BUILDING STONE AT THE WESTERN EDGE OF THE BLACKDOWN HILLS

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The western slopes of the Blackdown Hills and the east side of the Exe Estuary are not well endowed with good quality building stone. The buildings here are characterised by mixtures of local and imported stone and the use of cob is widespread for vernacular farmhouses. In this respect the area contrasts with the main part of the Blackdown Hills where chert from the Upper Greensand preponderates over other building materials and the tracts further east where the area of each local building stone is well delineated. The distribution of some of the local and imported stones in buildings is illustrated by a series of maps and the factors that affect their distribution discussed.

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INTRODUCTION

Architects frequently refer to the use of 'local stone' when describing the construction or finishing materials of buildings. This is the case, for example, in the citations of buildings listed for the purposes of the Planning (Listed Buildings and Conservation Areas) Act 1990. It leaves unanswered questions about the appearance of the stone and its source and in some cases appears to be a cover for ignorance about the nature and origin of the stone in question. In any case, there are many buildings composed of more than one kind of stone which therefore cannot all be entirely 'local'. There are also stone buildings in areas underlain by rocks that are not suited to building, in which case, the stone must have been imported from elsewhere.

The western slopes of the Blackdown Hills beneath the Upper Greensand escarpment in Devon are mostly underlain by marls and mudstones and generally lack good quality building stone. This is therefore an area where some stone for building was imported and illustrates within a relatively restricted area, some of the factors that have controlled which kind of stone was used and where.

Figure 1 illustrates the different kinds of stone used in this area. The symbols on the map represent churches, houses, outbuildings, walls and embankments and other structures with a stone-built element. The methods used to collect the data are outlined in Barr (2006). For the sake of clarity, the observations in the figure have been sampled so that no two observations are closer than 200 m. This does not materially affect the broad distribution pattern. However, buildings composed predominantly of Jurassic limestones and man-made materials other than cob have been excluded.

The area is characterised by a mixture of main building materials, contrasting with the central Blackdown Hills, where chert greatly predominates (east part of Figure 1) and the areas to the east of the Blackdown Hills where the zones where each 'local' building stone predominates are relatively well defined (Barr, 2006).

IMPORTED DEVONIAN AND CARBONIFEROUS LIMESTONE

Imported grey recrystallised limestone, in many cases with purple staining, is widely used throughout the area especially for walls, embankments and bridge parapets (L in Figure 1). The source of much of this stone is indeterminate because of a lack of distinctive features but it is possible to differentiate: (1) dark grey limestone with lamination defined by grain size and and laminae/beds of quartzite and chert from Westleigh and nearby quarries (Figure 2a), and (2) light grey limestone and dolomite, often crushed or sheared, with corals and stromatoporoids from the Middle Devonian rocks of Torbay (Figure 2b).

The use of Westleigh limestone is concentrated in the north of the area near the source quarries but is quite widespread (Figure 3). For buildings remote from the source it is mainly used for garden walls and public works, especially roadside walls and embankments built in the twentieth century; the qualities of the stone, combined with relatively cheap modern transport by rail or road has made the choice of this stone advantageous over quite a large part of the area of study.

Pale grey limestone from Torbay is particularly characteristic of coastal towns and the Exe Estuary where building mainly took place in the late eighteenth and nineteenth centuries. Its concentration along the coast is believed to result from relatively cheap transport by sea even though the source quarries are at least 20 km away. However, relatively expensive onward transport by land at that time prevented further penetration of the stone into the hinterland of the coastal ports. The contrast in dispersion of Westleigh and Torbay limestones is probably the result of continued production of stone for building at Westleigh into the era of easy road transport but its cessation at the Torbay quarries shortly after the First World War and transport mainly by sea.

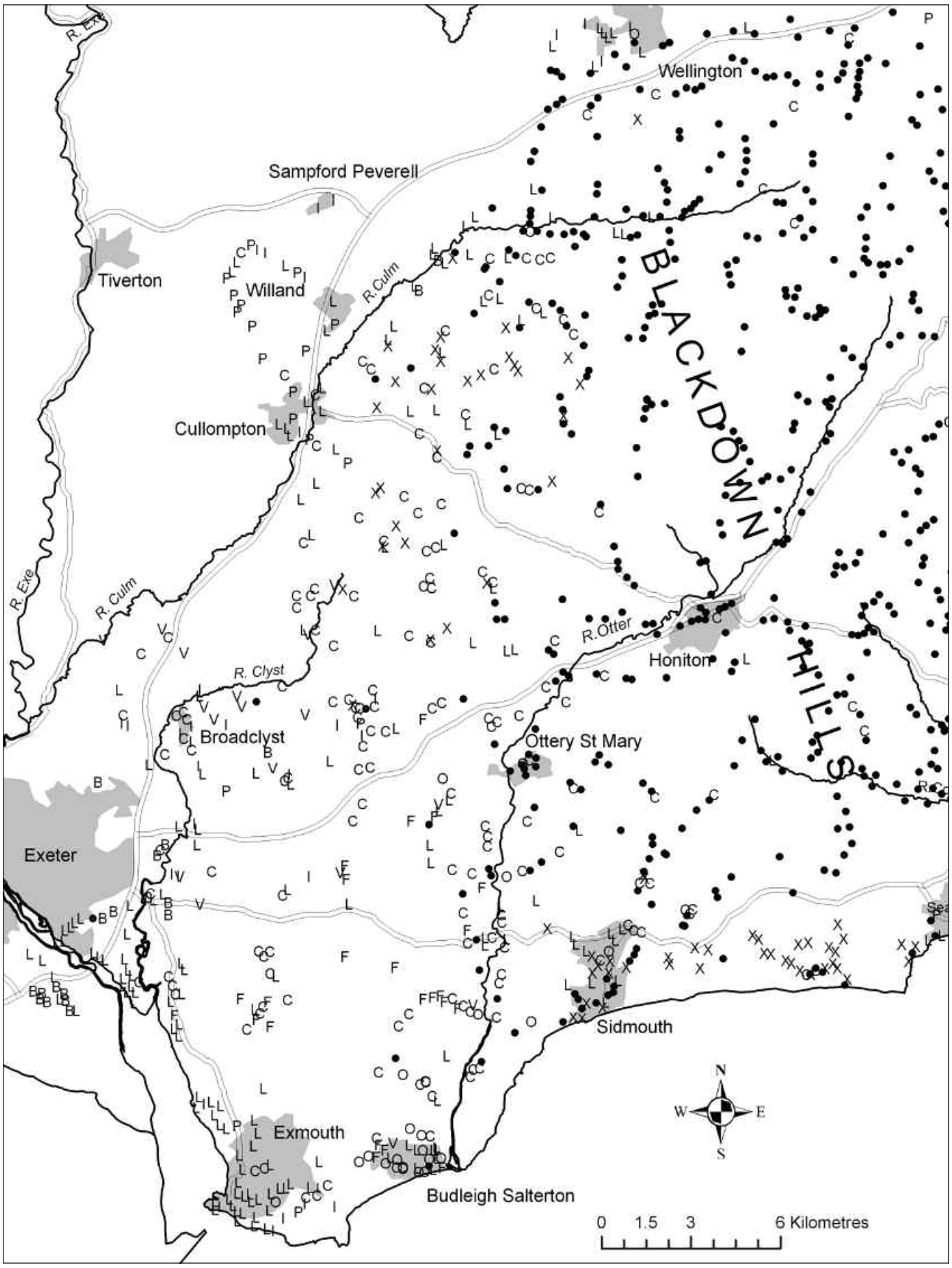

Figure 1. *Distribution of building stone and cob used as the main building or finishing material, western edge of the Blackdown Hills. L, Devonian and Carboniferous limestone; P, Devonian and Carboniferous slate, greywacké and sandstone; V, Exeter Volcanic Group; B, Heavitree Breccia; I, Sandstone from the Exeter Group and the Exmouth Mudstone and Sandstone Formation; O, Otter Sandstone Formation; dots, flint and chert; X, Upper Greensand sandstone; C, cob; shaded, towns. Data points sampled so that they are at least 200 m apart.*

Figure 2. *Limestone building stones. (**a**) Grey limestone with black chert (Westleigh Limestone Group), wall of outbuilding, Upcott, Vale of Taunton Deane, (**b**) pale grey Middle Devonian limestone from Torbay as random rubble walling, Balfour Lodge, Station Road, Sidmouth.*

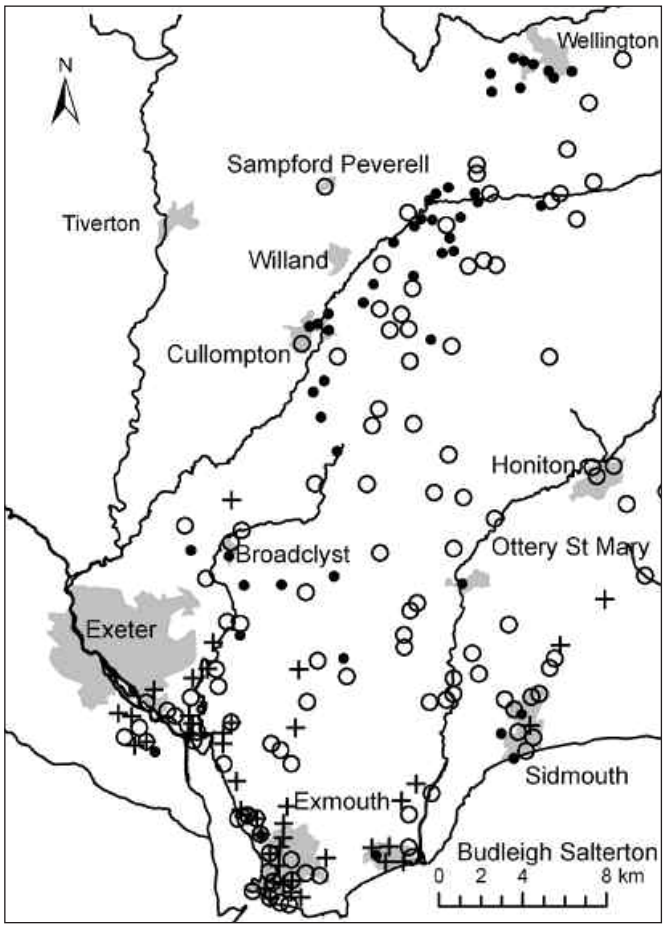

Figure 3. *Distribution of buildings with at least one element made of Devonian or Carboniferous limestone. Small filled circles, grey limestone with chert from Westleigh and nearby quarries (between Wellington and Willand); crosses, pale grey limestone from Torbay; Open circles, grey Devonian or Carboniferous limestone of indeterminate origin. Data sampled so that buildings are at least 400 m apart.*

Bude Formation Sandstone

Red sandstone is widely used in the area of study and in most cases it can be referred with reasonable certainty to the Exeter Group, or in the case of sandstone used around Exmouth, to the Exmouth Mudstone and Sandstone Formation of the Aylesbeare Mudstone Group. Dark brownish red or maroon sandstone used in the construction of Kentisbeare Church was referred to the New Red Sandstone by Hoskins (1954) who commented also on its unusual colour. The vicar of the church noted that the stone was quarried at Upton Farm east of Cullompton (Chalk, 1934). The quarry is within the Bude Formation exposed in an elongated peninsula-shaped outcrop extending eastwards several kilometres into younger, post-Variscan rocks (Figure 4). Red sandstone which closely matches that used at Kentisbeare occurs as float in the quarry and there are no lithological grounds to doubt Chalk's assertion. In earlier descriptions of churches on the west margin of the Blackdown Hills, Chalk (1910) refers to the sandstone used as 'local stone'. It seems that between the dates of these publications, Chalk had come across some evidence that the stone used in his church was from Upton Farm. However, he seems to have been unaware that this was Carboniferous in age and Hoskins similarly had assumed that it was won from the post-Variscan sedimentary sequence.

The discovery that some of the red sandstone used in the area was from the Bude Formation led to a re-examination of buildings where red sandstone occurs. Several occurrences were reassigned to the Bude Formation as a result. The sandstone is strongly pigmented in hues of deep brownish red or maroon but here and there with spots and streaks where the iron pigment is reduced, giving the rock a distinct olive-green hue. It is medium-grained and well sorted. At the scale of the building block it seldom exhibits obvious bedding features. The clasts are predominantly of quartz and are subangular. It is moderately to strongly cemented probably by the suturing together of adjacent grains but these are quite distinct under the hand lens and voids between the grains are very obvious. It is distinguished from sandstone of the Exeter Group and younger formations by being slightly more strongly cemented so that blocks retain their sharp edges and do not become significantly rounded by weathering in the walls of buildings. It lacks poorly sorted pebble laminae, common in the Exeter Group sandstones. The hue of reduced parts of the rock differs from that typical of the Exeter Group. However, the differences with Exeter Group sandstone are not great and it is easy to see how confusion can have arisen.

Every medieval parish church from Kentisbeare in the north to Whimple in the south contains elements built using this stone

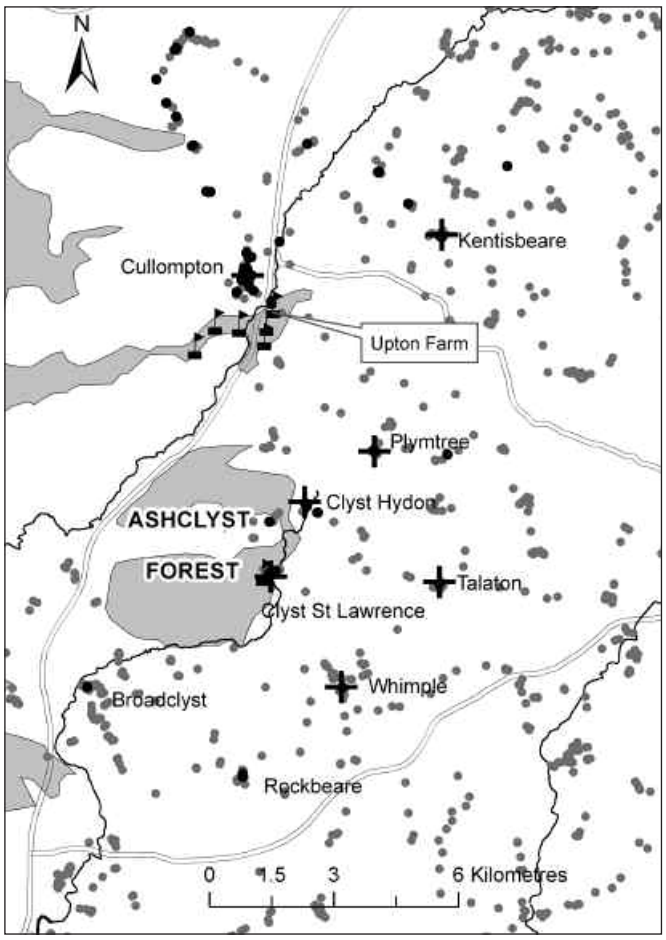

Figure 4. *Distribution of buildings with at least one element composed of maroon sandstone from the Bude Formation. Crosses, churches; black circles, other buildings; grey circles, buildings lacking this sandstone; flags, known or implied stone quarries in the Bude Formation; grey fill, outcrop of Bude and Crackington formations.*

Figure 5. *Porch of Talaton Church. Walls are predominantly of Bude Formation sandstone with minor chert and lava from the Exeter Volcanic Group. The quoins are of a mixture of Salcombe stone (Upper Greensand) and lava and the parapet and dressings round the door are of Beer Stone.*

(Figure 4). Its occurrence in other kinds of buildings is proportionately much less common although several of the older secular buildings in Cullompton use it. To the south, red sandstone from the Dawlish Sandstone predominates around Broadclyst and Poltimore. To the north, recrystallised Carboniferous quartzite and psammite, in many cases cleaved, that can be easily distinguished from the Permian and younger sandstones replace it.

Besides the quarry at Upton Farm, there are several others well attested in the Cullompton area shown on the Ordnance Survey 1st Edition mapping and implied by names of parcels shown on the tithe maps of the area both east and west of the River Culm (Figure 4). However, no documentary evidence that any of these were used for building stone has so far been discovered. Only one possible source of building stone of this type has been uncovered in Ashclyst Forest, the closest area of outcrop of the Bude Formation for the southern occurrences in buildings (Figure 4).

The concentration of this stone in older buildings, especially late medieval parts of the local churches suggests that it was sought after at that time and was preferred over alternative rock-types for high status buildings, but that in early modern and later times it either fell out of fashion or was superseded by the discovery of more conveniently located or more easily won or worked stone. There is a distinct possibility that the combinations of deep red sandstone and white Beer stone, so evident for example in the porch at Talaton Church (Figure 5), in the tower of Kentisbeare church, and the walls of Walronds, Fore Street in Cullompton was an intentional decorative effect favoured by the masons responsible for these buildings or their patrons.

Glauconitic sandstone from the Upper Greensand

Soft grey sandstone with disseminated glauconite is used for walling in Sidmouth (Figure 6a) and similar sandstone, but with chalcedonic cement, occurs widely in buildings on the west flank of the Blackdown Hills (Figure 6b). The rock-types contain the serpulid worm *Rotularia concava* and abundant sponge spicules in some blocks. The abundance of glauconite invites correlation with the Foxmould Member of the Upper Greensand.

Attention has already been drawn to these varieties of Upper Greensand sandstone (Barr, 2006, pp. 208-212) and a distinction drawn between them and the better documented Salcombe stone and white sandstone from the Chard area, both of which are from the Bindon Sandstone Member of the formation. No source quarries have been discovered for the soft sandstone used in Sidmouth. The rounded shape of boulders and cobbles of the stone (Figure 6a) strongly suggests that they have not been quarried in a conventional way. It is possible that some stone was won from Quaternary deposits derived from the Upper Greensand; large cobbles of this material have been seen in the spoil from ditch cleaning around the town. However, they are not particularly well rounded. Another possibility is that they were collected from the beach at low tide. Hutchinson (1843, p.45) observed that the townsfolk of Sidmouth were in the habit of collecting stone from the beach. 'Scattered masses of lias are also, but sparingly, found at low water; and as quarries of building stone are not met with nearer than Salcombe, these fragments which the tides have transported from beyond Axmouth, are often collected for

Figure 6. *Glauconitic sandstone from the Upper Greensand Formation. (**a**) Wall of rounded boulders, lane off High Street, Sidmouth. (**b**) Large thin slabs with irregular bedding forming the quoins of Feniton church tower.*

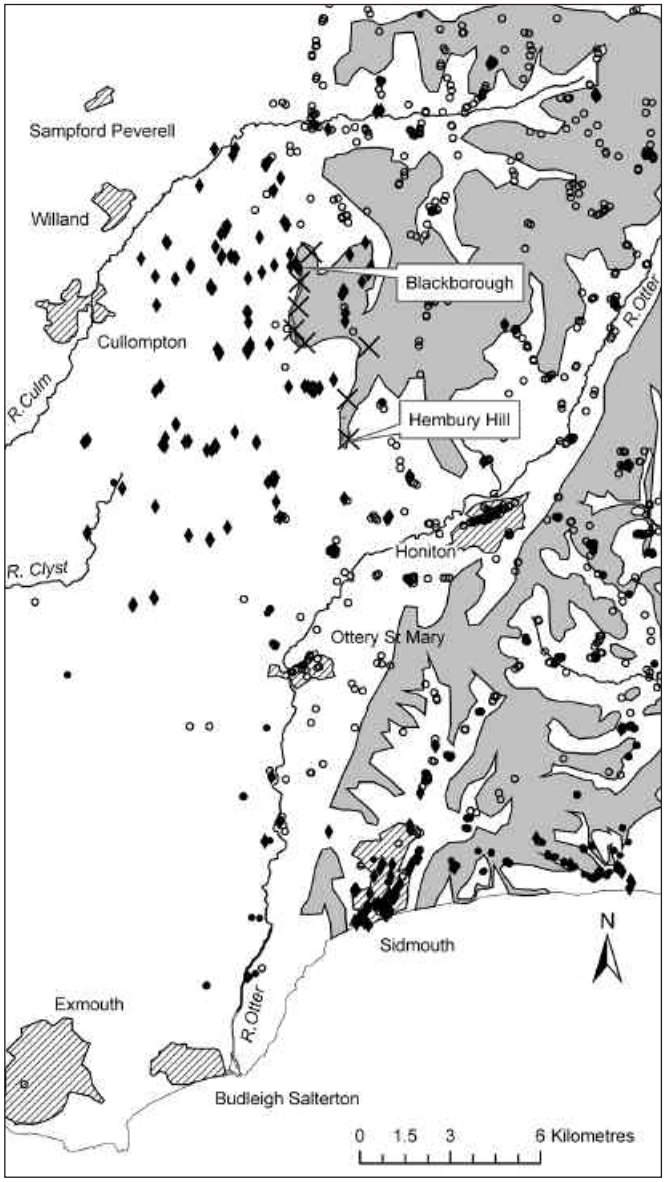

Figure 7. *Distribution of buildings with at least one element made of glauconitic sandstone. Diamonds, glauconitic sandstone; filled circles, other Upper Greensand sandstone; open circles, Upper Greensand chert; crosses, whetstone mines; grey fill, outcrop of Upper Greensand Formation.*

economical purposes.' He expresses some surprise that Lias rocks can have been transported so far and is right to do so, considering their softness and the fact that longshore drift would take beach material from Axmouth to the east not the west. A more likely explanation of the townspeople's activities is that they were collecting glauconitic sandstone boulders and cobbles from the Upper Greensand, the equivalent at Sidmouth of the "cowstones" reportedly used for building the cob at Lyme Regis and still a feature of the beach between that town and Seaton.

The shore around Sidmouth has been searched for glauconitic sandstone 'cowstones' or for rock that could be mistaken for them or indeed for Lias limestone, at low water springs and none has been found. It may be that the nineteenth century beachcombers have exhausted the supply or more likely, that the sea defences at Sidmouth have covered up any remaining examples of such boulders.

With regard to the harder glauconitic sandstone used along the west margin of the Blackdown Hills, Stanes and Edwards (1993) record that material unsuitable for shaping into whetstones was sold by the whetstone miners for building stone. Both the similarity of lithology between the whetstones and the building stone and the geographical coincidence of buildings with mines, which at the height of the industry extended from Blackborough as far south as Hembury Hill, reinforces this view (Figure 7). Considering the size and status of the buildings made of this stone (the United Reformed Church at Norman's Green near Plymtree, built in the nineteenth century, is entirely made of it), the arrangements made for the sale of by-product building stone must in some cases have been formal enough to have included a written contract but no documentation has so far been found. While the rock-type typically has a very rough surface caused by the open framework of chalcedony-cemented sand grains (making the rock suitable for whetstone manufacture), some blocks have smooth curviplanar surfaces believed to record the cleaving of the rock by the miner's adze while it was still soft.

Flint and Chert breccia

Chert from the Upper Greensand is the most widely used building stone of the Blackdown Hills but around Sidmouth and in the lower Otter Valley, its use dies out, and it is replaced by flint from the Chalk (Figure 8), distinguished from other kinds of chert by its white surface crust, nodular form with many re-entrants, lack of many inclusions and conchoidal fracture. The decorative use of flint for the coping of walls and in brick-lined panels is a feature of the area (Figure 9a). The distribution of flint in buildings is mirrored by that of chert

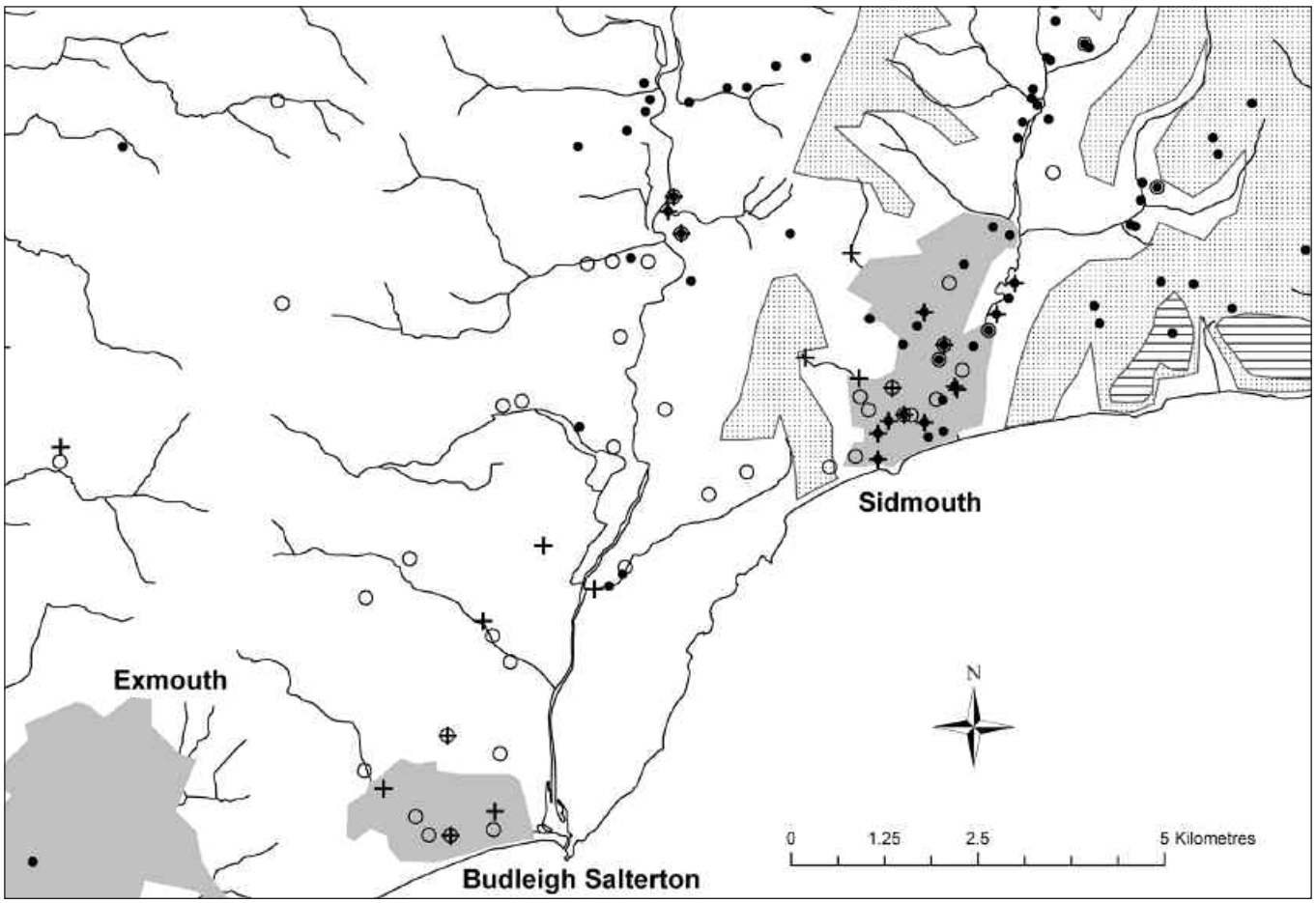

Figure 8. *Distribution of buildings with at least one element made of flint or chert breccia. Open circles, flint; crosses, chert breccia; filled circles, chert; stippled, outcrop of Upper Greensand Formation; hatched, outcrop of Chalk.*

Figure 9. *Examples of buildings incorporating flint or chert brecciaa. (**a**) Decorative brick-lined panels of flint from the Chalk. Boundary wall, The Old Rectory, Budleigh Salterton. The footing is made of Otter Sandstone rubble. (**b**) Chert breccia, wall of the Shell House, Bicton Park.*

breccia (Figures 9b) and is unrelated to the outcrop of the Chalk from which it is ultimately derived but which does not extend to the west of Sidmouth (Figure 8).

Jukes-Brown and Hill (1900) and Edwards and Gallois (2004) note the relative paucity of chert in the Upper Greensand going west towards Sidmouth and this lack may explain why it is not much used there and further west. They also note the widespread occurrence of flint from the Chalk in the Clay with Flints, even where it overlies the Upper Greensand. The association of flint with chert breccia in buildings strongly suggests that the former is not derived directly from the chalk but was first deposited or concentrated in the Clay with Flints, parts of which became cemented with chalcedony to produce chert breccia. However, the areas west of Sidmouth are not completely lacking in chert; the scarcity of buildings that incorporate it may have more to do with a local tradition of building that preferred flint to chert, especially for decorative use.

Other rock types

Other patterns of use of stone as the main construction or finishing material of buildings illustrated in Figure 1 include the following of note.

Lavas of the Exeter Volcanic Group are widely used for the quoins and dressings of buildings and are quite well dispersed even in buildings where they are the main material of the walls (V on Figure 1).

Red breccia, referred to the Heavitree Breccia Formation and its equivalents (B on Figure 1) is also quite widely used but the main focus of use is close to its outcrop, extending, within the area of study, from Exminster, south of Exeter across the south-eastern suburbs of the city.

Red and fawn sandstones (I on Figure 1) mostly from the Exeter Group predominate around Broadclyst and Poltimore north-east of Exeter. Slightly younger sandstone mottled in shades of red and fawn from the Exmouth Mudstone and Sandstone Formation is used in Woodbury and Littleham, east and southeast of Exmouth, also close to its outcrop.

Conglomerate and sandstone from the Otter Sandstone Formation is widespread in the lower Otter valley (O on Figure 1) but has not been identified in many buildings north of Ottery St Mary.

Cob is the building material of choice over a large part of the area for older vernacular farmhouses. There is a very strong contrast between the use of cob on the west side of the Blackdowns and its general lack within the hills where its place as the main construction material is taken by chert. It is not clear whether this contrast merely reflects a lack of suitable stone on the western slopes or is reinforced by the presence of rock - calcareous mudstone – particularly well suited to the making of cob in this region.

Conclusions

The varied building materials of the western edge of the Blackdown Hills illustrate the importance of cost of transport on the pattern of use of building stone in Devon as elsewhere. Because transport is a major cost factor, stone tends to be used close to where it is won. A mosaic of small areas dominated by one building stone – Heavitree Breccia, Dawlish Sandstone, sandstone for the Exmouth Mudstone and Sandstone Formation – reflects this and these could truly be described as 'local stone' at least where they are used as the main construction or finishing material of buildings. Similarly, the Otter Sandstone is only used close to its area of outcrop although for parishes falling in East Budleigh hundred, transport by boat up the Otter Estuary was important in allowing stone won in the cliffs to the east to be more widely used in medieval and early modern times (Brushfield, 1894). Cost of transport is also a main influence on the distribution of limestone from the Devonian and Carboniferous. The method of transport and the way its cost has changed has resulted in a more complex distribution pattern. Torbay limestone is mainly restricted to the coastal ports because access to the quarries was relatively easy and cheap by sea, but access from the ports to the hinterland by cart or packhorse was more difficult and costly at the time the stone was used for building. Conversely, Westleigh limestone appears to be favoured for twentieth century public works over a comparatively large area because of the relative unimportance then of transport compared to other costs.

However the cost of transport was not the only consideration. Two other factors besides the technical suitability of the stone for building are illustrated in the area of study. First, tradition and usage; the decorative use of flint but not chert in Sidmouth and the lower Otter valley seems to have been a matter of tradition among local builders since both materials were available. Maroon sandstone (Bude Formation) from Upton Farm and nearby quarries appears to have been favoured over other sources for medieval churches and high status early modern houses over an area with alternative source of stone, perhaps because of its pleasing appearance especially where combined with white Beer stone. In this case the more durable nature of the stone may have been a contributory factor. Second, cost of extraction; the availability of glauconitic sandstone as a cheap by-product of whetstone mining seems to have led to its use in buildings over a much wider area than would have been the case in the absence of the mines. Similar but softer sandstone used for walling in Sidmouth appears to have been favoured because it could be won very cheaply by collecting it off the beach.

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