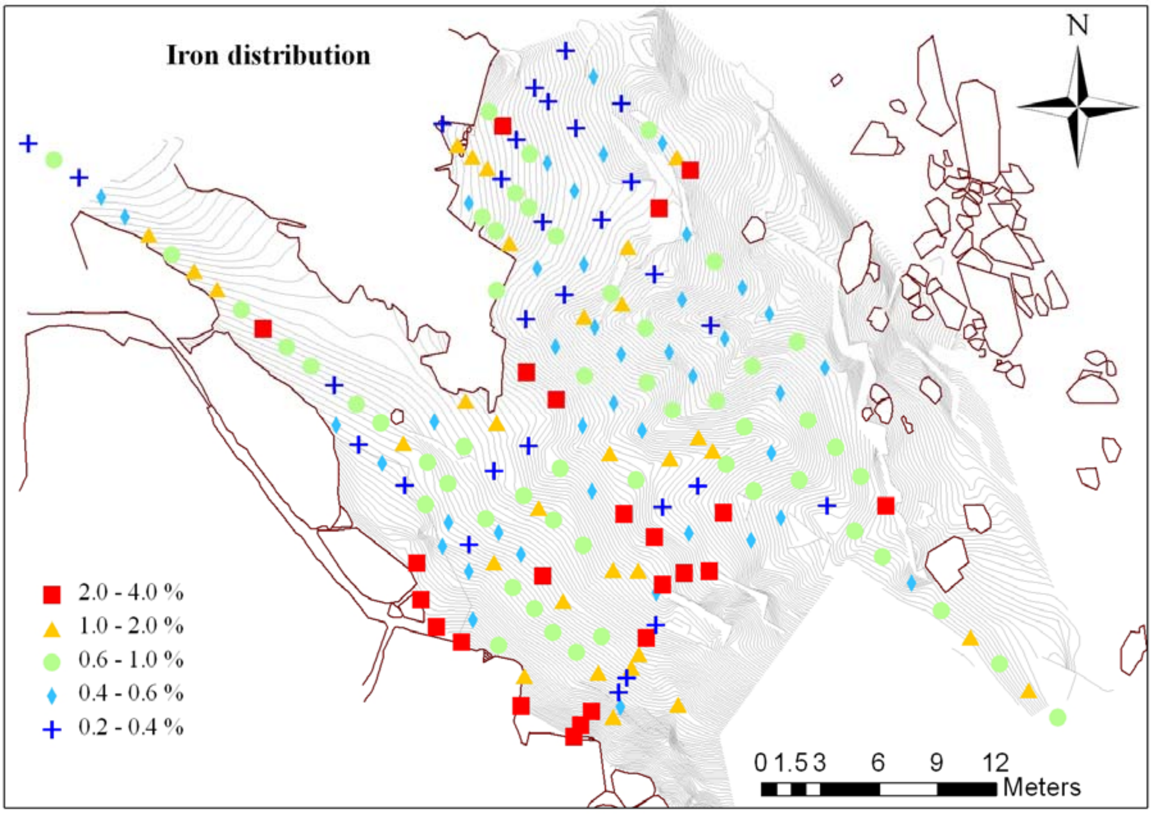

Figure 13: Spatial distribution of Fe values in the survey area.

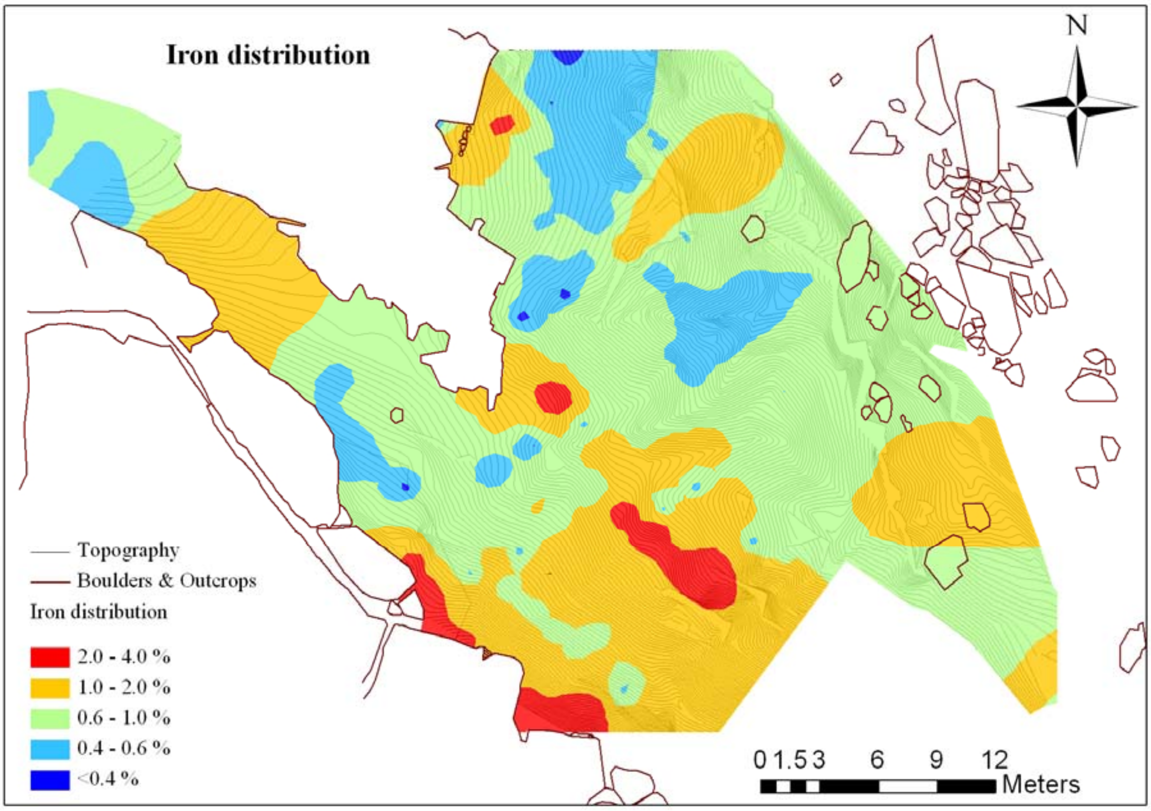

Figure 14: Inverse distance weighted interpolated contour map of Fe in the survey area.

Manganese

Manganese levels range widely and are <500 ppm across much of the site, increasing to 1000–3000 ppm at four locations. One of these, in the northeast, is a bedrock coating of asbolane that is also rich in cobalt and other metals (**Figure 25**). Relatively high Mn occurs in ore-rich soils (associated with high Pb levels) in the west of the site, and in soil overlying the copper-rich layer in the northern corner.

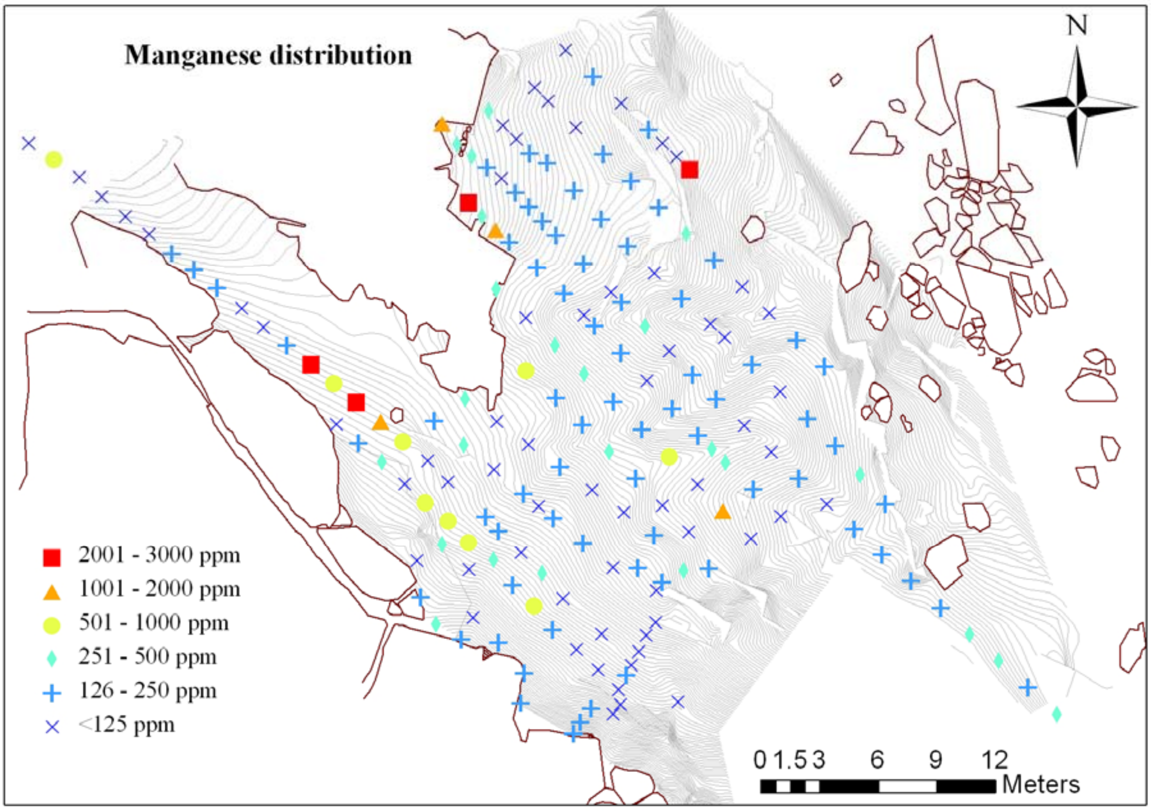

Figure 15: Spatial distribution of Mn values in the survey area.

Zinc

Zinc levels are highly variable across the site, ranging from 20 ppm to almost 10,000 ppm (1%). **Figures 16 & 17** show the high zinc values that occur in marl and green sandstone bedrock (and derived soil) in the central southeast, south and west of the surveyed area. Relatively high zinc values are also associated with Pb and Cu in ore-rich soils, notably the copper-rich material at site 223-224 in the north.

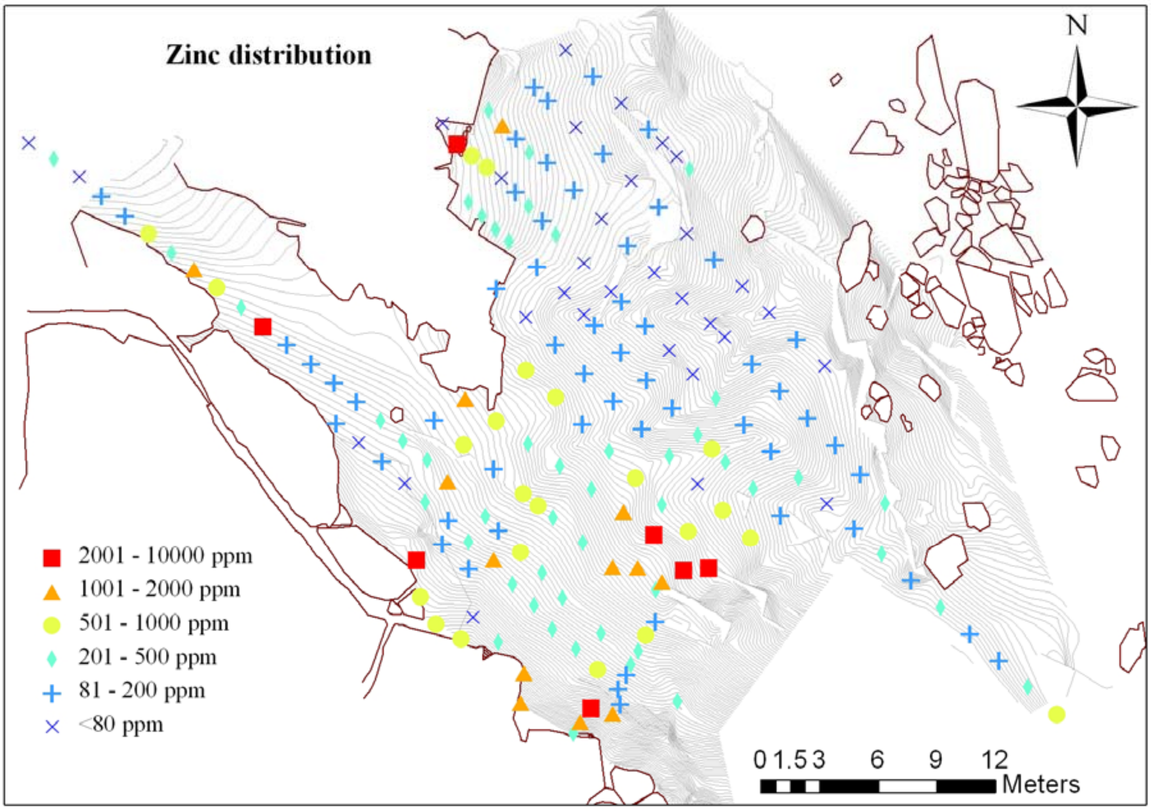

Figure 16: Spatial distribution of Zn values in the survey area.

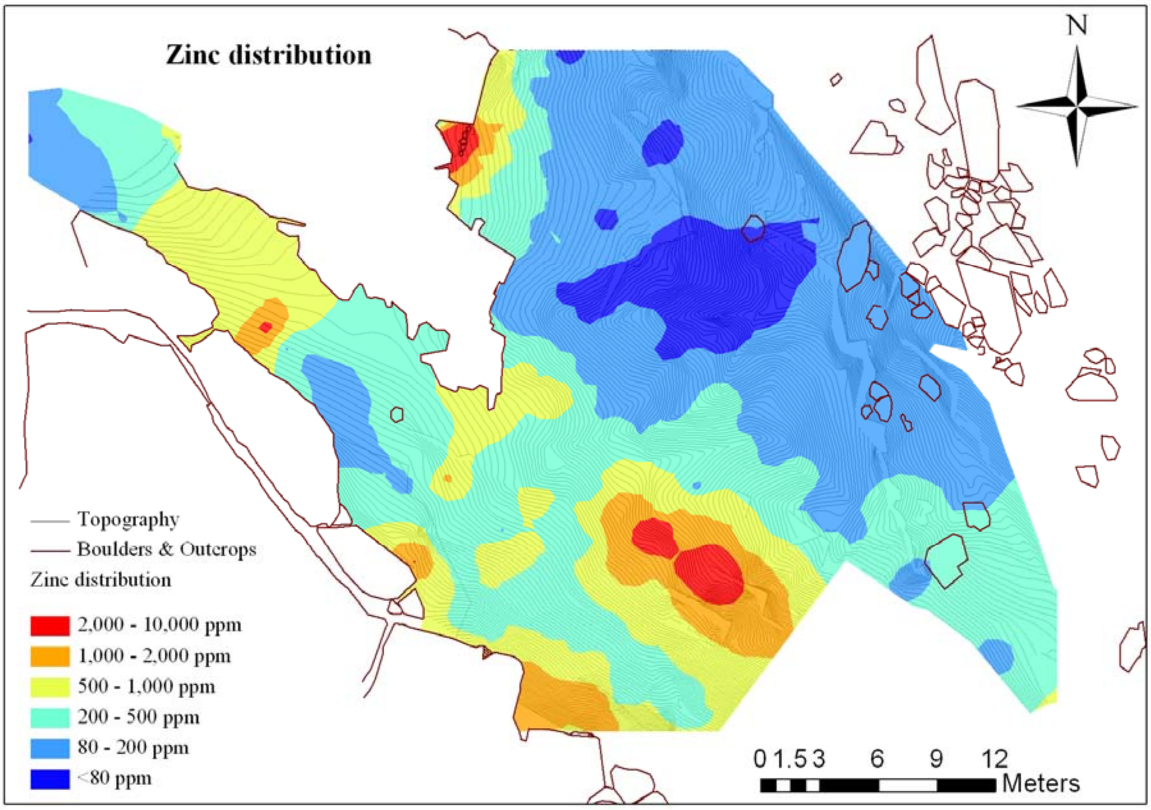

Figure 17: Inverse distance weighted interpolated contour map of Zn in the survey area.

Silver

Compared with the previous elements considered, silver shows a less pronounced variation across the site (**Figure 18**) with values up to 475 ppm. The lowest Ag values are associated with bedrock and ore-poor soils, and the highest values occur in ore-rich soils. The distribution of silver is very similar to that of lead (**Figures 10 & 11**), with which it is strongly associated as noted above in the discussion on inter-element associations. It is probable that silver was a component of the lead ore as it commonly occurs in galena (PbS).

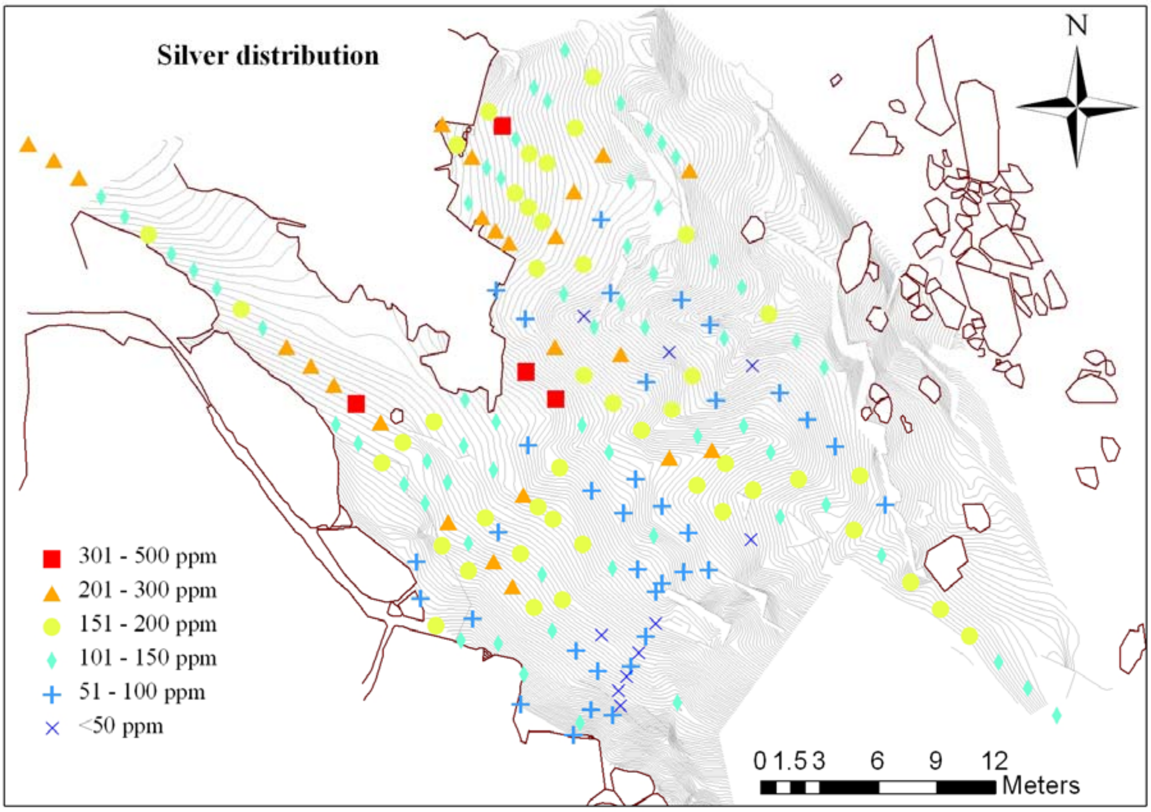

Figure 18: Spatial distribution of Ag values in the survey area.

Barium

Barium is an alkali element that commonly occurs as barite ($BaSO_4$) in hydrothermal mineralization. As with silver, barium shows a distribution (**Figures 19 & 20**) similar to that of lead, suggesting its derivation from ore material. However, relatively high values of Ba are more widely distributed than Pb or Ag, particularly to the southeast and northwest where values are commonly >0.5% in sites where Pb is variable or low. Much of the Ba in these areas is probably derived from the nearby sandstone and conglomerate bedrock, in which barite occurs as a cementing mineral. In some sandstone exposures, barite occurs as 1–2 centimetre-sized sieved crystals. In contrast, marl bedrock has relatively low Ba concentrations and show as blue areas on the contour map (**Figure 20**). Along the northwest transect, site 38 (marl bedrock) has low levels of Ba whereas all other sites in this area have >0.5% Ba (**Figure 19**).

As noted previously, the trace element strontium shows a strong correlation with barium, and a very similar distribution at Stormy Point. Sr commonly substitutes for Ba in barite and other barium minerals.

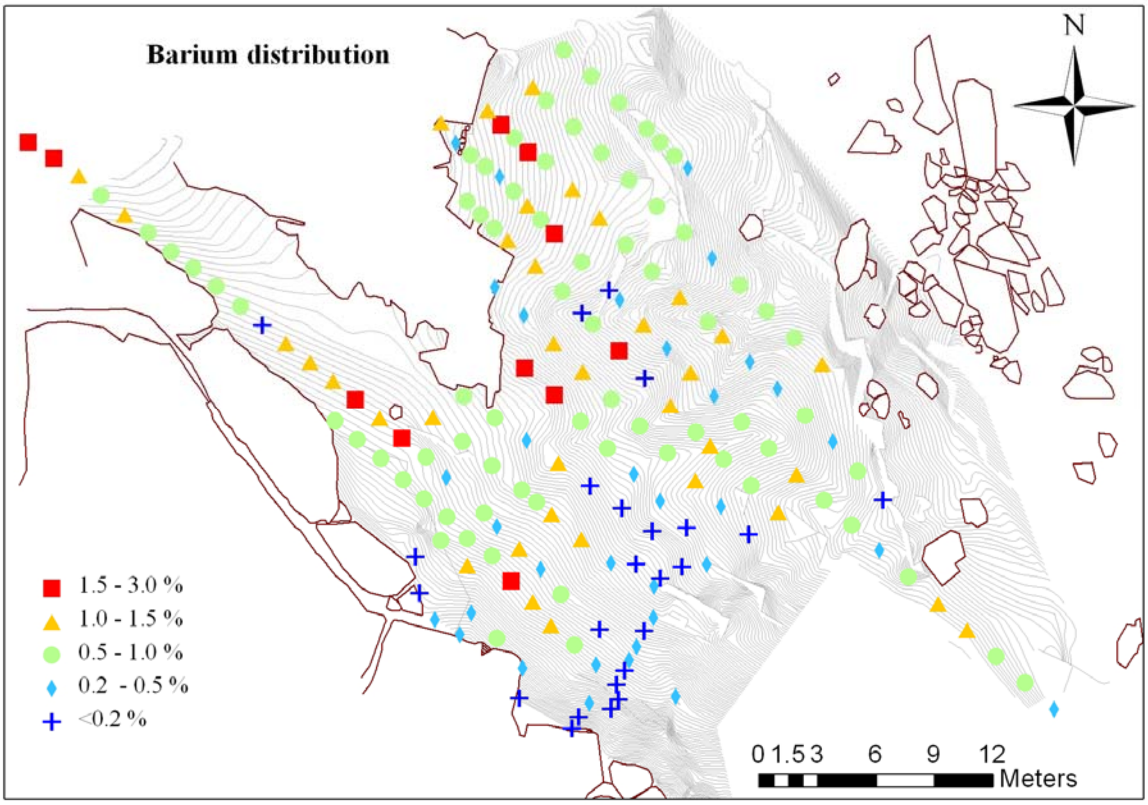

Figure 19: Spatial distribution of Ba values in the survey area.

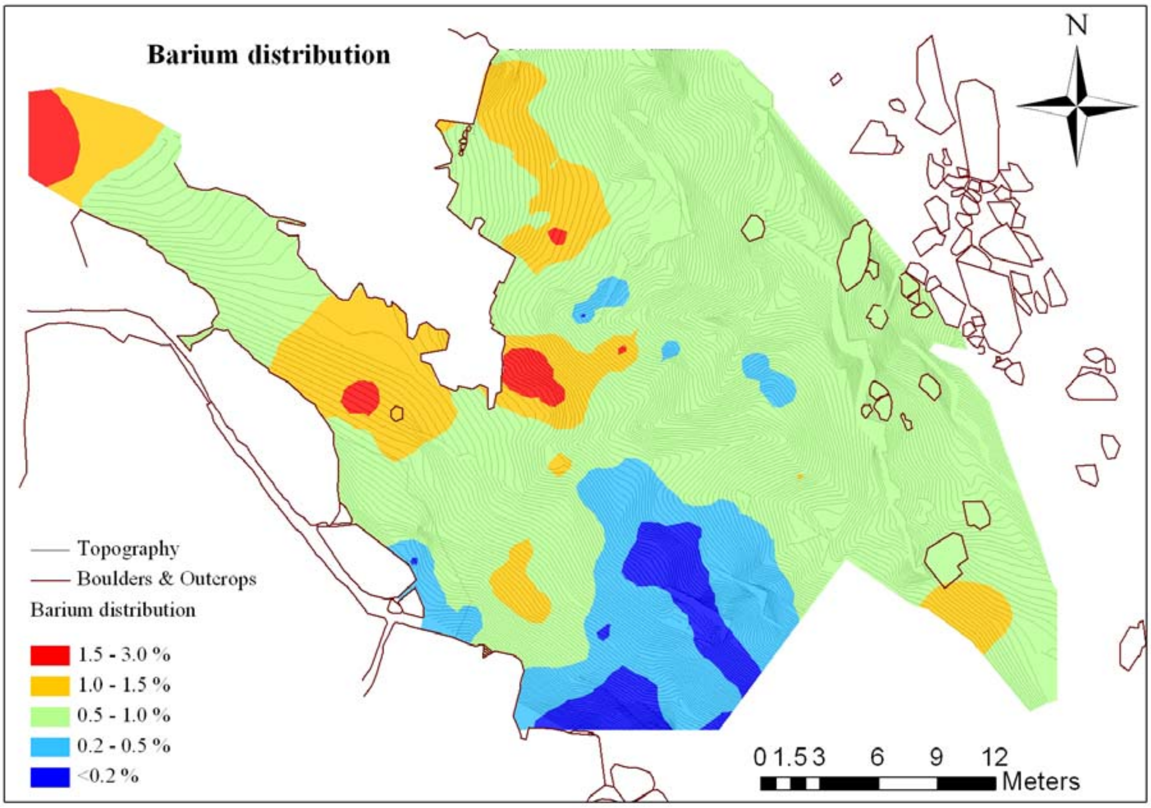

Figure 20: Inverse distance weighted interpolated contour map of Ba in the survey area.

Rubidium

Rubidium is a trace element commonly associated with potassium in minerals such as micas and feldspars. Higher values of Rb are therefore a good indicator of argillaceous bedrock and bedrock-sourced soils. At Stormy Point, Rb values do not vary widely (about one order of magnitude) and relatively high values correspond to sites of bedrock exposure, mostly marl, and marl-rich soil (**Figure 21**). An isolated high value in the centre of the surveyed area, at site 212, was measured in a green sandstone that is probably rich in mica.

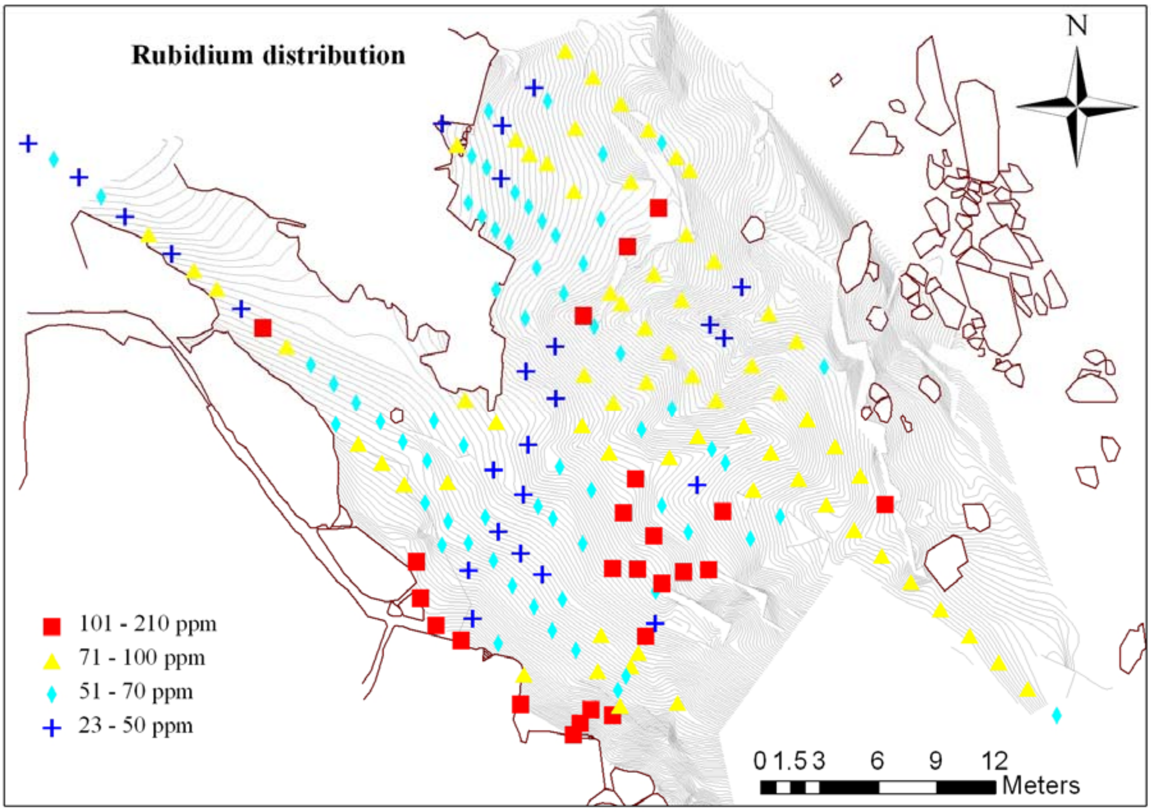

Figure 21: Spatial distribution of Rb values in the survey area.

Tin

With maximum concentrations of around 320 ppm, tin is not particularly enriched in the Stormy Point soils. Tin also shows relatively little variation in concentrations at the site. In contrast to Rb, bedrock has low concentrations of tin and ore material has relatively higher concentrations. Higher tin values occur mainly in soils enriched in lead (**Figure 10**). However, as shown in **Table 6**, the associations between Pb and Sn, and between Pb and Ag, are moderate with a correlation coefficient of +0.54. The distribution of tin in the northern corner (**Figure 22**) is different to that of Cu, Pb and Fe, possibly indicating a different source.

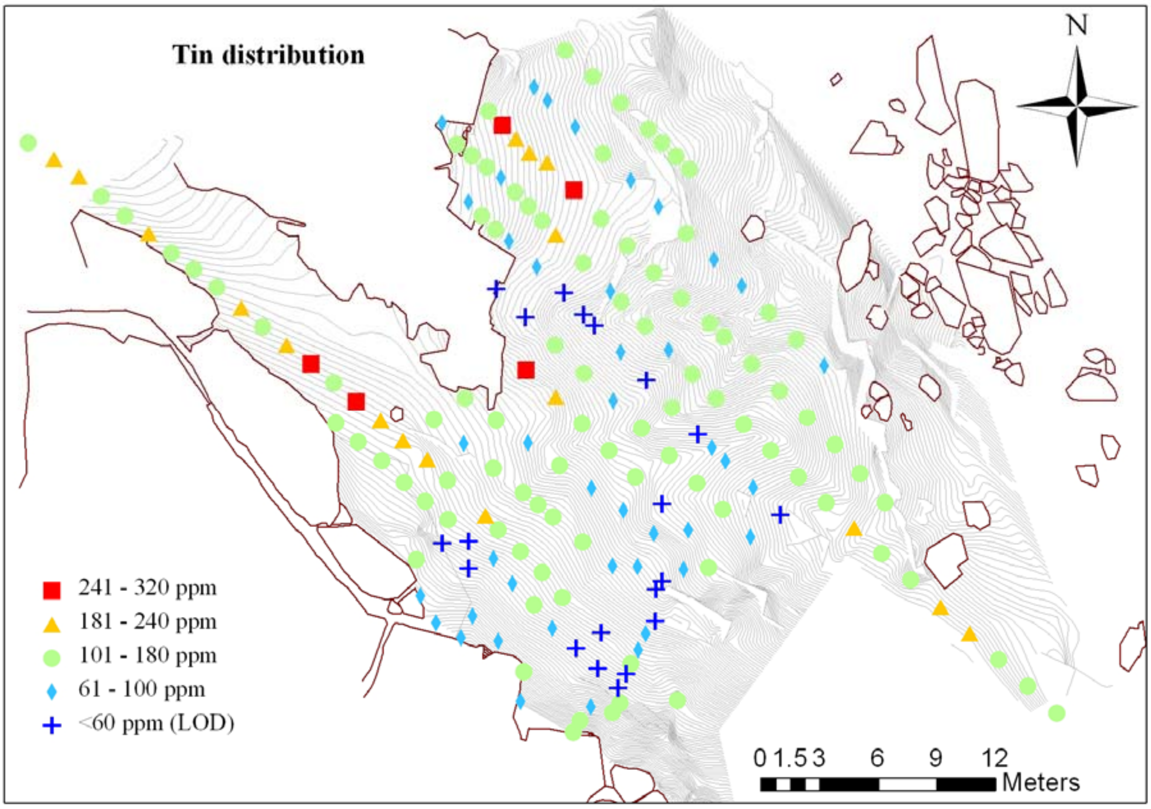

Figure 22: Spatial distribution of Sn values in the survey area.

Arsenic

Arsenic is a metalloid element that is a major component of some ore minerals, for example arsenopyrite (FeAsS) and scorodite ($FeAsO_4.2H_2O$) and a minor component of many other hydrothermal and secondary minerals. It can be enriched in sedimentary rocks e.g. in black shales and phosphate rocks. Arsenic is mobile in soils and is volatilized during smelting of ores. It is acutely toxic when inhaled or ingested.

Arsenic was above the PXRF detection limit (ca. 30 ppm) in analyses at 67 sites (**Figure 23**). The exceptionally high value of 1146 ppm plotted as an outlier [at site 91, 100-14], is an average of 5 analyses ranging from 580 to 1612 ppm (**Table 2**). Relatively high values for As occur at other sites where the soil is enriched in Pb (**Figure 10**). Although the PXRF is programmed to deal with overlaps in the fluorescent spectra of Pb and As, it may be that these very high lead concentrations have interfered with the arsenic peak giving a false reading. However, Pb-As minerals are present at Stormy Point and mineralogical evidence may demonstrate the presence of arsenic at this site. Also of note is the relatively high As value at site 222 in soil above the copper-rich layer (**Figure 9**) that does not have a high Pb concentration. The isolated high As point in the northeast occurs in the asbolane mineral coating analysed at site 291 (**Figure 25**). The asbolane is also enriched in molybdenum, which is the next element to be considered.

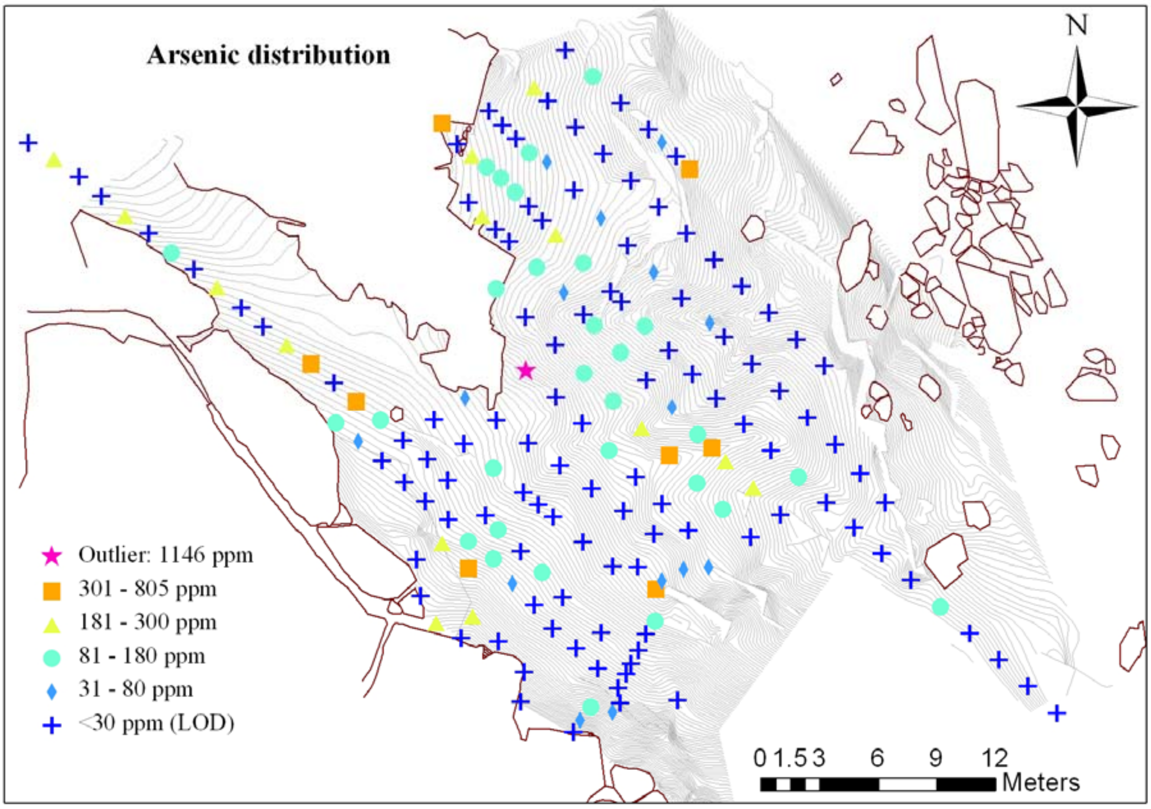

Figure 23: Spatial distribution of As values in the survey area.

Molybdenum

Molybdenum was above the PXRF detection limit (ca. 6 ppm) in analyses at 73 sites (**Figure 24**), with a maximum value of 87 ppm. It is of interest as the distribution corresponds well to areas of observed ore material, particularly copper-rich soils, but not to areas of bedrock regardless of the bedrock Cu content. This supports the hypothesis that most of the copper-rich ore material has been imported to Stormy Point, rather than being derived from mining of nearby bedrock material.

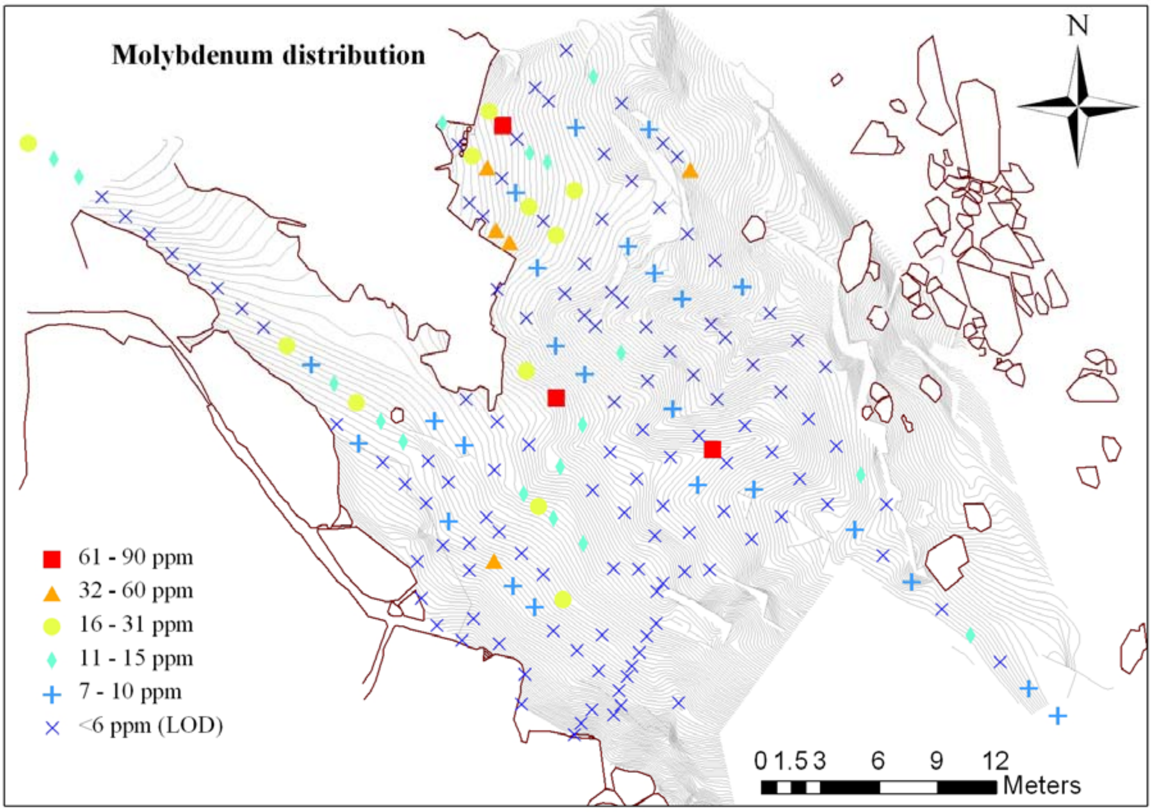

Figure 24: Spatial distribution of Mo values in the survey area.

Cadmium and cobalt

Cadmium and cobalt were detected in a small number of analyses, in total 22 and 10 respectively, and distribution maps are not presented here. Cadmium levels of 65 to 93 ppm occur in marl bedrock at sites 14-16 and 73, and in Pb-rich ore at site 91, 100-104. Cobalt concentrations up to around 600 ppm occur in a few marl bedrock analyses, and a value of 8.8% cobalt was indicated in the asbolane coating at site 291 (**Figure 25**).

Figure 25: Blue-grey coating of cobalt-rich asbolane on sandstone bedrock below a red marl bed at site 291, in the northeast of the survey area. Hammer for scale: shaft is ca. 300mm.

Conclusions and recommendations

A 2-day survey of the eroded soil materials and exposed bedrock Stormy Point using a portable XRF metals analyser has provided useful geochemical data and maps. Of particular interest is the variety of ore (or spoil) material exposed at the site, which is thought to have been used in mineral dressing and smelting activities from the Bronze Age onwards. This variety is shown by differing spatial patterns of metal distribution, as well as inter-element associations indicated by simple statistical analyses of the dataset. The availability of data for several minor metals, such as molybdenum, is important as these may allow the discrimination of multiple sources of metals in the soils.

Specifically, the association of silver, tin and molybdenum with ore-enriched soils, and not with copper-enriched bedrock and derived soils, suggests that the copper ore at the site was brought in from another area – rather than having been worked from the sandstones and marls in the immediate vicinity of the site.

The geochemical maps confirm that the area of most interest for copper ore processing is in the north / northwest of the site where a layer has been exhumed of ore-rich soil overlying a thin dark soil presumed to be an ancient land surface (**Figure 9**). A small area of lead- and barium-rich ore, with very high metal levels, has been exhumed in the central western part of the area (sites 91–92). Metal levels along the base of the conglomerate bluff towards the west are locally high, and at one location (site 12) abundant charcoal was found along with glassy, iron-rich slag at a shallow depth, possibly indicating the presence of a small furnace (also suggested by magnetic surveys).

WERG recommends that further work should include:

(1) Processing of the existing set of PXRF data using log-ratios and Principal Components Analysis, which may reveal distinctive element associations corresponding to the various types of ore/spoil material suspected to be present at the site;

(2) Mineralogical analyses of soil samples from selected sites, followed by comparison with the geochemical data from these sites, which may further unravel the variety and provenance of ore/spoil types. This would be facilitated by comparing the compositions of ore from Stormy Point with that from other ancient mine sites around Alderley Edge;

(3) Further PXRF surveys of the area during excavation to obtain measurements in vertical profiles and along ancient ground surfaces. The survey reported here is difficult to interpret because the exposed surface is in effect an oblique section through the soil layers, with varying amounts of ‘contamination’ of the soils by material washed downslope (colluvium);

(4) Extension of the area surveyed to the southeast and northwest, as transects in these directions clearly show that ore-bearing soils extend outside the exposed extent of the site. This would involve temporarily removing small blocks (sods) of organic-rich soil and vegetation to expose the mineral soil underneath.

Appendix 2: Environmental Report

Archaeological Services
University of Durham

Stormy Point, Alderley Edge, Cheshire

palaeoenvironmental assessment

on behalf of

University of Manchester Archaeology Unit

Report 1810
January 2008

Archaeological Services
Durham University
South Road
Durham DH1 3LE
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Stormy Point, Alderley Edge, Cheshire

palaeoenvironmental assessment

Report 1810
January 2008

Archaeological Services Durham University

on behalf of

University of Manchester Archaeology Unit
University of Manchester, Oxford Road, Manchester, M13 9PL

Contents

1. Summary

The project

1.1 This report presents the results of the palaeoenvironmental assessment of bulk samples taken during an excavation at Stormy Point, Alderley Edge, Cheshire, by the University of Manchester Archaeology Unit.

Results

1.2 Four small samples of non-oak charcoal were recovered from (32), (38), (168) and (174); these are potentially suitable for obtaining AMS radiocarbon dates.

2. Project background

Location and background

2.1 Excavations were conducted by the University of Manchester Archaeology Unit, on the important prehistoric mining site at Stormy Point, Alderley Edge, Cheshire. A palaeoenvironmental assessment was carried out on bulk samples taken from deposits of mining waste.

Objective

2.2 The objective was to assess the palaeoenvironmental evidence in the bulk samples and to recover charcoal suitable for radiocarbon dating and the identification of tree taxa utilised at the site.

Dates

2.3 Analysis and report writing were carried out between 18th and 22nd January 2008.

Personnel

2.4 Assessment and report preparation were conducted by Dr. Helen Ranner. Processing was carried out by Mr Bryan Atkinson.

Archive

2.5 The site code is **SP07.** The flots and residues are retained in the Environmental Laboratory at Archaeological Services Durham University, for collection.

3. Method

3.1 A total of thirteen bulk samples were taken from the two test pits, 4 and 5. Contexts (168) (174) were fills of a prehistoric prospection pit, of which (170) and (171) were the primary fills. The others are believed to be colluvial deposits. The full volume of each sample was manually floated and sieved through a 500 μm mesh. The residues were retained, described and scanned using a magnet for ferrous fragments. The flots were dried slowly and scanned at ×40 magnification for charcoal, calcined bone and mining waste. Identification of these was undertaken by comparison with modern reference material held in the Environmental Laboratory at Archaeological Services Durham University.

4. Results

4.1 The flot volumes were consistently small; (174) produced 25ml of material and the other samples produced between 10 and <5 ml of material. The flots consisted principally of sand with a few fragments of charcoal. A small fragment of charcoal deriving from pine wood was identified in (174), and an additional piece of alder or hazel charcoal was in (32), suggesting that these taxa were being utilised at the site. Coal was present in (37), (168), (169) and (171). Very small levels of modern roots and miscellaneous plant material were common throughout with insect remains recorded in (33), (34), (168) and

(174). Some of the mineral in (168) was tinted with copper corrosion products, and some contained significant levels of copper. There are very small fragments of non-oak charcoal that are potentially suitable for radiocarbon dating in (32), (38), (168) and (174). Charred seeds and bone were absent from the samples.

5. Recommendations

5.1 The four fragments of non-oak charcoal are potentially suitable for processing for AMS radiocarbon dates, although they may prove to be too small to provide sufficient carbon for analysis. No other further work is recommended for the samples due to the dearth of charred plant remains.

Appendix 3: AMS Dating

Scottish Universities Environmental Research Centre

Rankine Avenue
Scottish Enterprise Technology Park
East Kilbride Scotland UK G75 0QF

Director: *Professor A B MacKenzie*

Email: **g.cook@suerc.gla.ac.uk**
Telephone: **01355 223332**
Direct Dial: **01355 270136**
Fax: **01355 229898**

RADIOCARBON DATING CERTIFICATE

9 April 2008

Laboratory Code	SUERC-17839 (GU-16447)
Submitter	Graham Mottershead University of Manchester Archaeological Unit University of Manchester Oxford Road Manchester M13 9PL
Site Reference	Stormy Point, Alderley Edge, Cheshire
Sample Reference	SP07 Sample 174
Material	Charcoal : Diffuse porous (non oak deciduous)
$\delta^{13}C$ relative to VPDB	-24.7 ‰
Radiocarbon Age BP	9160 ± 35

N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

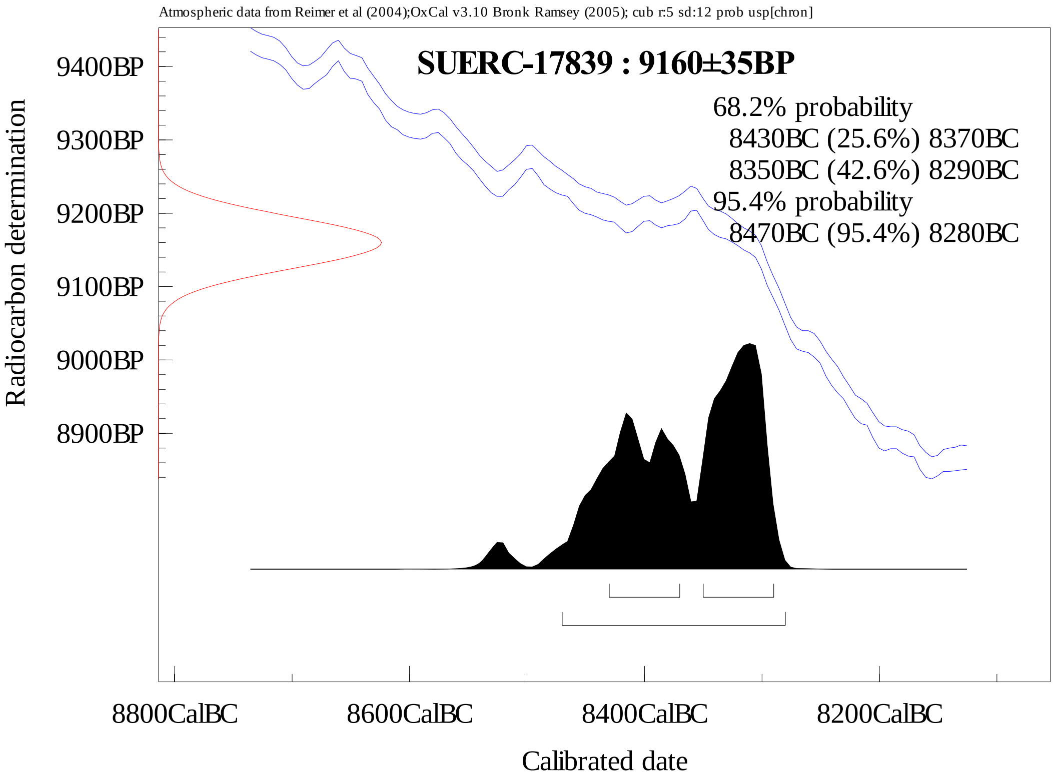
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



SUERC

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RADIOCARBON DATING CERTIFICATE

9 April 2008

Laboratory Code SUERC-17840 (GU-16448)

Submitter Graham Mottershead
University of Manchester Archaeological Unit
University of Manchester
Oxford Road
Manchester M13 9PL

Site Reference Stormy Point, Alderley Edge, Cheshire
Sample Reference SP07 (168) <17>

Material Charcoal : Diffuse porous (non oak deciduous)

$\delta^{13}C$ relative to VPDB -24.1 ‰

Radiocarbon Age BP 3320 ± 35

N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

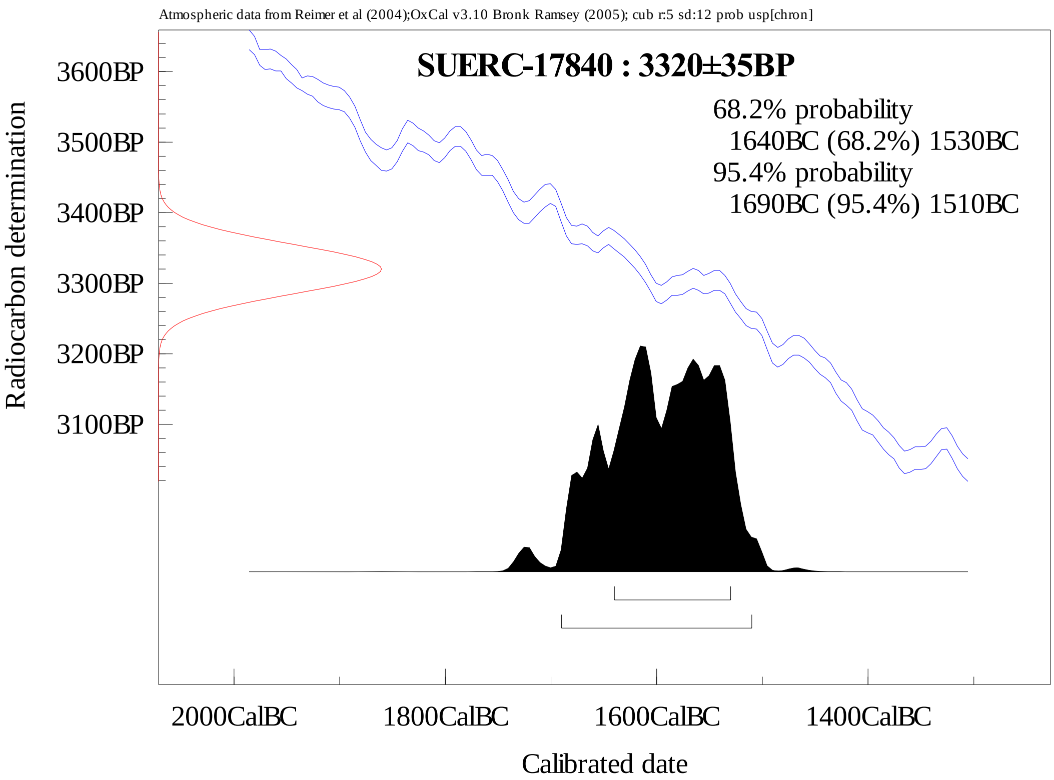
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



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RADIOCARBON DATING CERTIFICATE

9 April 2008

Laboratory Code	SUERC-17841 (GU-16449)
Submitter	Graham Mottershead University of Manchester Archaeological Unit University of Manchester Oxford Road Manchester M13 9PL
Site Reference **Sample Reference**	Stormy Point, Alderley Edge, Cheshire SP07 (38) <10>
Material	Charcoal : Diffuse porous (non oak deciduous)
$\delta^{13}C$ relative to VPDB	-24.6 ‰
Radiocarbon Age BP	2220 ± 35

N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

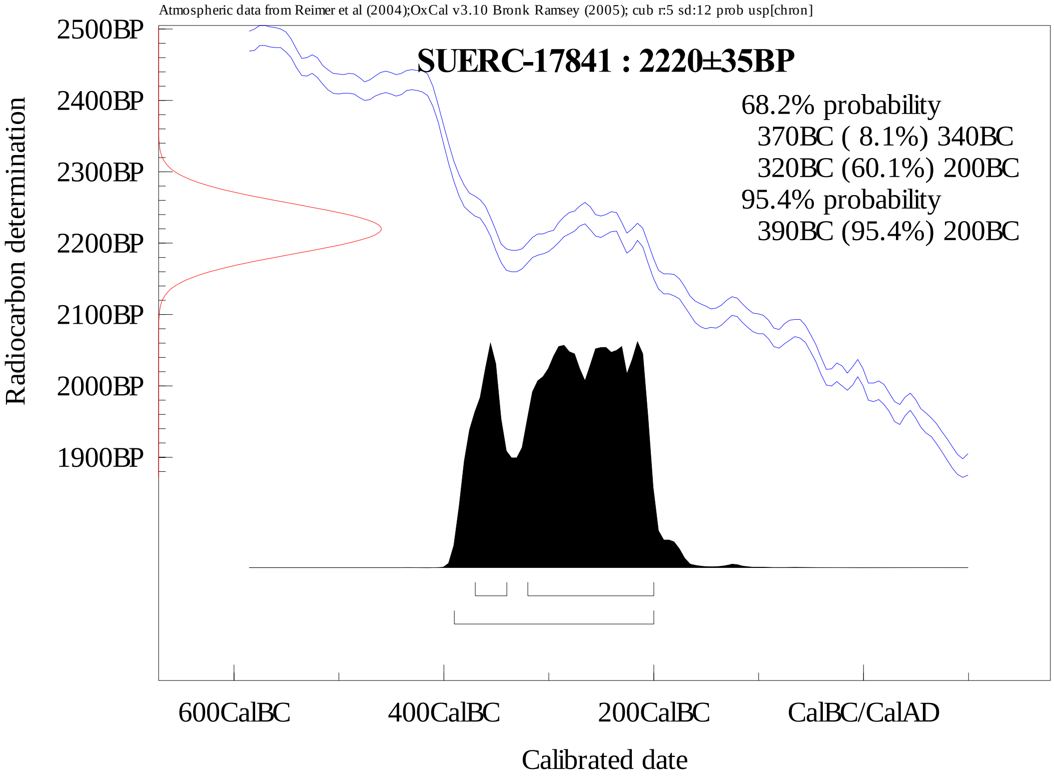
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



Director: *Professor A B MacKenzie*

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RADIOCARBON DATING CERTIFICATE

9 April 2008

Laboratory Code	SUERC-17842 (GU-16450)
Submitter	Graham Mottershead University of Manchester Archaeological Unit University of Manchester Oxford Road Manchester M13 9PL
Site Reference	Stormy Point, Alderley Edge, Cheshire
Sample Reference	SP07 (32) <4>
Material	Charcoal : Diffuse porous (non oak deciduous)
$\delta^{13}C$ relative to VPDB	-27.0 ‰
Radiocarbon Age BP	900 ± 40

N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

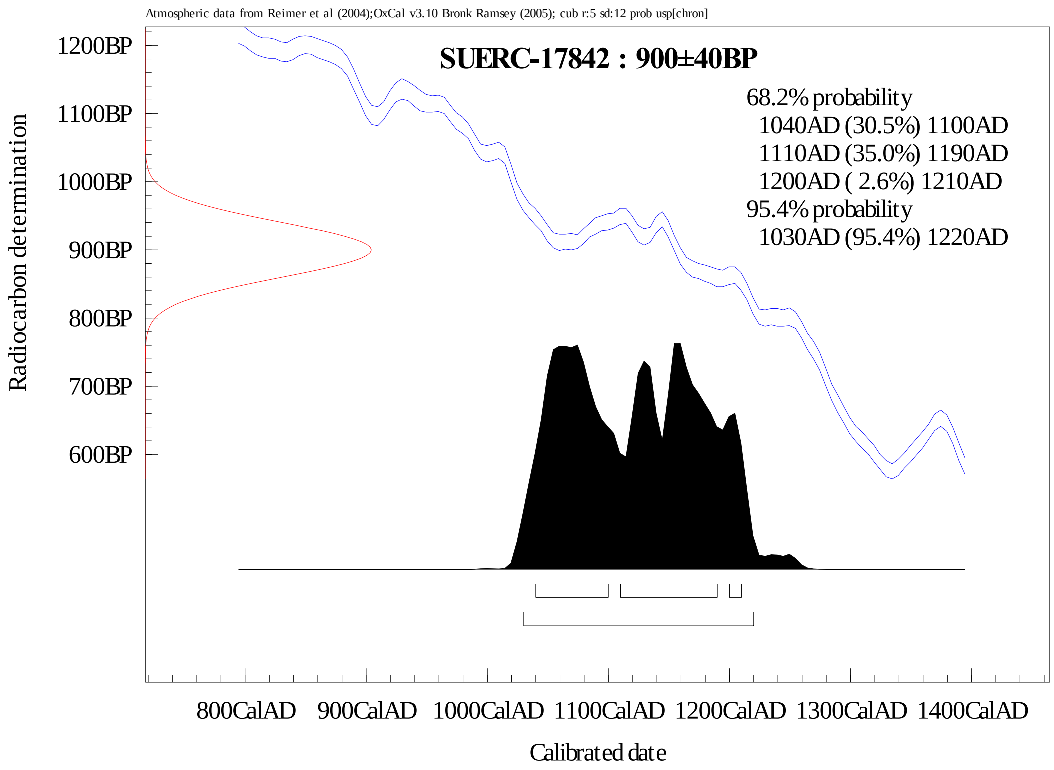
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



Appendix 4: Slag Analysis

Industrial Waste from Stormy Point

M. Adams (NMLFAU)

Introduction

Samples of industrial waste from test-pits at Stormy Point were examined at National Museums Liverpool Field Archaeology Unit. The assessment was conducted according to the guidelines in Jones (2001).

The samples were examined as hand specimens under natural light using a hand lens. A magnet was used to assess the magnetism of larger fragments and to retrieve magnetic particles from any sand fraction present. No analytical work was undertaken.

Description

Eight bags containing a total of c. 2.7 kg of industrial waste were submitted for examination. Three bags had no details of the context, one bag was labelled 'slag from initial clean' and the remaining four bags were from contexts 116, 117, 118 and 119.

A detailed description of the contents of each bag is given in the catalogue.

In general the contents of each bag were very similar. All of the bags contained fragments of purplish grey, vesicular slag with a dark grey streak suggesting a fayalitic composition typical of pre-Industrial bloomery and smithing slags. In general the pieces were very fragmentary, ranging in size between 80-10 mm with very few diagnostic pieces present. One unlabelled bag contained what may be a section of smithing hearth base, though this is very fragmentary and this identification must be regarded as provisional. There was no evidence of tap slags. A few pieces had partly vitrified hearth lining attached which is in a coarse sandy fabric. Most fragments were at least moderately magnetic and some strongly magnetic which suggests the presence of iron inclusions. Most fragments were fresh and uncorroded though where corrosion products were present they were ferrous. In general there was little evidence for the type of fuel used, though one fragment (context 116) contained small black inclusions provisionally identified as coal.

In addition to the larger fragments of industrial waste most bags contained a sand residue. All of these residues contain strongly magnetic particles including small plates identified as flake hammerscale. Some contexts (e.g. 116) also contained small (<5 mm) flecks of coal.

Discussion

Most of the larger pieces of slag are undiagnostic of process, though the presence of iron corrosion products and the magnetism of most pieces suggest that they relate to ferrous metallurgy and the relatively small quantities present suggest smithing rather than smelting. There is little clear evidence of the fuels used, though it is possible that coal was at least part of the fuel mix which suggests that the assemblage derives from smithing rather than smelting, the sulphur content of coal making it unsuitable for smelting operations (Jones 2001, 10).

The only diagnostic element of the assemblage was the magnetic fraction within the sands. This contained small fragments of flake hammerscale likely to originate from iron smithing and was present in all contexts. There is little evidence of the date of the assemblage, though its general character suggests that it is pre-Industrial Revolution. The use of coal as a fuel suggests that it is Roman or later.

Recommendations for Further Work

It is unlikely that any further analytical work would add significantly to the conclusions in this report.

References

Jones D. M. 2001*Archaeometallurgy: Centre for Archaeology Guidelines*. English Heritage.

Catalogue

Unlabelled bag	0.55 kg	c.50 pieces 20-50 mm across, purplish grey, vesicular very fragmentary, most weakly magnetic, most are moderately magnetic, some with sandy hearth lining adhering. No diagnostic forms. No direct evidence of fuel.
Unlabelled bag	0.35 kg	5 fragments and sand, 80-20mm across, purplish grey vesicular very fragmentary. Most are weakly magnetic, some with sandy hearth lining adhering very fragmentary one possible plano-convex cake/smithing hearth base.
Stormy Point June 07 Slag	0.07kg	13 fragments 15-40mm across purplish grey vesicular very fragmentary, most weakly magnetic, no diagnostic forms.
TP6 SP07 Slag from initial clean	0.35 kg	c. 50 pieces 50-10 mm across, mainly purplish grey vesicular very fragmentary, most moderately magnetic. No diagnostic pieces. Sand fraction includes unidentified magnetic particles and flake hammer scale
SP 07 TP6 17/7/07 Slag from (116)	0.2 kg	c. 20 pieces 50-20 mm across purplish grey vesicular very fragmentary, most weakly magnetic, one with inclusions of coal(?), no diagnostic forms. Sand fraction includes coal, unidentified magnetic particles and hammerscale
SP 07 TP6 17/7/07 Slag from (117)	0.2 kg	c. 15 pieces 50-20 mm across, mainly purplish grey vesicular very fragmentary, some weakly magnetic. No diagnostic pieces. Two pieces with iron corrosion products and shale(?) inclusions. Sand fraction includes coal, unidentified magnetic particles and flake hammerscale.
SP07 TP6 17/7/07 Slag from (118)	0.85 kg	c. 50-80 pieces ranging in size from 60 mm across to c. 15 mm across. Bag also contained sand. Some smaller fragments strongly magnetic, some with evidence of iron corrosion products. Sand fraction contained magnetic particles including what appears to be flake hammerscale. Slag fragments are generally very fragmentary and vesicular. Includes one fragment of burnt shale(?) with vitrified surface or adhering slag. No diagnostic forms. No direct evidence of fuel but some flecks of coal(?) in sand.

SP 07 TP6 18/7/07 Slag from (119)	0.15 kg	c. 10 pieces 70-10 mm across, mainly purplish grey vesicular very fragmentary, most moderately magnetic. One fragment denser with iron corrosion products. Sand fraction includes unidentified magnetic particles

Appendix 5: Finds Report

Assessment Report for the Artefacts recovered during the Archaeological Evaluation at Stormy Point, Alderley Edge, Cheshire.
Report by Ruth Garratt.

1. Introduction

This report contains details of the pottery and clay tobacco pipe assemblage excavated by the University of Manchester Archaeological Unit during July 2007 as part of an archaeological evaluation at Stormy Point, Alderley edge, Cheshire (site code: SP07). The assemblage was viewed by the author in October 2007.

2. Methodology

The assessment was carried out in accordance with the guidelines set out by English Heritage in *Management of Archaeological Projects 2nd Edition, Appendix 4* (English Heritage 1991a) and with reference to the *Guidelines for the Processing and Publication of Medieval Pottery From Excavations* (Blake & Davey 1983) and the *Medieval Research Agenda* drafted by the *North West Region Research Framework* (Newman 2004 in Brennand 2007).

All categories of find were examined in full, with observations supplemented by the finds records generated during the course of the fieldwork. The finds were categorised according to fabric type and class and entered onto a database in order to prepare a preliminary catalogue. The finds were then digitally photographed. Full details of all recovered material reside within the project archive held at the University of Manchester Archaeological Unit.

3. The Finds

The finds were examined in context alongside other categories of artefact recovered from the excavation. The medieval ceramic and clay tobacco pipes were catalogued according to ware type and form. The assessment conformed to the minimum standards established by the *Medieval Pottery Research Group* (2001) for the *Processing, Recording and Analysis of Post-Roman Ceramics* and the *Draft Guidelines for Using the Clay Pipe Record Sheets* established by the University of Liverpool (Higgins & Davey 1994).

All categories of material were washed, bagged and sorted by type. Ware types and fabrics were examined by eye and sorted into type on the basis of fabric, form, glaze and decorative technique. An estimation of the range of forms based on fragment profile and diagnostic features such as rim and base fragments formed the basis of the analysis. A digital photographic archive was produced and any related fragments were bagged individually.

4. The Pottery

4.1 Quantification

A single fragment of medieval pottery was recovered from a well stratified deposit in Test Pit 8. Context (130) was identified as a friable loam soil deposit associated with the entrance to a mine or bench quarry. This deposit also contained fragmentary evidence of clay tobacco pipes dating to the late 17th or early eighteenth century.

4.2 Fabric, Form and Surface Treatment

The fragment of medieval pottery is a rim sherd made from white-firing local coal-measures clay with a faintly pinkish hue, and reduced light grey inner core. The sherd is highly abraded with a suggestion of a residual external light brown colour-coat or slip visible on the underside of the rim with a pinkish-orange slip continuing down the external body surface, suggesting that the vessel may have been glazed externally at some point, or with at least some attempt at external surface modification/treatment.

The surface of the pottery in its basic state feels harsh, abrasive to the touch and has the appearance of a calcite gritted ware, although the texture is relatively fine, with small closely spaced irregularities. The surface is pitted by vesicles as a result of the regular protrusion of inclusions in the clay matrix.

Although highly abraded the rim appears short and everted, with no evidence of sooting on the underside or over the external surfaces. The fabric is very coarse, with abundant/moderate sub-angular large grey quartzitic inclusions suggesting a relatively local source of production, possibly even within a 20 mile radius of the site.

The diameter of the rim would suggest a relatively modest sized vessel, possibly a deep dish or bowl, or jar. Although these vessels served multiple purposes, the lack of sooting or heat scorching on the surfaces suggest that this vessel was not used a cooking pot or placed over a fire. Unfortunately, the size and condition of the fragment renders precise identification of form and function impracticable but the sherd could represent part of a small everted-rim jar, similar to forms identified in ceramic assemblages at Rhuddlan (Speakman 2000, 143 after Owen 1994 196 fig 18.3) or Pipkin.

4.3 Context

The heavily abraded surfaces of the fragment indicate that it had already been deposited in the ground some time before finding its way into this deposit, suggesting that this is not its primary context. Because of the uncertainty of its deposition and the nature of the archaeological deposit in which it was found it is uncertain whether this fragment represents merely a stray, possibly residual find in a soil which has been artificially 'brought into' the site in order to decommission the working mine or if it represents the possibility of preserved medieval ploughsoil deposits and occupation in the area during this period.

4.4 Range & Variety/Comparative Material

Similar examples of this fabric have been recovered from sites across the North-west, and more recently in central Manchester and Salford (Garratt 2005: Garratt 2007) as well as sites further to the south-west (Speakman 2000). Miscellaneous white-bodied medieval pottery commonly comprises a small percentage of medieval ceramic assemblages otherwise dominated by reduced grey wares and red/grey firing sandy-bodied wares of the 13th and 14th centuries.

The Alderley Edge sherd is distinctly different in appearance from the typical local ceramic traditions of Cheshire. Comparable material could be sourced outside the county, with the suggestion of wider links with contemporary production centers at Ewloe and Buckley (J. Edwards *pers. comm.*) rather than Chester wares, as a more appropriate comparison.

Everyday medieval pottery was made on a small scale locally. A number of medieval pottery kilns have been excavated in the area such as those at Audlem, Ashton and pottery finds in deposits associated with the regional centre at Chester, such as Deanery Fields (Rutter 1990)

4.5 Analysis

The study area at Alderley Edge has no published ceramic type-group on which to base a comparative analysis of the single pottery fragment. The nearest assemblages of excavated material are largely centred on excavations at the regional centre at Chester, where occupation strata from the Romano-British period through to the post-medieval period provides crucial stratigraphic and contextual evidence for pottery seriation.

Although Chester is the nearest established large urban centre it is approx 25 miles from the study area. Within a 10 miles radius pottery has been excavated from Altrincham and Stockport to the north-west and north-east respectively which appear to provide evidence for the trans-Pennine trade links of northern gritty wares, Hillam-type wares from Yorkshire and pale-firing sandy fabrics of South-west Lancashire.

Pottery kilns at Eaton, Ashton and Brereton Park all lie to the south-east of the study area, with the kiln at Sneyd Green, Staffordshire directly to the south. Alderley Edge is situated in a liminal zone between Greater Manchester, Lancashire, Cheshire, Derbyshire and Staffordshire. The appearance of the fabric of the sherd recovered from Alderley has affinities with 'Type 5a Ware' identified in the medieval ceramic assemblage recovered from a domestic occupation site at Brunt Boggart, Tarbock in Merseyside (Speakman 2000).

As a result of the paucity of evidence, it has been suggested that before the 9th century AD Cheshire was largely aceramic or that habitation of the area was so light during the Post-Conquest period that settlement and occupation deposits are poorly represented (Edwards 1994, 69). Continental imports have been found dating to the late 8th or 9th century but the prevailing local ware-type was *Chester Ware*, which dominated assemblages in the late Saxon Period at Chester typified by sandy orange fabrics (Laing 2003, 102).

In the 13th and 14th centuries the town was supplied by kilns operating to the south and north at Ashton and Audlem, specializing in highly decorative and anthropomorphic jugs, as well as cooking pots. Earlier Chester-Type wares have a more pinky-buff hue with distinctive upright rims and form part of a widespread tradition from the 10th century (Laing, 2003 81). However, the sherd from Stormy Point does not share the same characteristics of these dominant traditions and appears to have closer affinities with the whiter fabrics of similar vessels recorded as Sandal

Castle 'Type 1a' dating to the 12th to early 13th century described as a hard white wheel-thrown fabric with small angular inclusions (McCarthy & Brooks 1988, 145).

Other regional wares include Shelly Wares and Stamford Wares from the East of England. Kiln sites for these types are widespread with similar wares produced at Kilns in Staffordshire from the early 10th century until the Norman Conquest. During the Medieval Period red/grey wares emerge as the dominant fabric type with lead-glazed jugs and highly decorative and anthropomorphic vessels produced at the Ashton and Audlem Kilns (Laing 2003, 102). However, it is still unclear how these different types inter-relate to each other in terms of contemporary or sequential typologies.

Undoubtedly, the ceramic sequence for the region is obscure during the medieval period, with little structural or artefactual evidence for the immediate post-conquest period (Edwards 1994, 70). Occasional finds of diagnostic rim sherds from 12th century cooking pots have been recorded across the region but these, like the Alderley Edge find, are usually stray residual finds. During the 13th and 14th centuries the artefactual evidence increases mirroring the castle-building activity during the campaigns of Henry III and Edward I against the Welsh. Documentary evidence chronicles the construction, destruction and modification phases of many of the castle installations on the welsh borders, providing crucial relative dating evidence (Davey 1977).

A contemporary tradition which appears alongside the Chester and Shelly wares of the 13th and 14th centuries is a miscellaneous group of white wares made from hard, white firing clays which have been identified as having a similar range of inclusions to the coal measure clays seen in the 14th century Ewloe-type wares produced near Buckley (Edwards 1994, 71: Laing 2003, 103). The fragment from Stormy Point can be tentatively grouped within this tradition.

These types, identified in deposits at Chester all exhibit a copper-coloured green glaze or clear glaze appearing yellow and perhaps are predecessors to the later influx of pink/white wares popular in the late medieval period, represented by small drinking jugs, bottles and storage vessels. Many pieces identified as part of this tradition are so fragmentary that the range of forms is unclear and possibly originate from more than one source, perhaps originating in the Midlands. The white-firing clays are derived from the carboniferous coal measures clays which are characteristic of the Prescot and St Helens areas (Speakaman 2000, 140) and similar clays occur throughout Cheshire and the West Midlands (Williams 1985, 56). It is possible that the red/grey wares of the 13th and early 14th centuries are superseded by the pink/whiter wares and could imply a Staffordshire, Derbyshire or historic Lancashire link, suggesting a mid-late 14th century date for the Stormy Point sherd.

5. The Clay Tobacco Pipes

5.1 Quantification

A small assemblage of fragmentary clay tobacco pipes were recovered during the archaeological evaluation at Stormy Point. A single stem fragment was recovered from the same context as the single sherd of medieval pottery (130) and has been tentatively dated to the late 17th or early 18th century as the distinctively oval section would imply at date after the late 17th century. The fabric is white-firing and could represent an imported fabric.

The remainder of the clay pipe assemblage was recovered from deposit (052) in test pit 2. A total of 13 individual fragments were recovered, representing a minimum of 4 individual pipes. Table 1 lists the fragments in more detail, showing the number of bowl (B), stem (S) and mouthpieces (M) recovered from each context and their overall date range. A 'deposit' date is also given representing the most likely date for the deposition group, based on the pipe fragments alone, and not taking into account any other site or stratigraphic evidence.

Code	Cxt	Frags	B	S	M	Range	Deposit	Comments
SP07	(052)	13	4	9	0	1660 - 1750	1660 - 1720	Minimum if 4 individual pipes identified; two pre 1720; Both made from coal measure fabric: evidence of burnishing on earlier stem; oval section on later bowl/stem; flattened spur pipe (1660 to 1680); reduced inner grey core; suggestion of transitional types present
SP07	(130)	1	0	1	0	1680 - 1750	Post 1700 - 1720	Oval section; no burnishing; fine fabric; off-white colour; possible import; post 1700

Table 1: Catalogue of Clay Tobacco Pipes recovered from Stormy Point evaluation.

5.2 Fabric, Form, Range and Variety

Clay tobacco pipes are one of the most useful dating tools for post-medieval archaeological deposits. They are ubiquitous on most archaeological sites and had a short live-expectancy, subject to rapid change in size and shape, reflecting contemporary socio-economic factors. They can often be provenanced to a specific production site or at the very least, a regional centre.

The context summary shows a fairly restricted range of pipe fragments were recovered with the two archaeological deposits, contexts (052) and (130), producing only 17th or 18th century material. However, context (052) also contained two very small, white fragments, one from the stem and one from a bowl, which could suggest an early 19th century date.

Several of the fragmentary bowls and stems have a reduced inner core and suggest that they may have been poorly fired. This could indicate a local source of production within a 20 to 30 mile radius, presumably using local Coal Measure clays around the Anglo-Welsh border. These bowls, based on the form and fabric, appear to have a pre-1700 date and comparable material has been found in deposits excavated during archaeological work at No 6 Market Place, Altrincham (Higgins 2004).

One of the most complete partial bowl and stem fragments recovered from Stormy Point exhibits a flattened spur and has been tentatively dated to forms occurring from

1660 1680. This example appears to have been produced from a local, rather than imported white clay fabric and represents the earliest pipe recovered from There are no makers' stamps or marks on any of the fragments and as a result the exact provenance or dates for these items is given based on form and fabric alone. There are some fragments which exhibit markedly oval stem sections which suggest they could be 'transitional' types, dating to the early 18th century.

Burnishing is evident on the one of the early stems with the flattened spur. However, the fabric is quite smooth and has an off-white colour. The reduced inner grey core would suggest this example was poorly fired but could represent a transitional type, copying the more popular Rainford types which will have been increasingly available to the wider market after 1700.

5.3 Discussion

Although this assemblage is too small to drawn any firm conclusions it does however, provide contextual evidence for the nature of the archaeological deposits at Stormy Point, Cheshire. These clay pipe fragments were recovered alongside a single piece of medieval pottery in backfilled deposits associated with the entrance to a mine. The formation of the deposits appears to consist of friable loam soils that may have been imported into the area in order to effectively 'close-down' certain areas of the site, or used to remodel the landscape in that specific place. Clearly, the medieval pottery represents a residual sherd, however the security of the deposits is questionable and it is uncertain whether the clay pipes themselves were in fact in their primary context.

Unfortunately the date range based on the clay pipe evidence would suggest that these deposits, particularly context (052) could have either taken some time to accumulate or that the deposit itself represents a mixed backfill which was imported from elsewhere and deposited in a single backfilling event.

6. Discussion

6.1 The Early medieval period

There have been relatively few stratified sequences of medieval ceramics which have been written up as published groups for reference but a regional reference collection is curated in Chester. However, known production sites before the 13th century are still rare (Edwards 1994). The period is well known to have few ceramics, although this could simply be an artefact of identification, or survival in the largely acid soils of the North West, or both (Newman 2004a). In the later medieval period evidence for pottery production in the north-west remains poor (Newman 2004b).

The only other evidence to date for a 'local' pottery tradition in the region is Chester ware (Rutter 1985), although some caution as to provenance should be exercised as the only known kilns for this group to date are in Stafford (Ford 1995). Finds of the material concentrate in Chester, although small numbers of sherds have been found in the rural hinterland (Rutter 1985; Brotherton-Radcliffe 1975; Higham 2000). It has a wide distribution beyond the southern boundaries of the North West, but has not to date been found north of the Mersey

6.2 The Medieval Period

The evidence for pottery and tile production in the North West is generally poor. As mentioned above, two tile kilns were excavated in Chester at the Deanery field and a dump of medieval roof tiles, including wasters were recovered during excavations at George Street (Rutter 1977) and to the east of the city walls a dump of waste pottery and building material was found in Frodsham Street (Rutter 1990). Several other production sites have been suggested by finds of waste pottery, but only four medieval kilns have been excavated in Cheshire, and the region is also known to have been served by kilns beyond its modern day borders. Excavations at a possible kiln site at Salmesbury, Preston has highlighted potential differences in medieval pottery traditions between the north and south of the River Ribble (Miller *forthcoming*).

Knowledge of pottery in the region before the 13th century is limited. Dendrochronology has enabled distribution patterns to be constructed for the principle wares of the 12th and 13th centuries but mostly for the north-west. Excavation of two wich houses in Nantwich produced unprovenanced groups of late 12th century pottery in the form of coarse cooking pots and unglazed jugs (McNeil 1983). Likewise, at Norton Priory excavations produced a floor tile kiln and a mid-to late 12th century assemblage with glazed and decorated wares. There is a general lack of published groups for the north-west although a relative abundance of ceramics dating to the mid 13th to the 14th centuries exists; there is a bias towards pottery from Cheshire and Cumbria (Newman 2004, 16). Good sequences have been provided from in and around Chester, with associated datable sequences provided by the castle assemblages in North Wales.

The change from ceramics vessels made from local Cheshire boulder clays to those made from Coal Measures clay appears to have occurred in the 14th century, which would place the Stormy Point sherd in this transitional group. Poorly stratified sequences from Beeston Castle and unpublished groups from Nantwich and Middlewich have provided comparable material, although excavations in the Macclesfield and Congleton areas is less well understood, and excavations at the regional religious centres, such as Norton Priory and several excavations on more rural settlements have not elucidated the problem.

At present, the dataset is so small that little analysis of the landscape and territories of the early medieval North West can be undertaken, beyond the evidence that place-names can provide. However, in the south of the region the continuity of boundaries as visible features in the landscape may have some implication for the longevity of the settlement around stormy point and Alderley Edge. For instance, a bank and ditch marking the former boundary between two townships, was certainly in existence by the fourteenth century, and may well have been in existence by Domesday (J. Prag *pers. comm.*), and this sealed a buried soil producing evidence for iron working (Gifford and Partners 2002) indicating that the area has been settled from at least the early medieval period.

7. Summary and Conclusion

We need to know more about the occurrence of medieval pottery throughout the region so that distributions of different wares and fabric groups can be plotted and possible centres of production located. Although broad patterns of distribution can be identified, apparently following ancient geophysical boundaries such as the Mersey, some traditions clearly extended beyond these traditional regional boundaries, for example Chester with North Wales (Ewloe) and the West Midlands (Ford 1995).

Medieval ceramics from the region cannot be provenanced with any certainty, in part due to the relative lack of published groups. The use of historical documents and accounts during this period has greatly increased our understanding of medieval landsuse and inter-regional trade and it may be that detailed analysis of the accounts and inventories of households or ecclesiastical establishments, such as nearby Warburton and Mobberly Priories and Tatton Park would help to provenance portable goods such as household ceramics.

During the 14th century, pottery manufacture retained a highly localised nature, with areas serviced by a locally operating pottery kiln. The bulk of medieval pottery would have been produced within a 20 to 40 mile radius of the site, with potters conforming to specifically 'medieval' types of pottery manufacture using sandy-bodied wares with differing inclusions, but implementing their own particular methods, resulting in a picture of regional diversification (Speakman 2000, 148). Evidence for the distribution of pottery types across the region s patchy at best, but suggests a lack of interchange of locally produced wares (Newman 2004, 18). Cheshire was dominated by red firing pottery types during the 13th to 14th centuries but subsequently was superseded by pink/white firing wares made from Coal Measures clays sometime in the 14th century, which occasionally traveled north into the Merseyside area.

Parallels between waste pottery and some excavated material can be identified in the relevant areas but further evidence is required to identify distribution zones. Well-stratified occupation deposits and independent dating means are required to identify the time spans during which these sites were in production. Little is known about technological advances or changes in ceramic production in the North West. Whilst some changes can be detected in methods of manufacture there is not enough evidence to associate these with any chronological or geographical framework. Study of pottery outside the major urban centres of Chester and Carlisle, such as evidence provided by certain moated, ecclesiastical and defensive sites, is limited by lack of excavation on these site types. When excavations have occurred, assemblages have often been small, abraded and clearly not in primary deposits, such is the case at Stormy Point. In addition to poor assemblages there is a lack of good stratigraphy and independently dated artefacts; any means of absolute dating is often a problem. Thus dating of settlements in the region is hampered by lack of pottery, and the means by which to construct ceramic chronologies is difficult to find.

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Appendix 6: Summary of Contexts

(001)	TP1	Mixed mid-dark brown compact sand
(002)	TP1	Mottled light-mid brown sand, part of (001)
(003)	TP1	Mid gritty brown sand, part of (006)
(004)	TP1	Dark brown sand, part of (006)
(005)	TP1	Light-mid brown sand, part of (006)
(006)	TP1	Dark brown soft sand
(007)	TP1	Light yellow brown sand with galena, same as (009)
(008)	TP1	Mid-dark brown gritty sand, part of (007)
(009)	TP1	Same as (007)
(010)	TP1	Mixed mid brown sand
(011)	TP1	Lens of chocolate brown sand within (010)
(012)	TP1	Dark brown gritty sand
(013)	TP1	Sandstone bedrock
(014)	TP1	Very dark brown sand
(015)	TP1	Broken, fragmented sandstone
(016)	TP5	Mixed green/yellow deposit
(017)	TP5	Pink silty sand in-wash
(018)	TP5	Dark red silty sand
(019)	TP5	Yellow sand and crushed sandstone
[020]	TP5	Cut for (020)
(021)	TP5	Pink gritty sand with green marl
(022)	TP5	Mixed yellow sand and sandstone, fill of [020]
(023)	TP5	Pink sand and sandstone with green marl, fill of [020]
(024)	TP5	Red clayey sand with green marl, fill of [020]
(025)	TP5	Red sand with occasional sandstone, fill of [020]
(026)	TP5	Yellow sand and sandstone, fill of [020]
(027)	TP5	Lens of red sand, fill of [020]
(028)	TP5	Red sand, fill of [020]
(029)	TP5	Yellow fine sand and sandstone, fill of [020]
(030)	TP5	Fine red sand, fill of [020]
(031)	TP5	Fine yellow sand and occasional sandstone, fill of [020]
(032)	TP5	Very dark red clayey sand, semi-compact
(033)	TP5	Compact red sandy clay
(034)	TP5	Yellow sand
(035)	TP5	Fine red sandy clay, semi-compact
(036)	TP5	Yellow sand and sandstone fragments
(037)	TP5	Red sandy clay
(038)	TP5	Red firm sand
(039)	TP5	very dark reddish brown sandy clay, compact
[040]	TP5	Cut
(041)	TP5	Mixed light-mid yellow brown mottled sand and sandstone fragments, fill of [040]

(042)	TP5	Mixed red sand with abundant sandstone fragments, fill of [040]
(043)	TP5	Broken sandstone bedrock
(044)-(045)		Not used
[046]	TP6	Bowl cut
(047)	TP6	Dark reddish brown sandy clay
[048]	TP6	Cut filled by (122)
(049)	TP6	Dark greyish brown sandy silt
(050)	TP6	Light pinkish yellow sand – crushed sandstone
(051)	TP2	Dark greyish brown silty sand, fine, loose
(052)	TP2	Mid-dark greyish brown silty sand – clay pipe layers, combined with (059)
(053)	TP2	Mid brownish yellow silty sand and crushed sandstone
(054)	TP2	Grey brownish black silty sand, compact with small pebbles
[055]	TP2	Cut for (051), band of blackish silt partly following cut
(056)	TP2	Yellowish crushed sandstone
(057)	TP2	Combined layer with (058), mixed brown/yellow sand, small pebbles and crushed sandstone fragments, blackish patches
(058)	TP2	See (057)
(059)	TP2	Combined with (052). High percentage of large sandstone fragments
[060]	TP2	Not used
(061)	TP2	Continuation of (052) with clay pipe fragments
[062]	TP2	Cut for fill (054), steep sided and sharp
(063)	TP2	Layer above/against bedrock of mid yellow sand/crushed sandstone
(064)	TP7	Deposit of blackish sand
(065)	TP7	Layer of fragmented sandstone
(066)	TP7	Dark red clay
(067)	TP7	Reddish brown/black silty sand, fill of [069]?
(068)	TP7	Compact reddish sandy clay
[069]	TP7	Cut for (067)?
(070)	TP7	Mixed red and green clay deposit
(071)	TP7	Dark red silty clay
(072)	TP7	Layer of fragmented sandstone
(073)	TP7	Layer of greenish grey sandstone
(074)	TP7	Broken bedrock
(075)	TP7	Greenish grey sandstone
(076)	TP7	Red/green clay layer
(077)	TP10	Mid yellow sand
(078)	TP10	Patchy orange/brown sand
(079)	TP10	Mid yellow sandy clay
(080)	TP10	Mid yellowish brown sand
(081)	TP10	Reddish clay deposit
[082]	TP10	Cut for possible pit
[083]	TP10	Edge of feature
(084)	TP10	Same as (079)

(085)	TP10	Very mixed sandy clay
(086)	TP10	Yellow/brown sandy layer
(087)	TP10	Yellow/orange sand
(088)	TP10	Very mixed sandy layer
(089)	TP10	Mixed sandy layer
(090)-(100)		Not used
(101)	TP3	Mixed sand and pebbles – ‘topsoil’ wash
(102)	TP3	Mid brown silty sand
(103)	TP3	Light greyish yellow sand
(104)	TP3	Reddish brown sand layer
(105)	TP3	Dark-mid greyish brown and green marl
(106)	TP3	Greyish green clay, natural
(107)	TP3	Brownish red clay, natural
(108)	TP3	Brownish grey manganese layer
(109)	TP3	Brownish grey sand
(110)	TP3	Light yellowish brown sand
(111)	TP3	Layer of manganese (same as (108))
(112)	TP3	Mid reddish brown sand
(113)	TP3	Greyish brown sand
(114)	TP3	Layer of manganese (same as (108))
(115)	TP3	Mixed greenish brown sand and marl (same as (105))
(116)	TP6	Mid yellow and greyish brown silty sand
(117)	TP6	Dark black/brown silty sand with slag and burnt material
(118)	TP6	As (117)
(119)	TP6	Mid brownish yellow sand
(120)	TP6	Mixed reddish brown silty sand
(121)	TP6	Red and green mixed silty clay
(122)	TP6	Red clay
(123)	TP6	Mid red clay with small green clay content
(124)	TP6	Dark greyish brown sandy silt
(125)	TP6	Light pinkish yellow sand – degraded sandstone
(126)	TP6	Light yellowish green clay/degraded bedrock
(127)	TP6	Mid reddish brown silty sand
(128)	TP6	Mid yellowish brown sand
(129)	TP8	Green ‘layer’ of malachite, very shallow
(130)	TP8	Deposit of dark brown silty loam, appearance of garden soil
(131)-(149)		Not used
(150)	TP4	Sandstone bedrock
[151]	TP4	Bench quarry cut
(152)	TP4	Mid brown silty sand
(153)	TP4	Light yellowy brown fine sand
(154)	TP4	Black sand, gritty, semi-compact

(155)	TP4	Light yellow brown fine sand
(156)	TP4	Mid-dark grey/brown sand
(157)	TP4	Very dark grey brown sand
(158)	TP4	Mixed orangey brown gritty sand
(159)	TP4	Mid reddy brown fine sand
(160)	TP4	Light yellowy brown fine sand
(161)	TP4	Dark brown fine sand
(162)	TP4	Light yellowy brown fine sand
(163)	TP4	Mid-dark grey brown silty sand
(164)	TP4	Light yellowish brown sand, fill of [165]
[165]	TP4	Cut into (168) filled with (172-4), (166) and (164)
(166)	TP4	Light mid brown grey silty sand, fill of ([165]
[167]	TP4	Sub-circular pit cut into bedrock
(168)	TP4	Mid grey brown silty sand, fill of [167]
(169)	TP4	Mid-dark grey brown sand, fill of [167]
(170)	TP4	Light grey brown sand, fill of [167]
(171)	TP4	Very light grey brown sand, fill of [167]
(172)	TP4	Mid-dark grey brown sand, fill of [167]
(173	TP4	Light grey brown sand, fill of [165]
(174)	TP4	Mid-dark grey brown sand, fill of [165]

Appendix 7: Photographic Register

Frame	Subdiv	Description	Looking
1	TP1	Pre-excavation	W
2	TP2	Pre-excavation	N
3	TP1	After initial cleaning	W
4	TP2	After initial cleaning	SE
5	TP2	After initial cleaning	NW
6	TP2	Detail of location of SF1	SE
7	TP1	After excavation of c.280mm	W
8	TP3	Pre-ex after initial cleaning	NW
9	TP3	After removal of sandy wash layer (101)	NW
10	TP2	Removal f (051) and (052)	NW
11	TP2	Removal f (051) and (052)	SE
12	TP2	Removal f (051) and (052)	N
13	TP3	Top of possible feature	NW
14	TP1	Excavation to 500mm	W
15	TP3	Excavation after removal of c.70mm	NW
16	TP2	Post removal of (052)	NW
17	TP2	Post removal of (052)	SE
18	TP2	Post removal of (052) and partial section	W
19	TP3	Extension to SE after initial clean	SE
20	TP3	Extension after removal; of top layer (101)	SE
21	TP3	Showing top of (105) and green marl	SE
22	TP2	General shot, removal of (056)	NW
23	TP2	General shot, removal of (056)	SE
24	TP2	Detail of NE facing section	S
25	TP2	Angled shot of detail of NE facing section	W
26	TP1	Bedrock, bottomed	W
27	TP2	Removal of fill (054)	NW
28	TP2	Angled shot of removal of fill (054)	E
29	TP3	Top of clay layers (106)	NW
30	TP3	Top of clay layers (106)	SE
31	TP3	NE facing section	SW
32	TP3	SW facing section	NE
33	TP3	SE facing section	NW
34	TP3	Angled shot of NE and SW facing sections	NE
35	TP3	Angled shot of SW and NW facing sections	NW
36	TP5	Before cleaning	S
37	TP4	After initial clean	NW
38	TP5	After initial clean	S
39	TP2	NE facing section (1)	SW

40	TP2	Section (2) NE facing	SW
41	TP2	Angled shot of NE facing section	W
42	TP2	Stone face	NW
43	TP2	Section (1) SW facing	NE
44	TP2	Section (1) SW facing	NE
45	TP12	Angled shot SW facing shot	W
46	TP2	General shot	NW
47	TP2	General shot angled	SE
48	TP2	General shot angled	W
49	TP4	General shot	NW
50	TP4	General shot	NW
51	TP4	General shot	SE
52	TP4	General shot	NW
53	TP4	General shot	SE
54	TP5	Post-ex	S
55	TP5	Post-ex	S
56	TP5	Post-ex	SW
57	TP5	Post-ex	SW
58	TP5	Post-ex cut in section	W
59	TP5	Post-ex	NE
60	TP5	Post-ex	SE
61	TP5	Post-ex north end	N
62	TP5	Post-ex north end	S
63	TP7	General shot	W
64	TP7	General shot	E
65	TP4	General shot	NW
66	TP4	General shot	SE
67	TP6	After spit of c.5cm removed	W
68	TP6	After spit of c.10cm removed	E
69	TP7	Possible channel to east of trench	W
70	TP7	Possible channel to east of trench (removal of (067)	E
71	TP7	Removal of fill (064) general shot	W
72	TP7	Removal of fill (064) general shot	E
73	TP7	Removal of fill (064) general shot, angled	NW
74	TP7	Removal of sandstone fractured layer	E
75	TP7	Removal of sandstone fractured layer	W
76	TP7	Removal of sandstone fractured layer, angled	SW
77	TP6	General shot post-ex	W
78	TP6	East facing section, post-ex	W
79	TP6	Post-ex, general shot	W
80	TP6	Post-ex east facing section	W
81	TP6	Post-ex south facing section	N
82	TP6	Post-ex north facing section	S
83	TP6	Post-ex west facing section	E
84	TP6	Post-ex general shot	E

85	TP6	Post-ex general shot, angled	NW
86	TP6	Post-ex general shot, angled	SW
87	TP4	Post-ex general shot	NW
88	TP4	Post-ex general shot	SE
89	TP4	Section	N
90	TP4	General shot, angled	NW
91	TP7	General shot, removal of (065) to (069)	W
92	TP7	General shot, removal of (065) to (069)	E
93	TP7	North facing section	S
94	TP7	South facing section	N
95	TP7	East facing section	W
96	TP7	Angled general shot	SW
97	TP8	General shot after initial clean	N
98	TP8	Close up of green malachite ‘feature’	N
99	TP7	General shot, half sectioned clay	W
100	TP7	General shot, half sectioned clay	E
101	TP7	Angled shot of trench	NW
102	TP7	South facing section	N
103	TP7	Angled shot of trench	NE
104	TP7	East facing section	W
105	TP7	East facing section	W
106	TP7	North facing section	S
107	TP9	Prior to cleaning	N
108	TP10	Pre-ex	W
109	TP10	Pre-ex	E
110	TP8	Post-ex north facing section	S
111	TP8	Post-ex north facing section	S
112	TP8	Post-ex southeast facing rock face	NW
113	TP8	Post-ex southwest facing rock face	NE
114	TP8	Post-ex part of southwest facing rock face	NE
115	TP8	Post-ex north facing section, angled	SW
116	TP10	Surface cleaning	W
117	TP10	Surface cleaning	E
118	TP9	Red clay at north end	N
119	TP9	Red clay at north end	N
120	TP8	Post-ex general shot	N
121	TP8	Post-ex general plan shot	N
122	TP4	Bronze Age pit [167] after full half section	N
123	TP4	Bronze Age pit [167] after full half section	E
124	TP4	Bronze Age pit [167] after full half section	N
125	TP4	Bronze Age pit [167] after full half section	E
126	TP4	Bronze Age pit [167] after full half section	NE
127	TP4	Bronze Age pit [167] after full half section	N
128	TP4	Bronze Age pit [167] after full half section	NW
129	TP4	Bronze Age pit [167] after full half section	N

130	TP4	Bronze Age pit [167] after full half section no scale	S
131	TP10	General shot removal of (077)	W
132	TP10	General shot removal of (077)	E
133	TP10	Plan view of [082]	E
134	TP10	General shot, spit removed	W
135	TP10	General shot, spit removed	E
136	TP10	Feature [082], spit removed	S
137	TP9	Post-ex	N
138	TP9	Post-ex	N
139	TP9	Post-ex	N
140	TP10	Removal of fill (078)	W
141	TP10	Removal of fill (078)	E
142	TP10	East facing section	W
143	TP10	Angled shot	SW
144		Working shot	-
145		Working shot	-
146		Working shot	-
147		Working shot	-

Appendix 8: Index to Archive

The archive is currently held by the University of Manchester Archaeological Unit.

The archive contains:

- Paper records including, context lists, context sheets, photographic register, drawing register, day book pages
- Slide negatives
- Original field drawings
- Correspondance
- Bound copy of the final report
- DVD with all .doc, .ai, .dwg and .tif files relating to the final report and all photographs
- CD with a .PDF copy of the final report

Appendix 9: Project Summary Sheet

PROJECT NAME: Stormy Point, Alderley Edge, Cheshire: An Archaeological Evaluation			
PROJECT LOCATION:	COUNTY Cheshire DISTRICT Macclesfield PARISH/TOWNSHIP		NGR(S)centred: SJ86037788
TYPE OF PROJECT:	**EXCAVATION** **FIELD SURVEY** **GEOPHYSICAL SURVEY** **ENVIRONMENTAL STUDIES**	**TRIAL TRENCHING** WATCHING BRIEF DESK BASED STUDY BUILDING SURVEY	**GEOCHEMICAL ANALYSIS**
RESPONSIBLE ORGANISATION: University of Manchester Archaeological Unit			PROJECT CODE: SP07
STAFF: Graham Mottershead, Steve Bell, Phil Cooke, Ruth Garratt, Lee Gregory, Brian Grimsditch, Joanna Wright			
COMMISSIONED/FUNDED BY: The National Trust			
REASON(S) FOR WORK:	**RESEARCH/**TRAINING **INTERPRETATION/DISPLAY** **CONSERVATION/MANAGEMENT**	DEVELOPMENT OTHER (SPECIFY)	
DATE PROJECT STARTED : 12th June 2007		DATE FINISHED : 27th July 2007	
SUMMARY OF RESULTS : The work comprised topographic, geophysical and XRF survey and the excavation of ten hand dug test pits followed by environmental analysis and AMS dating. The evaluation revealed that archaeologically deposits survive across the whole of the Stormy Point site including a Bronze Age prospection pit, a second prehistoric possible prospection pit, at least one previously unknown prehistoric mine working with a collapsed ceiling, a possible prehistoric smelting bowl and another prehistoric pit probably associated with ore processing. Evidence was found of intermittent periodic ore processing and dumping with a date range from the Earlier Bronze Age to the Medieval period. Quarrying activity could be dated from the Medieval period to the Mid 17th century and traces of evidence for possible Romano-British or Medieval iron smithing were recovered along with evidence for Medieval activity close by, probably at Saddlebole.			
REPORT REFERENCE: UMAU 2008 (40)			
PROPOSED ARCHIVE REPOSITORY (name and address): UMAU, as below			
CONTACT NAME (FOR INFORMATION/ENQUIRIES): Dr Mike Nevell ADDRESS: University of Manchester Archaeological Unit, Rm 4.10, Mansfield Cooper Building, University of Manchester, Oxford Road, Manchester, M13 9PL. TEL: 0161-275-2314; FAX: 0161-275-2315; E-MAIL: umfac@man.ac.uk			