Inventory of the Building Stones of Devon

and adjacent parts of Dorset and Somerset

Volume I

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Introduction

This inventory of the building stones of Devon and adjacent parts of Somerset and Dorset was assembled between 2003 and 2018 (Figure 1) and stored in an Access database. The database is in two parts:

(i) information about the distribution of stone used in buildings within the project area
(ii) information about the quarries both within and outside the project area from which stone used in these buildings was won.

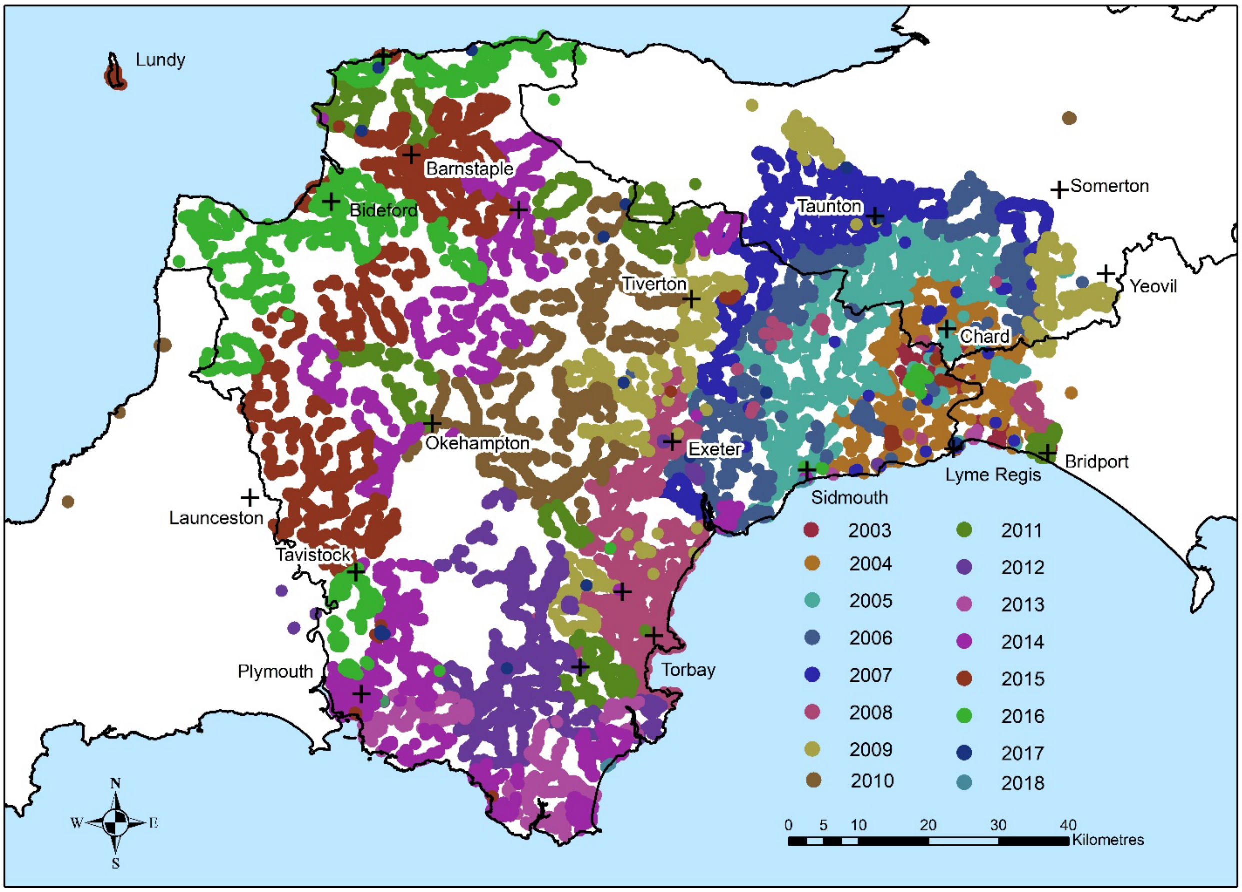

Figure 1. Progress of the survey.

The data about buildings were collected mainly through bicycle traverses using the dense network of roads and lanes that are typical of Devon. The density of observations is about 4/km^2 overall, rising to 100/km^2 in the towns and the database contains about 30,000 records. Most buildings are represented by a single record but those with a complex history of construction and alteration, especially churches with a medieval origin, may require more than one record to provide an adequate description of the building materials. Only buildings exhibiting evidence of a stone-built element, or cob or timber-framed construction, were included in the main survey and the observations are mostly restricted to the external construction materials. A full report on the work, dealing with both buildings and quarries is in preparation.

The following summaries of building-stone types used in the project area are based on the database records. They include a description of the appearance of each building stone with illustrations, its distinguishing features and the ways in which it can be discriminated from similar stone likely to be seen in the project area. As far as possible each type of stone is linked to its source formation(s) as set out in the British Geological Survey's Lexicon of Named Rock Units, and the description includes a map of where the stone has been seen within the project area. The inventory therefore sets out how each kind of stone might be recognised and the parts of the county where it can be seen, and in this respect, resembles other field guides, for example for birds or mammals.

The building stones are identified by a unique number. Because the survey did not start with the oldest rocks, the numbers have no stratigraphic significance but were assigned in sequence as the survey progressed. Figure 2 shows how these numbers are distributed through the stratigraphic column.

A geological map of the project area with a compressed legend is attached at the end of the inventory to assist the reader in relating the distribution of stone in buildings to the outcrop area of the parent formations.

Figure 2. Stratigraphic distribution of Material Codes

	Stages	Epochs, Series	West	South	Central &Teign Valley	North	East	Distant sources
CAINOZOIC		Recent	Cob (10) and rendered cob (42); tile (76)	Cob (10) and rendered cob (42); tile (76)	Cob (10) and rendered cob (42); tile (76)	Cob (10) and rendered cob (42); tile (76)	Cob (10) and rendered cob (42); cemented river gravel (105); slag (126); tile (76)	Italian travertine (143)
		Pleistocene				Beach rock - Saunton Stone (204)	Alluvium and colluvium (1, 2)	
		Pliocene						
		Miocene						
		Oligocene						
		Eocene					Clay-with-flints (1, 2); chert breccia (83)	
		Paleocene				Lundy Granite (32)		
CRETACEOUS	Maastrichtian							
	Campanian							
	Santonian							
	Coniacian							
	Turonian						Beer Head Limestone Fm. and Chalk (2) incl. Beer Stone (3)	
	Cenomanian							
	Albian						Upper Greensand incl. sandstone various (29, 52, 84), Salcombe Stone (13), calcareous grit (14), Eggardon Grit (16) and chert (1)	
	Aptian							
	Barremian							
	Valanginian							
	Berriasian							Purbeck Marble (Durlston Fm, 102)
JURASS IC	Tithonian	Upper Jurassic						Portland Stone (60) and Portland Roach (37)
	Kimmeridgian							
	Oxfordian						Oxford Clay	
	Callovian	Middle Jurassic					Kellaways Formation	
							Cornbrash	
	Bathonian						Forest Marble (19, 64 and 166)	
							Fuller's Earth Formation	Bath Stone (20) and Caen Stone (214)
	Bajocian						Inferior Oolite Group (15 and 18)	Doulting Stone (49)
	Aalenian							
	Toarcian	Lower Jurassic	Ham Hill Stone (4)	Ham Hill Stone (4)	Ham Hill Stone (4)	Ham Hill Stone (4)	Bridport Sand Fm. (63, 68 & 107) incl. Ham Hill Stone (4 & 100).	
	Pliensbachian						Beacon Limestone Fm. Incl. Eype Mouth Limestone member (22) above and Marlstone member (66 & 99) below; assoc. siltstone (63 and 68)	
							Dyrham Formation shale and marl (6) and siltstone (63 and 68)	
	Sinemurian						Charmouth Mudstone Fm (6)	
	Hettangian						Blue Lias Formatiom (5,6, 34, 35, 74 and others)	
TRIASSIC	Rhaetian	Upper Triassic					White Lias Formatiom (27)	
							Mercia Mudstone Group incl. North Curry Sandstone (75) and limestone breccia (168)	
							Sidmouth Mudstone Formatiom	
		Middle Triassic					Otter Sandstone Formation - 80, 81, 82 & 89 (Helsby Sandstone Formation)	
		Lower Triassic			Sandstone from Capton Quarry (167)		Budleigh Salterton Pebble Beds (Chester Formation) - 36 &127; sandstone from Capton Quarry (167)	
							Exmouth Mudstone and Sandstone Formation; sandstone (121)	

TRIASSIC	Rhaetian	Upper Triassic					Blue Lias Formation
							White Lias Formatiom (27)
							Mercia Mudstone Group incl. North Curry Sandstone (75) and limestone breccia (168)
							Sidmouth Mudstone Formatiom
		Middle Triassic					Otter Sandstone Formation - 80, 81, 82 & 89 (Helsby Sandstone Formation)
		Lower Triassic			Sandstone from Capton Quarry (167)		Budleigh Salterton Pebble Beds (Chester Formation) - 36 &127; sandstone from Capton Quarry (167)
							Exmouth Mudstone and Sandstone Formation; sandstone (121)
PERMIAN		Lopingian					
		Guadalupian					
		Cisuralian	Tough sandstone from the Exeter Group (144); Hatherleigh and Halwill Stone (154 &205)	Exeter Group including sandstone (144), breccia (85, 141, 151) and alkaline volcanic and hypabyssal rocks (Exeter Volcanics 79)	Exeter Group including sandstone (144), breccia (85, 141, 151) and alkaline volcanic and hypabyssal rocks (Exeter Volcanics 79); Hatherleigh and Halwill Stone (154 &205)	Exeter Group including sandstone, breccia (85) and alkaline volcanic and hypabyssal rocks (Exeter Volcanics 79 & 115); Hatherleigh and Halwill Stone (154 &205)	Exeter Group including sandstone (106 & 110), breccia (85, 120, 125), alkaline volcanic and hypabyssal rocks (Exeter Volcanics) 79 & 115; and associated tufa (111); porphyry (155); School Wood basalt (164)
			Dartmoor Granite (32), hornfels (148), schorl (156), microgranite (162), Roborough Stone (190), Pentewan-typ elvan (208), Polyphant Stone (197)	Dartmoor Granite (32), hornfels (148), schorl (156), microgranite (162), Roborough Stone (190)	Dartmoor Granite (32), hornfels (148), schorl (156), microgranite (162), Roborough Stone (190), Bovey Tracey slate (164)	Dartmoor Granite (32)	Dartmoor Granite (32)
CARBONIFEROUS	Gzhelian and Kasimovian	Upper Pennsylvanian	Amphibolite and metagabbro (91)	Amphibolite (91)	Amphibolite (91) and metagabbro (164); basalt (147)	Amphibolite (91)	
	Moscovian	Middle Pennsylvanian			Bude Formation; sandstone (172) and slate (171)	Bude Formation; sandstone (172) and slate (171)	Bude Formation: maroon sandstone (119)
	Bashkirian	Lower Pennsylvanian			Crackington Formation; fine-grained sandstone (152) and slate (171)	Bideford Formation; sandstone and slate (215) incl. Cornborough Sandstone (206), buff friable sandstone (207)	

Figure 2. Stratigraphic distribution of Material Codes

	A	B	C	D	E	F	G	H	I	J
1		Stages	Epochs, Series	West	South		Central &Teign Valley	North	East	Distant sources
80	CARBONIFEROUS	Serpukhovian	Upper Mississippian	St Mellion Formation (152 & 171),			Crackington Formation; fine-grained sandstone (152) and slate (171)	Crackington Formation; fine-grained sandstone (152) and slate (171) incl. black slate (128). Dowhills Mudstone Formation (to lower Pennsylvanian); black mudstone and slate (128, 177)		
81							Ashton Shale member; black slate (128)			
82							Teign Chert; chert (146), mudstone (128) and limestone			
83										
84		Visean	Middle Mississippian					Codden Hill Chert; banded chert and sandstone (148), shale (128), and mudstone (177). Bampton Limestone (123) and Westleigh Limestone (58, 139) Formations; banded limestone and chert; speckled limestone (104); dark grey limestone (137); black slate (128, 177)		Grey crinoidal limestone (174)
85				St Mellion Formation (152 & 171), & Hurdwick Stone (186)	Ugbrooke Sandstone Formation (145)		Combe Mudstone Formation; black shales (128)			
86				St Mellion Formation (152 & 171)						
87		Tournaisian	Lower Mississippian							
88				Tavy Formation; grey and green slates (59); spotted slate (157); Mill Hill slate (210)				Pilton Mudstone Formation; grey slate (202), black slate (177) and xb sandstone (203). Doddiscombe Formation; hard black laminated mudstone (128, 177)		
89				Saltash Formation; slate and siltstone (59); volcanic rocks (161), hyaloclastite (199), Wearde sandstone member (200)	Tavy Formation; grey and green slates (59); spotted slate (157), volcanic rocks (161), hyaloclastite (199)		Trusham Mudstone Formation; Olive green and pale shales (59); spotted slate (157)			
90							Hyner Mudstone Formation; Hard dark blue-grey mudstone (59)			
91	DEVONIAN	Famennian	Upper Devonian							
92				Torpoint Formation, red, green and grey slate (201)			Kate Brook Slate, green slate; Gurrington Slate, green slate (59)	Baggy Sandstones Formation; friable sandstone (176)		
93								Upcott Slates Formation; slate (180)		Delabole Slates (135)
98								Pickwell Down Sandstone Fm; bedded sandstone (98)		
99		Frasnian		Saltash Formation; slate and siltstone (59); Plymouth Limestone Formation (72 and 140)				Morte Slate Formation (93)		
101		Givetian	Middle Devonian		Nordon Formation; grey and green slate (59); mid- and upper Devonian limestone (72 and 140); dolomite (198), volcanic rocks (161)		Mid-Devonian limestone (72 and 140)	Hangman Grits; sandstone (133) and coarse-grained grit (169)		Grey and purple-stained limestone (28, 31)
102										
103		Eifelian								
104							Kingsteignton Volcanic Group (161)			
105								Lynton Formation; Slate and sandstone (222)		
106		Emsian	Lower Devonian		Staddon Formation; sandstone and slate (159); volcanic rocks (161)					
107					Bovisand Formation, green slate weathered buff (187) and Meadfoot Group (159, 193), volcanics (161), limestone (184)					
108		Pragian								
109					Dartmouth Group; red, grey and green slate (185)					
110		Lochkovian								
111					Start Group, mica schist (188) and chlorite schist (189)					
112										
113										

1, Chert (Upper Greensand)

Grey, brown (typical), orange and blackish chert and associated siliceous sandstone is assigned Code 1 (Figures 1-4). It occurs in buildings as cobbles and pebbles, rarely as small boulders usually with a blocky, irregular outline. Because of the irregular shape of the stone, it is nearly always laid as random rubble. In some cases, cobbles used in buildings have been collected from the beach, in which case they are well rounded and have high sphericity (Figures 5-7). In other cases, chert more closely resembles flint and occurs as irregular nodules with many re-entrant angles and with a whitish outer surface and conchoidal fracture. In some of these cases it may well be properly described as flint from the Chalk. All types are composed predominantly of chalcedony, a cryptocrystalline form of silica and are extremely fine grained. The chert is associated in some buildings with greyish-weathered, partly chalcedony-cemented sandstone (Figure 8) in which the original bedding structure is defined by trains of quartz or green glauconite grains enclosed within the chalcedony. There are continuous gradations from this kind of sandstone to chert *sensu stricto*.

Chert walling is nearly always laid as random rubble but sometime in the Nineteenth Century, ways of squaring the blocks were devised and chert walls started to be laid in courses with roughly squared off blocks (Figures 9-11). The stone is susceptible to splintering if subjected to repeated heating and cooling cycles and for this reason, builders took trouble to line the chimneys of chert buildings with some other stone, or brick, that is not susceptible to this kind of damage (Figure 12). Similarly, the difficulty of dressings chert blocks means that many buildings made mainly of chert nevertheless have quoins and dressings of more workable stone. This is especially noticeable around the margins of the Blackdown Hills (Figures 13, 14).

A fair proportion of chert houses have fragments of render or stucco adhering to the walls and it seems that in these cases, the stonework was formerly covered in render. There appears to have been a recent shift away from a smooth rendered finish towards a more vernacular style of bare stonework although in the case of chert, the rough surface of the stone has made a good outcome difficult to achieve.

Although chert is known to have been collected from some specific localities and carted considerable distances, (e.g. pits on Trinity Hill near Axminster were used as the source of stone for repairing Axminster cemetery wall), most of the chert used in buildings probably originated from shallow temporary pits in the soil profile or superficial deposits close to the building sites. Some, maybe most, chert building material was formerly collected during the course of clearing stone from the fields. The ultimate source of the stone is the Whitecliff Chert member and its equivalents, part of the Upper Greensand Formation (Cretaceous). However, chert is extremely durable and persists in abundance in material derived from the Upper Greensand. Much chert used for building is probably derived from secondary sources, eg Clay with Flints, Head and younger alluvium.

Figure 15 shows the distribution of buildings containing chert. They are concentrated on and around the Blackdown and Haldon Hills, on or close to the outcrop of the Upper Greensand. In the main part of the Blackdowns, all parts of most buildings including the quoins and dressings are made of chert but towards the edges and extending onto the surrounding formations, chert is joined by other kinds of more easily worked, locally available building stone used for the quoins and dressings, including Inferior Oolite limestone and Moolham Stone. A somewhat similar although less well marked pattern occurs around the Haldon Hills.

Figure 1. Batts Cottage, Gittisham; chert rubble.

Figure 2. Groom Cottage. Moor Lane, Churchinford.

Figure 3. Poltimore Farm, Farway (C15), almost all of chert rubble with minor cob and timber framing. The cross wing on the left with brick-lined flue is Victorian.

Figure 4. Stapely Mill, Stapely – a classic chert house of the Blackdown Hills.

Figure 5. Wall of Beach House, Kings Lane, Sidmouth, of well-rounded chert cobbles collected from the beach with some “Budleigh Buns” (Budleigh Salterton Pebble Beds Formation, Code 36, qv).

Figure 6. Pebblestone Cottage, Station Road, Sidmouth.

Figure 7. Rounded chert cobbles used as decorative edging to access path, Salcombe Regis church.

Figure 8. Church of St. Nicholas, Dunkeswell. Chert and cherty sandstone rubble with quoin of Upper Greensand sandstone on left.

Figure 9. Church of St Peter and St Paul, Churchstanton. Coursed rubble of shaped chert blocks. Quoins of Upper Greensand sandstone, dressings of Beer Stone.

Figure 10. Parish Hall, Church Street, Winsham. The wall is made of alternating blocks of squared chert with hackly finish and yellow Upper Greensand sandstone with smooth finish.

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Figure 11. Church of St. Philip and St. James, Escot. Alternating courses of squared and random-rubble chert blocks. The cornerstones of the buttresses are of calcareous sandstone from the Upper Greensand.

Figure 12. 19 Victoria Avenue, Chard. The gable end is of chert with flues lined with brick.

Figure 13. Hampton Court, Whitford. A modern development finished in chert with Ham Hill Stone quoins and dressings.

Figure 14. Typical C19 house of chert rubble with brick quoins and dressings and rendered gable end. Sellick's Green, Blagdon Hill.

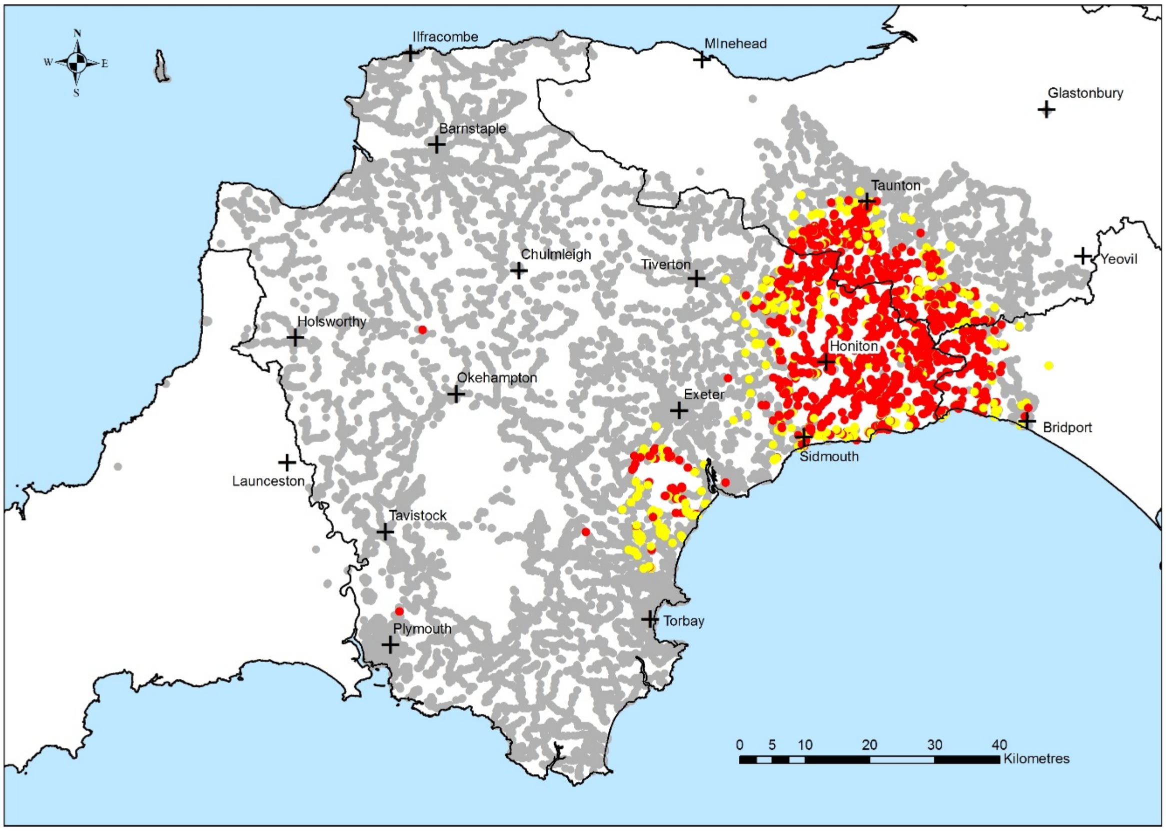

Figure 15. Distribution of buildings containing chert from the Upper Greensand Formation. Red symbols, building is mainly made of chert; yellow, building contains some chert; grey, building lacks visible chert.

2, Flint

Rock called here flint is black, dark grey, yellow and toffee-coloured chert forming irregular nodules up to small boulders in size, but typically as large pebbles and irregular cobbles, in many cases with a white outer selvage. The rock is very fine-grained and is composed almost entirely of cryptocrystalline silica (chalcedony). It is distinguished from chert by the lack of inclusions, lack of relict bedding structures, characteristic nodular shape and conchoidal fracture (Figures 1-4) but flint as used here is in fact a variety of chert and the two rock names are used interchangeably by some writers. The flint of the Sidmouth area and the Haldon Hills is a nodular chert with characteristic toffee-coloured or greyish pigmentation. It occurs in walls usually as carefully sized cobbles of nodular chalcedony showing many flint-like characteristics, especially the shape, and is often laid in courses (Figures 1, 2). It almost entirely replaces chert in the Sidmouth area. It is widely used as a decorative finish (Figure 7).

Flint as defined here is probably derived ultimately from the Chalk. However, there is a close association of flint in the Sidmouth area with chert breccia (Code 83, qv). The two occur together in many buildings and the clasts in the breccia are of the same toffee-coloured chalcedony. Chert breccia is believed to be silicified chert gravel from the Clay with Flints. Therefore, it is probable that much of the flint of the Sidmouth area is from the Clay with Flints or derived superficial deposits rather than directly from the Chalk which is not exposed here. In the same way, the flint used around the Haldon Hills is probably derived from the Bullers Hill and Tower Wood Gravels rather than directly from the chalk.

Like chert, flint is extremely durable and persists in the superficial deposits. It is probable that most flint used in buildings was collected from the surface or from shallow temporary pits rather than from permanent quarries.

Its distribution in buildings is shown in Figure 7. It is used near its outcrop as expected but also well to the west, in many cases as a decorative coping of walls made of some other material.

Figure 1. Photo © Mr Richard F Lloyd. Wall of Radway Guest House, Salcombe Road (N), Sidmouth.

Figure 2. The Old Vicarage, West Hill, Budleigh Salterton. Red conglomerate and sandstone from the Otter Sandstone below, flint in brick panels above.

Figure 3. St Paul's church, Chudleigh Knighton, finished almost entirely with flint which is not knapped. Quoins and dressings are of grey limestone from Torbay.

Figure 4. Wall next to Larbi Cote, Station Road, Sidmouth. Mainly of flint with minor chalcedonic sandstone and chert.

Figure 5. Longthorne Cottage, Ideford, close to Ideford Arch.

Figure 6. Jubilee Cottages, The Causeway, Beer. The walls are finished with flint. The quoins and dressings are of Beer Stone with decorative brick string course.

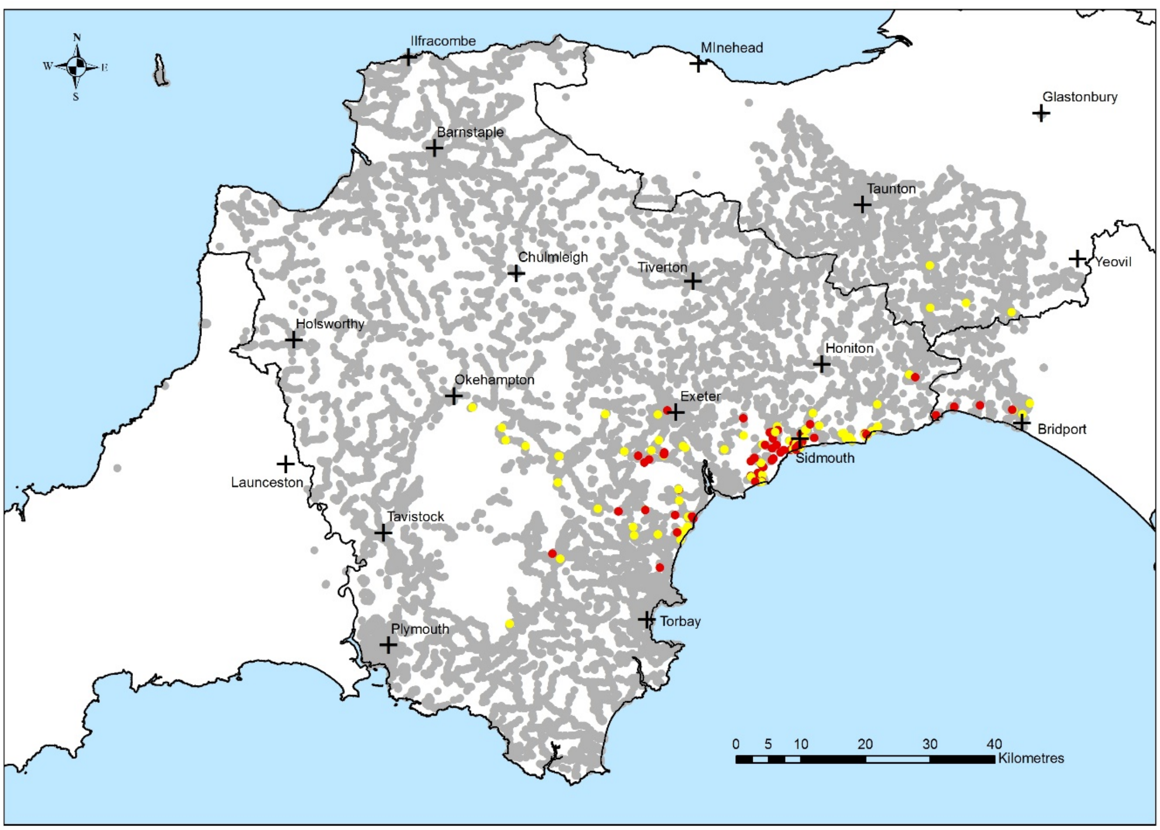

Figure 7. Distribution of flint in buildings. Red symbols, flint is the main building material; yellow symbols, flint is a subsidiary building material; grey symbols, building lacks visible flint.

3, Beer Stone

Beer Stone is a white or pale cream-coloured, fine- to medium-grained granular homogeneous clastic limestone (Figures 1 – 5). It is soft when first extracted but hardens on exposure to the air. The practice at the quarry was to leave stone lying outside for a season to harden off before it was used. However, its soft nature, fine white appearance, and marked homogeneity made it ideal material for intricate carving and it is very widely used for this purpose in the interior of buildings, especially churches in the West Country and further afield, but also for secular buildings of the better sort, e.g. for mantelpieces.

On exterior walls, it suffers from flaking of the surface which is a characteristic of the rock and helps to differentiate it from other clastic limestones of the area (Figure 6). Rotting of the stone is a problem where used externally, especially if the atmosphere is polluted (Figure 7). It is also susceptible to the accumulation of dirt which obscures the white colour of the stone and makes it much harder to identify (Figure 8). Because of its tendency to flake, the stone is regularly covered in a protective layer of whitewash or other white preservative coating which obscures its nature but does at least preserve it from disintegration. Nevertheless, very fine detail is still displayed by Beer Stone dressings on the exterior of churches in the clear atmosphere of rural Devon (Figures 9-11).

Beer Stone characteristically shows a faint nodular structure on weathered surfaces. In some cases, the nodules are somewhat flattened in the bedding planes which they help to define (Figures 12 and 13). Otherwise the stone is remarkably homogeneous. This and its initial softness and fine grain size make it an ideal stone for intricate decorative work. There is possibility of confusion with some kinds of calcareous sandstone from the Upper Greensand (Rock-type 52) especially on those weathered surfaces where the angular clastic calcite grains stand out from the surface.

Beer Stone used for ordinary walling is sparely used in the area of study compared to its use for the dressings of churches but is more common in Beer itself and in the nearby town of Colyton (Figure15). The blocks are relatively large, up to one metre on a side (Figure 16); there seems to have been no difficulty in extracting blocks large enough for most building purposes. The ease with which blocks could be shaped means that ashlar construction is relatively common where the stone is widely used, in Beer and Colyton (Figures 17 and 18).

Beer stone for building was quarried from the base of the Middle Chalk at Beer from Roman times until the recent past. Because of its soft, rather fine-grained and homogeneous nature, it was much sought after for carving and decorative work, mainly inside churches in many parts of England and for the grander sort of house in the south-west, but also for external carved tracery especially of late medieval churches in Devon, Somerset and Dorset (Figures 19 and 21). Most buildings of all kinds in Beer and Colyton that have a stone-built element are made of Beer Stone or include some Beer Stone (Figure 20).

Note also Sutton Stone (from Sutton Quarry near Offwell) according to Woodward and Ussher (1911), believed to be similar to Beer Stone and used for building locally in the Widworthy and Offwell area of East Devon (See also Howe 2001, p 263 where mention is also made of a Beer Stone quarry at Ware, near Lyme Regis).

References

Howe, J.A., 2001. *The Geology of Building Stones.* Facsimile edition. Donhead Publishing Ltd.

Woodward, H.B. and Ussher, W.A.E., 1911. *The geology of the country near Sidmouth and Lyme Regis: explanation of Sheets 326 and 340*. Mem. geol. Surv. UK. HMSO.

Figure 1. Tower of St Gregory's church, Harpford. Beer Stone dressings round the west door; mainly Upper Greensand sandstone with some Beer stone used for the quoins and mud pebble conglomerate from the Otter Sandstone used for the walls.

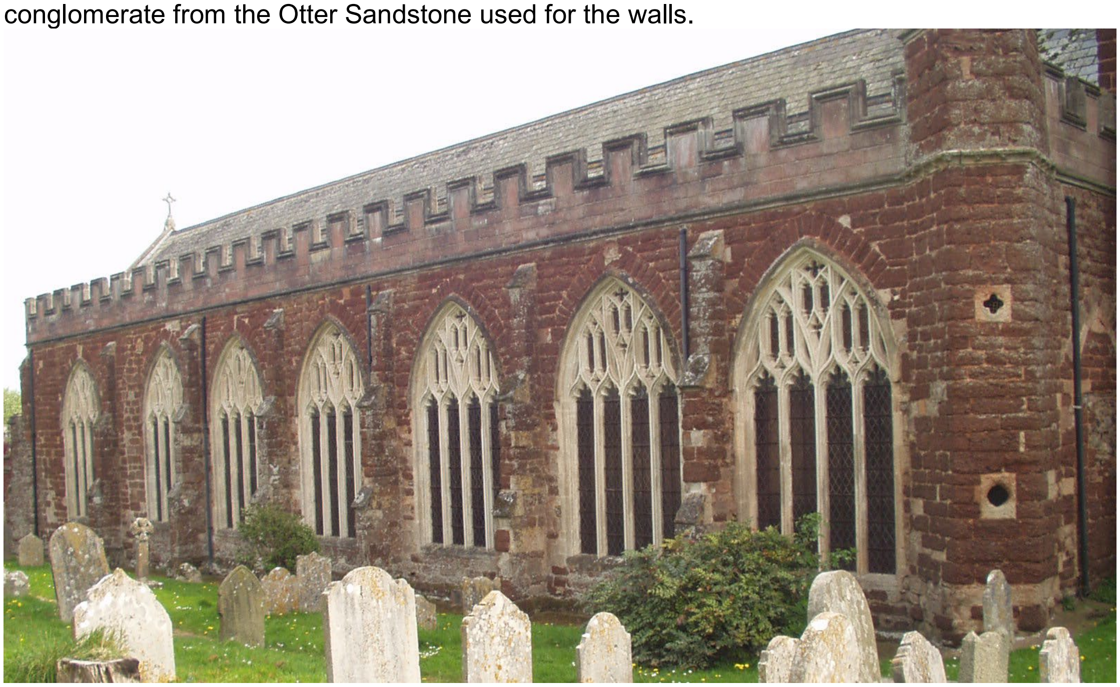

Figure 2. Beer Stone window dressings of the north aisle of All Saints church, Kenton. The wall is of red Heavitree Breccia and fawn sandstone probably from the Otter Sandstone Formation.

Figure 3. South aisle windows of Beer Stone with carved Beer Stone frieze over. Church of St Hieritha, Chittlehampton. The walls are made of Bude Formation sandstone.

Figure 4. Beer Stone window dressings, south side of nave, St George’s church, George Nympton. The wall is made of Bude sandstone rubble.

Figure 5. St John’s church, Plymtree. The window dressings and the niche for the statue are of Beer Stone. The walling and relieving arches are mainly of maroon Bude Formation sandstone (Code 119) with minor Exeter volcanics.

Figure 6. Buttress to the south aisle of St Andrew's church, Colyton. Characteristic surface flaking of Beer Stone.

Figure 7. North aisle of St Andrew's church, Charmouth. Badly weathered Beer Stone used for the quoins and buttresses.

Figure 8. St Leonard's church, Birchwood. The dressings and relieving arch of the west door are of Beer Stone discoloured by weathering. The dressings of the west window were not identified. The walls are mainly made of chert rubble.

Figure 9. Beer Stone tracery at the west end of the nave of St Andrew's church, Colyton. The slightly darker blocks used for the footing below the window and part of the wall on the right are believed to be from the Upper Greensand (Code 52). The west end of the south aisle on the far right is made of chert rubble.

Figure 10. Porch of St Peter's church, Tiverton; mainly of Beer Stone with some Portland Stone, perhaps repairs.

Figure 11. Porch of St James the Great, Talaton. Beer Stone is used for the carved dressings round the door, the parapet and, alternating with purple lava, for the relieving arch over the door. The quoins are mainly of calcareous sandstone from the Upper Greensand and the wall material is mainly maroon sandstone of the Bude Formation.

Figure 12. Quoin of the chancel of St George's church, George Nympton. The Beer Stone shows sub-parallel fractures roughly following to the bedding.

Figure 13. Detail of the Beer Stone window dressings of the Town Hall, Castle Circus, Torquay showing characteristic sub-parallel fractures defining the bedding.

Figure 14. Cockington Court, Torbay. The central range on the right is of Beer Stone ashlar. The range on the left is of mid-Devonian limestone.

Figure 15. Durham House apartments, Fore Street, Beer.

Figure 16. Tower of St Mary's church, Kentisbeare. The quoins and staircase are made of decorative alternating large blocks of Beer Stone and maroon Bude sandstone from the nearby Upton Quarry.


Figure 17. Starre House, The Causeway, Beer.


Figure 18. Galeen, Moke's Cottage and Althea, King Street, Colyton.

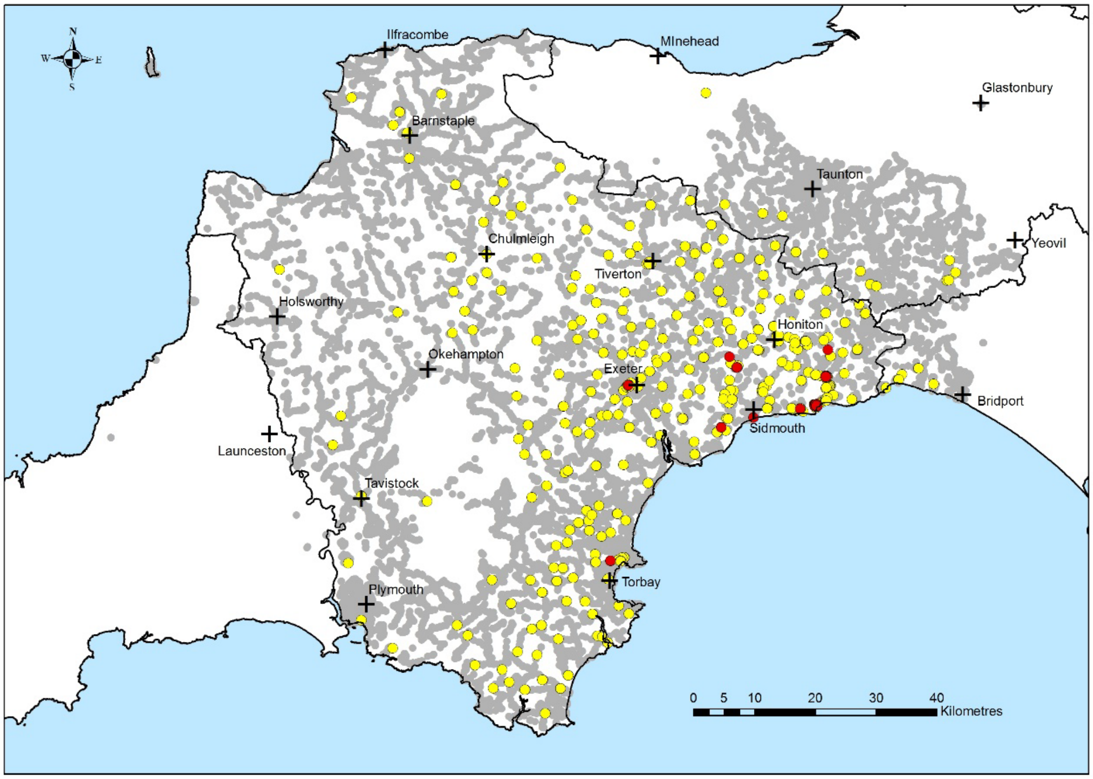

Figure 19. Distribution of Beer Stone in buildings. Red symbols, Beer Stone is the main building or finishing material; yellow symbols, building contains some Beer Stone; grey symbols, building lacks visible Beer Stone.

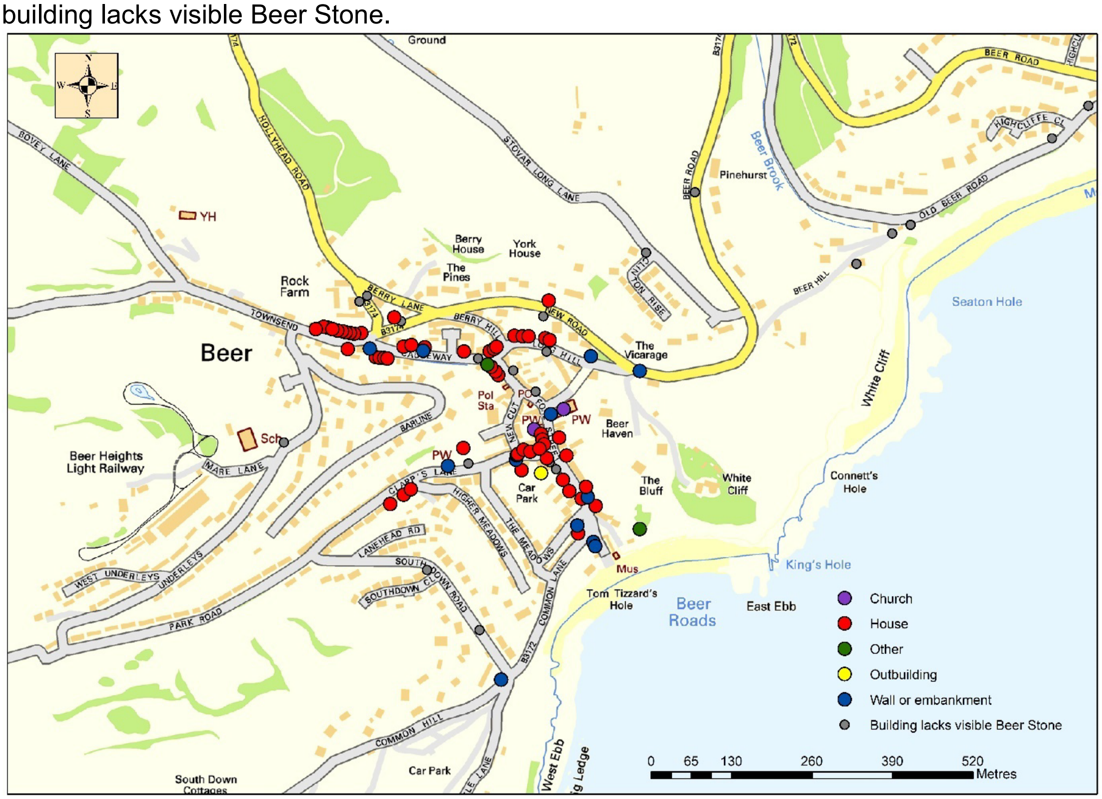

Figure 20. Buildings containing Beer Stone in Beer. Base map © Crown copyright and database rights 2018, OS 93830343

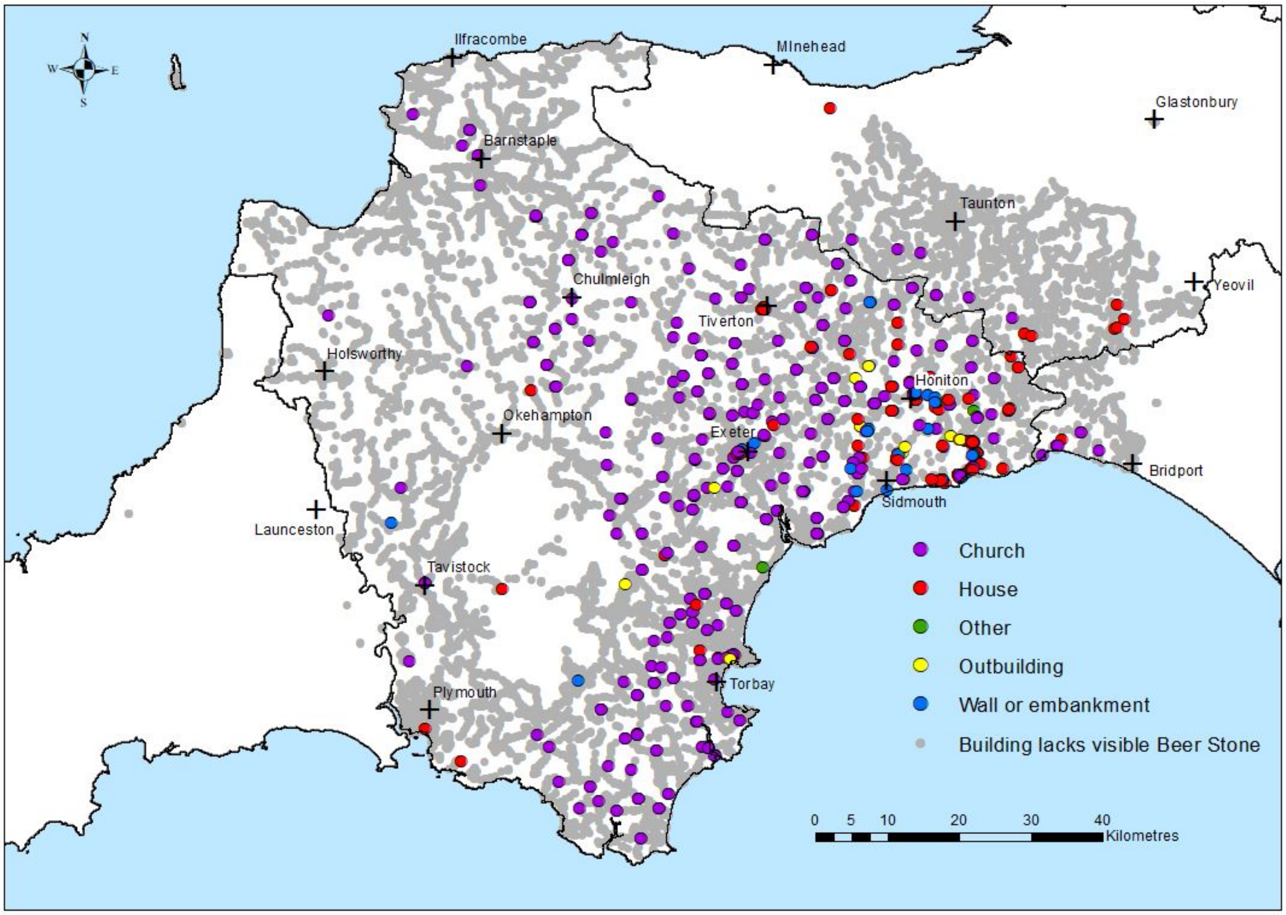

Figure 21. Distribution of Beer Stone by building type.

4, Ham Hill Stone

Ham Hill Stone is a biscuit-coloured medium- to coarse-grained clastic limestone (Figures 1, 3, 4, 6 and 7) with abundant fossils, cross-bedded in many cases, (Figure 2). Differential weathering that picks out the bedding planes is characteristic (Figure 2). The interstices between the fossil shells are filled with aggregates of brown-weathered micrite and clear sparite. Shell fragments form the continuous fabric of the rock and are strongly cemented together. The rock lacks the voids typical of Forest Marble and usually has no hint of grey in buildings, even in fresh rock, which helps to distinguish it from Forest Marble.

The flat shell fragments define a strong oriented fabric lying in the bedding. Most blocks show cross-bedding, a structure of curved sets of beds truncated on their upper surface caused by periodic erosion by strong currents while the rock was being deposited (Figure 2).

Ham Hill Stone has been quarried on Ham Hill, west of Yeovil, since Roman times and the quarries are still active. Similar shelly limestone was formerly quarried at nearby localities as far south as North Perrot. Ham Hill Stone is widely used in the region not only for the walls of major buildings including Barrington Court, Montacute House (Figure 7) and Brympton D'Evercy, but also for the quoins and dressings of buildings mainly made of other materials (Figures 1, 6 and 8)). It is the main building stone in and around Montacute, Martock and Crewkerne close to the source quarries, but also has a wide distribution across Devon, becoming progressively less commonly seen as one travels west (Figure 5). It was used for the cloister windows of Hartland Abbey built in 1157, an amazing feat considering the distance the stone had to be carried.

Figure 1. Peace Lane Cottage, Long Sutton. Ham Hill Stone dressings round door and windows. The front wall is of Blue Lias limestone.

Figure 2. South aisle, St Mary Magdalene's, Taunton. Differential weathering has picked out the cross-bedding.

Figure 3. Swan Inn, Church Street, Crewkerne. Ham Hill Stone ashlar front wall, Inferior Oolite limestone gable end.

Figure 4. Harvey's, High Street, Chard. Ham Hill Stone ashlar.

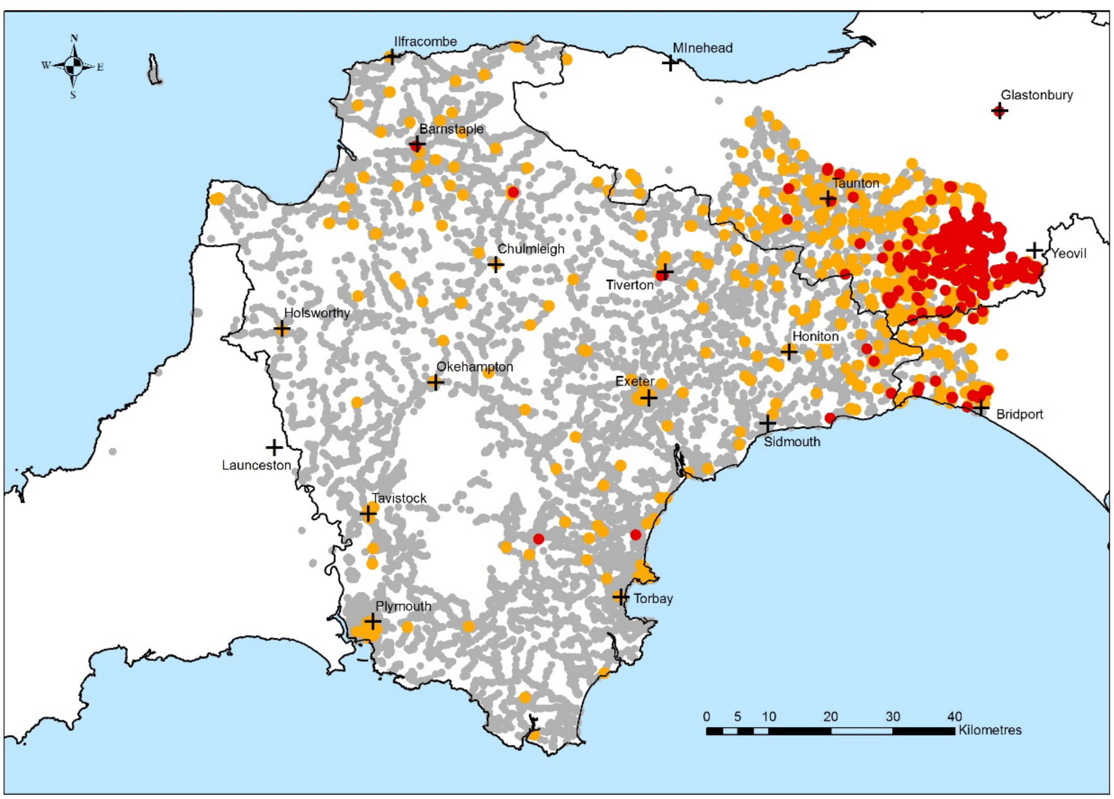

Figure 5. Distribution of Ham Hill Stone in the survey area. Red symbols, Ham Hill Stone is the main building material; yellow symbols, building contains some Ham Hill Stone; grey symbols, building lacks visible Ham Hill Stone.

Figure 6. Gateway to the churchyard of St James' church, Swimbridge. The upper part of the archway and the string courses and coping of the flanking walls are of Ham Hill Stone.

Figure 7. Montacute House, Montacute,

Figure 8. Terrace of C19 houses, of Middle Devonian limestone with dressings of Ham Hill Stone, Sutherland Road, Plymouth.

5, 25, 26, 34, 35 and 74, Blue Lias Limestone

Limestone from the lowest part of the Jurassic succession underlies parts of East Devon, west Dorset and South Somerset and is widely used for building in these areas; it is the dominant building stone on the south side of the Vale of Taunton Deane and on the southern borders of the Somerset Levels and is also important in Lyme Regis and Axminster (Figure 1).

During the course of the survey, attempts were made at various times to distinguish between different kinds of Blue Lias building stone so as to provide a more detailed picture of the pattern of extraction and use of the stone. Six varieties of stone were distinguished:

Material Code	Description
5	Undifferentiated; stone lacking features that would permit reference to a more tightly specified group.
25	Stone used in southeast Devon and south Dorset lacking weathered outer parts to the blocks and believed to have been won from the quarries on Monmouth Beach and at Church Cliffs in Lyme Regis where active erosion meant that fresh unweathered stone was available to the quarrymen (Figure 2).
26	Stone with strong compositional lamination and resistance to weathering believed to have been quarried at and around Keinton Mandeville, Charleton Mackerell and Charleton Adam in South Somerset (Keinton Stone – Figure 3).
34	Hard durable limestone quarried in South Somerset (Figure 4)
35	Uniformly grey limestone from deep quarries in south Somerset
74	Pale grey muddy limestone (Curry Mallet Stone)

These distinctions became progressively more difficult to sustain as the work continued from Devon into South Somerset. In any case, they fail to take account of one of the most obvious differences between stone from different sources; the extent of weathering. So, for example, the stone used in Devon for houses built before the recent revival of Blue Lias quarrying in south Somerset, is always yellow or fawn, in some cases with a blue heart, reflecting the fact that the local quarries were small and shallow and the stone extracted was always partly oxidised. Consequently, the different classes of Blue Lias building stone have been amalgamated into a single category.

The fresh stone is grey with considerable variation in tone from light to dark but generally maintaining the same tone for the stone used in a single building (Figures 5-7). Weathered stone shows a range of colours including yellow, fawn, orange and brown (Figures 8-10). This is typical of stone used in older houses, for example in Axminster, won from relatively shallow quarries where the stone is partly weathered. Very characteristic is the use of blocks with a grey centre and yellow or orange borders following either the top and bottom of the block or all four visible sides (blue hearted – Figure 11). This reflects the weathering of the stone in the ground. Oxidised surface water penetrates more effectively into weaknesses in the bedrock following joints and the bedding planes between limestone bands and the enclosing shale, oxidising the stone it comes in contact with but leaving the stone remote from these channels unaltered. Contrary to expectations, the partly weathered rock is in some cases more resident to weathering than the fresh stone, resulting in blocks with a dished profile in the wall surface (Figure 12).

The presence of these altered outer skins highlights an important aspect of Blue Lias building stone in older buildings, that each stone represents the full thickness of the limestone bed from which it was won. It seems to be the case that some builders took care to use stone from the same bed for each course of the wall they were building so that the height of each stone used matched that of the whole course. This has resulted in a special kind of ashlar construction where each course is of a different depth of stone of matched height (Figure 13), or where Blue Lias courses are interleaved with those of a different kind of building stone (Figure 14). Compared to other common Devon building stone, Blue Lias is more likely to be built in courses as coursed ashlar or rubble. Of the 747 buildings of all kinds in the survey where Blue Lias limestone is the main material used, 380 or just over 50% are of ashlar, rough ashlar or coursed rubble construction, compared to about 14% for all kinds of stone in the survey.

The limestone is generally rather fine grained and somewhat muddy, composed of calcite and clay minerals. Internal fabrics and structures are seldom obvious – the stone appears homogeneous or may be finely laminated- but fossil shells are locally abundant, crowding the bedding planes (Figure 4) or clearly visible in surfaces cut perpendicular to the bedding. Narrow veins of white, yellow, brown or orange calcite are very common; where the stone has split along one of these veins, the surfaces of the resulting block exhibits these colours, relieving to some extent the rather dull monotonous grey colour of the fresh stone. Modern buildings tend to include a scattering of these blocks so as to break up the overwhelming sense of greyness that the stone can impart (Figure 15). While some older Blue Lias buildings can show attractive colours, the general effect is in most cases distinctly sombre.

As mentioned in a previous paragraph, the building blocks in older houses are of a size that depends on the thickness of the limestone bed from which the stone was taken or, in random rubble construction buildings, are of variable but generally medium size. Modern buildings use stone from deep quarries with fewer constraints on the sizes that can be produced and here the stone tends to be marketed and used in blocks about the size and shape of a brick (Figure 15).

The stone is not very durable. The surface tends to flake off and spall and where this is advanced, the mortar between the wasted blocks may be left standing proud. This has been taken to an extreme in the case of the former sea wall in Lyme Regis (Figure 16). However, the stone is also strong in thin slabs, and although only noted in passing in this survey, Blue Lias flags are known to be widely distributed across the area of study especially for churchyard paths and the floors of churches. It is also easy to shape and many buildings made mostly or less manageable material such as chert, have quoins and dressings of Blue Lias limestone or have walls of a mixture of Blue Lias and some other stone. Conversely, its sombre hue has encouraged builders, masons and architects to brighten up buildings made of this stone with quoins and dressings of something else, including, no doubt because it comes easily to hand, Ham Hill Stone, an especially common combination in South Somerset (Figures 17-19).

In and around the Blackdown Hills where the main building stone is chert from the Upper Greensand, Blue Lias limestone is used in some buildings as a lining of the flues, presumably because chert tends to split and disintegrate under the constant expansion and contraction caused by lighting fires (Figure 20). In later buildings, stonework of all kinds may be replaced by bricks for the flues (Figure 21). In brick buildings, the limestone was used for the foundations and base of the walls in the days before the invention of the damp proof course, to prevent the damp from wicking up the walls though the porous bricks. Many Nineteenth Century brick buildings around Trinity Square in central Axminster have footings like this.

No attempt has been made to link the stone in a particular building to any one of the limestone beds of the Blue Lias sequence (see for example Lang, 1924). Paler grey limestone from the Blue Lias is believed to come from beds towards the base of the sequence and it may be that some of this paler limestone in buildings has been referred to the White Lias (Material Code 27, qv) in error. Otherwise, Blue Lias limestone is quite distinct lithologically from other building stone of the area. It is widely distributed away from its outcrop and the main area of occurrence in buildings, as a minor constituent of all kinds of buildings as far west as Dartmoor. A separate group of buildings containing Blue Lias limestone is centred on Barnstaple (Figures 1 and 22)) and here the stone is likely to have been shipped from Wales.

Reference

Lang, W. D., 1924. The Blue Lias of the Devon and Dorset coasts. *Proceedings of the Geologists' Association,* **35,** 169-185

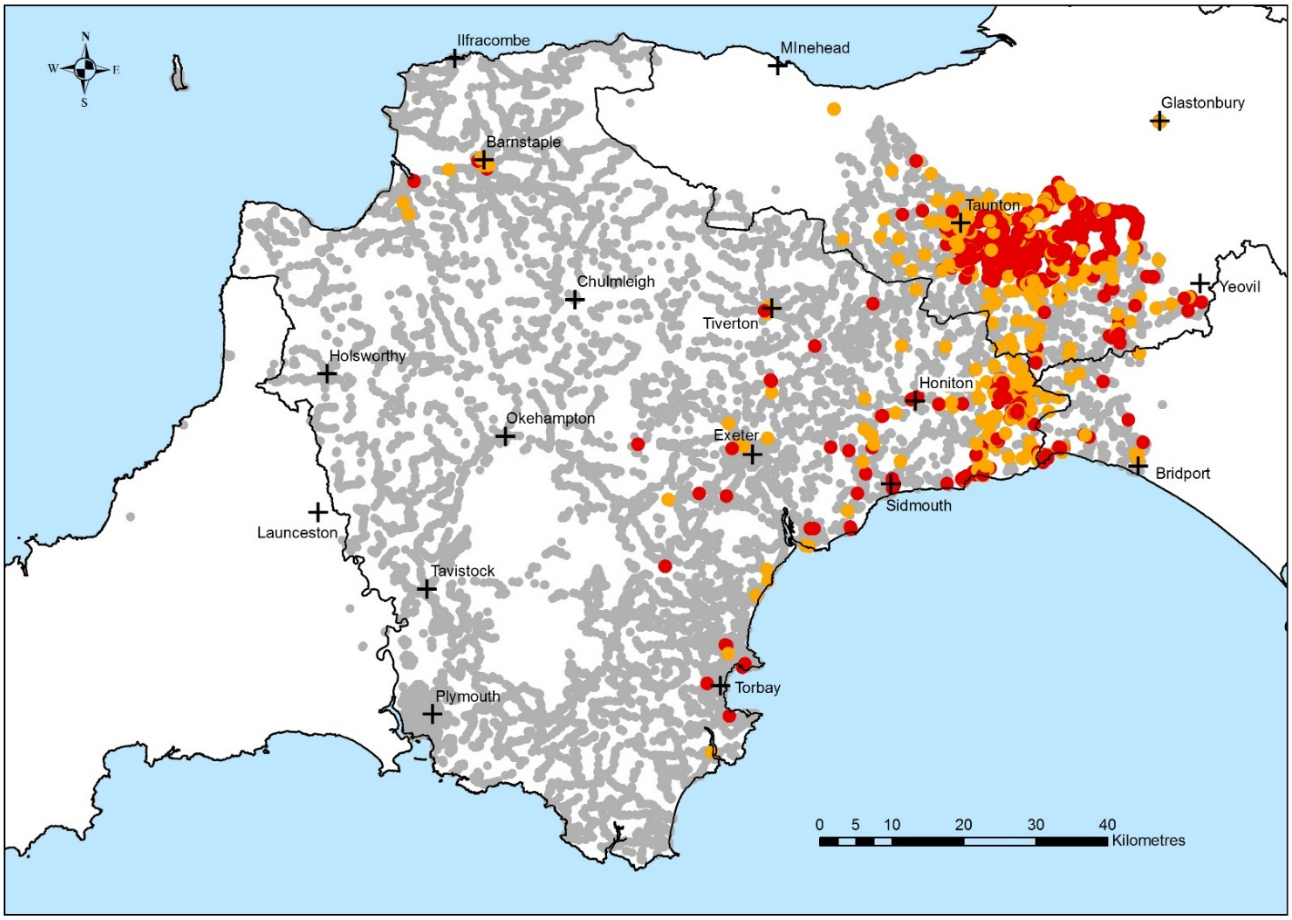

Figure 1. Distribution of Blue Lias limestone in buildings. Red, Blue Lias limestone is the main building material; yellow, building contains some Blue Lias limestone; grey, building lacks visible Blue Lias limestone.

Figure 2. Coram Tower, Lyme Regis. The quoins and dressings are of Ham Hill Stone. The uniformly grey colour of the Blue Lias suggests a source in the sea cliffs or at any rate, beyond the zone of surface weathering.

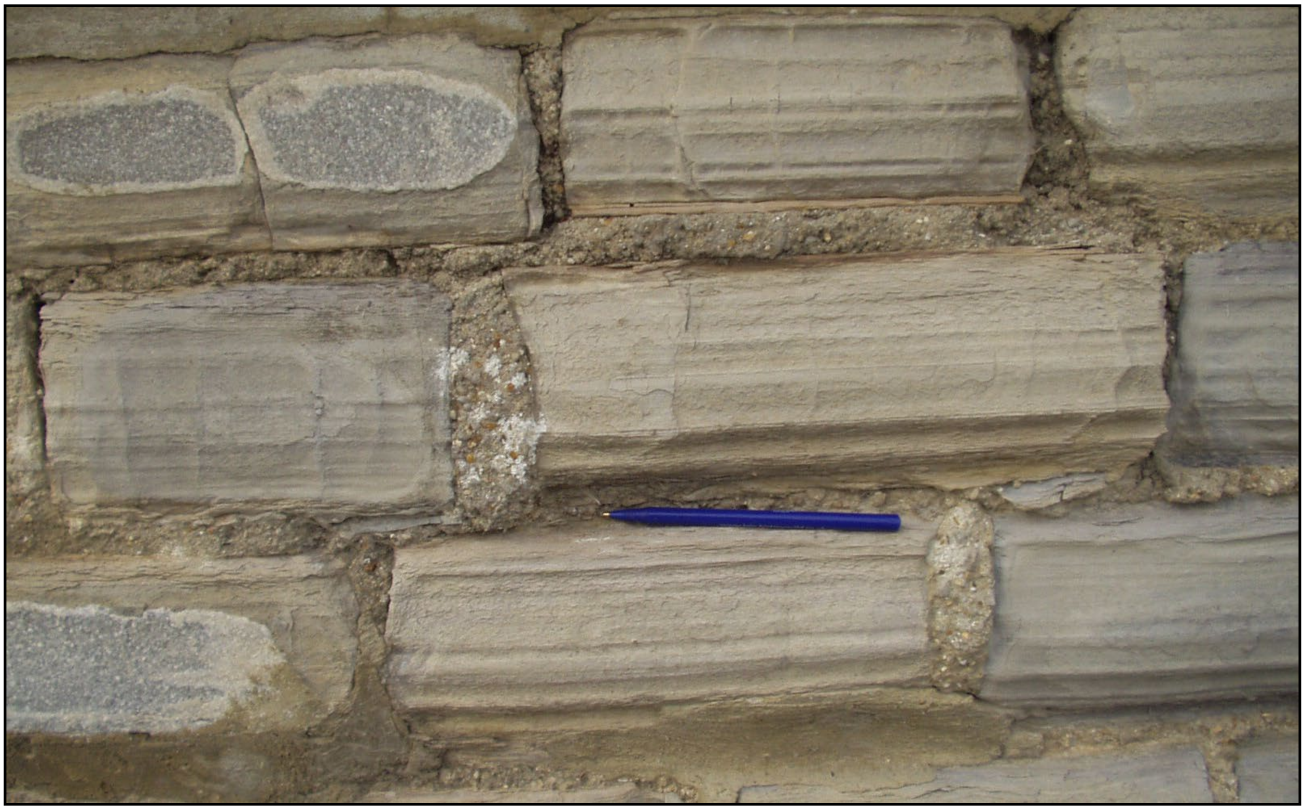

Figure 3. By the Bay Restaurant, Marine Parade, Lyme Regis. The flat faces of the blocks top left and bottom left follow cross-cutting veins of calcite.

Figure 4. Wall of Lifeboat Station, Lyme Regis. The block below the pen shows bivalve shells and worm tracks. The stone is from Tout Quarry, South Somerset.

Figure 5. Allens, Beercrocombe. The walls, quoins and dressings are all of Blue Lias limestone with some concrete sills.

Figure 6. 1-6 Bow Street Langport. Some of the quoins and dressings are of paler grey White Lias limestone.

Figure 7. All Saints church, Isle Brewers. Sombre grey Blue Lias limestone with Ham Hill Stone quoins and dressings.

Figure 7. All Saints church, Isle Brewers. Sombre grey Blue Lias limestone with Ham Hill Stone quoins and dressings.

Figure 8. The Old Brushworks, Castle Street, Axminster. Yellow Blue Lias limestone with brick quoins and dressings.

Figure 9. Membury Forge, Membury. Yellow and grey Blue Lias limestone.

Figure 10. The Old Register Office, Silver Street, Axminster. Blue Lias limestone with Ham Hill Stone dressings.

Figure 11. Blue-hearted building blocks. St Andrew's church, West Hatch.

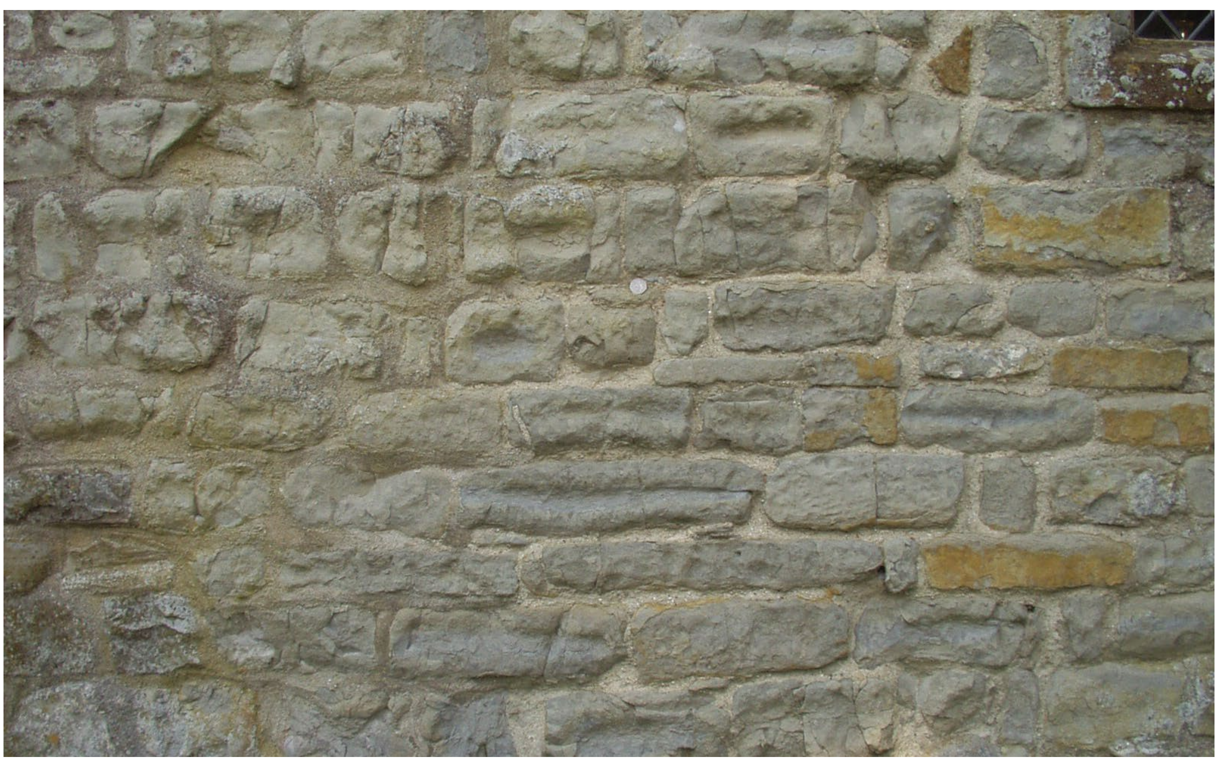

Figure 12. Dished building blocks. Chancel of St Peter's church, Ilton

Figure 13. Wall of St Catherine's churchyard, Drayton. Blue Lias limestone laid in courses of different thickness.

Figure 14. Gable end of Porch House, Broadway Road, Broadway. Two thin courses of Blue Lias limestone alternate with two thicker courses of grey Upper Greensand calcareous grit (Code 13) and yellow Moolham Stone (Code 66).

Figure 15. 1 Hillcrest Gardens, Exmouth. Blue Lias limestone finish to the front of the house including some cream and yellow blocks, breaking up the monotonous grey pigmentation.

Figure 16. Former sea wall below the Marine Theatre, Lyme Regis. Erosion has washed out the soft limestone leaving stringers of calcite standing proud.

Figure 17. Tower of St George’s church, Ruishton, of Blue Lias limestone with dressings of Ham Hill Stone.

Figure 18. Tudor St Anthony, Muchelney. Grey Blue Lias limestone enlivened by biscuit-coloured Ham Hill Stone dressings.

Figure 19. St Peter's and St Paul's, North Curry, south side of chancel. The Blue Lias limestone is enlivened by dressings and string courses of Ham Hill Stone.

Figure 20. The Old Farmhouse, Castle Hill, Axminster. The gable end is mainly of chert but the flues are lined with yellow Blue Lias limestone. There is only one chimney pot so one or perhaps both chimneys may be blocked up.

Figure 21. Gable end of 31 Ditton Street, Ilminster. The wall is of Moolham Stone below with Blue Lias limestone in the apex of the roof. The fireplaces and flues are of brick.

Figure 22. Wall outside the United Services Bowling Club, Pottington Road, Barnstaple.

6, Lower Lias shale and marl

These building stones resemble Blue Lias limestone but they are softer and more clayey. They have variable pigmentation from very dark to light grey or greenish grey where fresh (Figure 1). Their source is probably mainly from the Charmouth Mudstone Formation but may also include mudstone parts of the Blue Lias and Dyrham Formations.

Inclusion of this shale in the walls of buildings is adventitous – no right-minded person would include such poor material in their building on purpose – and it is, as a consequence, seldom seen and where it is, usually makes up only a few pieces among more suitable rock types (Figure 1).

Figure 1. Black shale referred to Building Stone Code 6 in chert rubble wall, St Gabriel's chapel, Morecombelake.

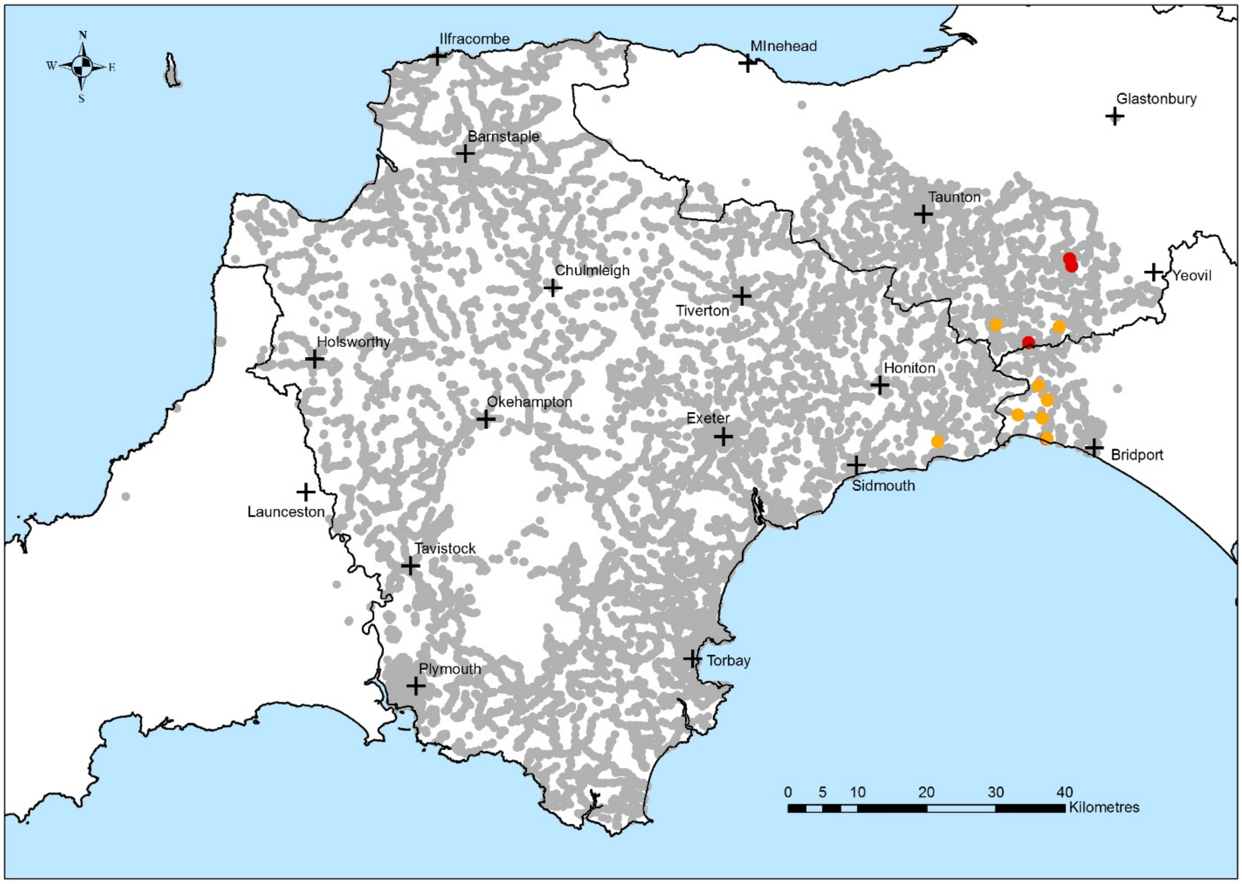

Figure 2. Distribution of slate and mudstone from the Charmouth Mudstone Formation. Red symbols, Charmouth Mudstone is the main building on finishing material; yellow symbols, building contains some of this mudstone; grey symbols, building lacks this kind of mudstone.

10, Cob

Cob is a building material composed of mud or marl with the addition of various materials (dung, straw), built up wet into a wall in stages and allowed to dry before the next layer is added. It is widely used for older buildings in south-west England, especially where good building stone is scarce. Material Code 10 is reserved for the occurrence of cob where the material is visible. Because cob must be kept dry, (or else it reverts to mud), most cob walls have a render which obscures its nature and cob is always built on a foundation of stone which protects it from rising moisture and has a waterproof coping to protect from the rain. Visible cob occurs mostly in poorly maintained garden walls and the walls of farm outbuildings (Figures 1-3). It is seldom visible in the walls of cob houses which tend to be better maintained.

Figure 1. Outbuilding, Tipton St John. Remains of the original tile roof are visible below the new corrugated iron.

Figure 2. Place Court, Colaton Raleigh. Boundary wall of cob with footing of Budleigh Salterton pebbles and coping of thatch. The cob is riddled with the burrows of solitary bees.

Figure 3. Salter's Farm, Luton. Lower parts of the cob walls are of chert.

Figure 4 shows the distribution of buildings where exposed cob was observed. There is a fair scattering of cob buildings throughout the area studied with a slight concentration running north from Sidmouth to the Somerset border, corresponding to the zone of red Permian and Triassic marls where building stone is hard to find. There is a marked lack of cob buildings in the South Hams. Cob outbuildings greatly outnumber cob houses and walls where the cob is exposed to the elements.

Figure 5 shows the distribution of buildings believed to contain cob where it has been rendered over. Again there is a fairly even distribution but with noticeably lower concentrations in the Blackdown Hills and South Hams. The type of building is now biased towards houses, reflecting the tendency for cob houses to be much better maintained than garden walls or outbuildings, with regular reapplication of the external render and maintenance of a waterproof roof. Table 1 sets out the number of cob buildings observed up to May 2015 and confirms the relative proportions of cob buildings illustrated in Figures 4 and 5. Only one church in the study (Coleford Gospel Hall) contains cob, confirmed by the listed building citation.

Of course, rendered cob was not observed in buildings directly but was inferred from aspects of their architecture. However, comparison with the listed building citations indicates that the number of rendered cob buildings has been underestimated rather than overestimated. In some towns and villages on the south coast of Devon, including Sidmouth and Dawlish, there was a late phase of building in cob in the early Twentieth Century. The presence of cob in these buildings cannot easily be inferred from aspects of their external appearance, leading to a further underestimate of their abundance in the Devon landscape.

Table 1. Cob buildings

	Number of buildings		
Building type	**Exposed cob**	**Rendered cob**	**Total**
Church	0	1	1
House	30	1339	1369
Outbuilding	242	121	363
Wall or embankment	59	87	146
Total	331	1547	1878

Devon is reckoned to be one of the counties where large numbers of cob buildings are preserved along with Cornwall and Cumbria and perhaps exceeds these other counties in this respect (http://www.devonearthbuilding.com/, 2015). In former times, nearly all Devon buildings were made of cob (Vancouver, 1808, p95). Because of its relative prosperity in medieval and early modern times, a comparatively large proportion of these were of good quality in Devon and this perhaps goes some way towards explaining why so many of them are preserved. While cob houses will doubtless continue to be a feature of the Devon landscape, cob farm outbuildings tend to be in a poor state of repair and many of them will no doubt be replaced by structures made of modern and more practical materials as the years go by.

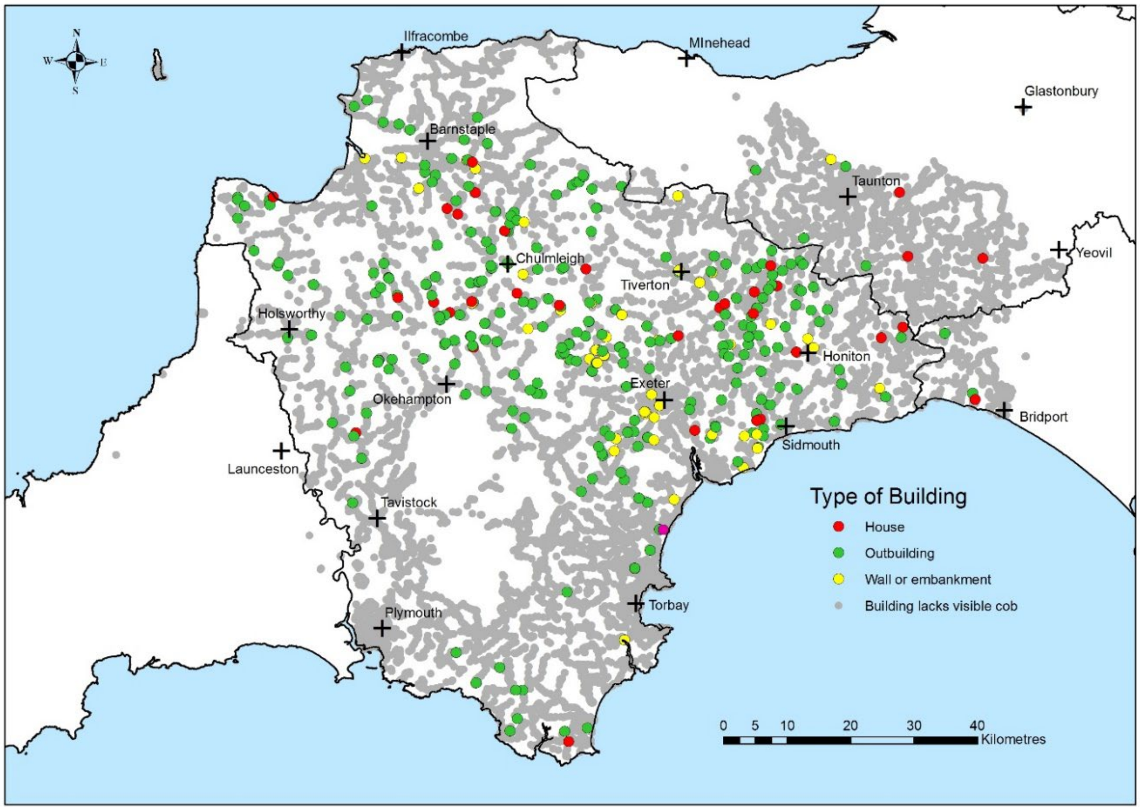

Figure 4. Distribution of buildings with exposed cob.

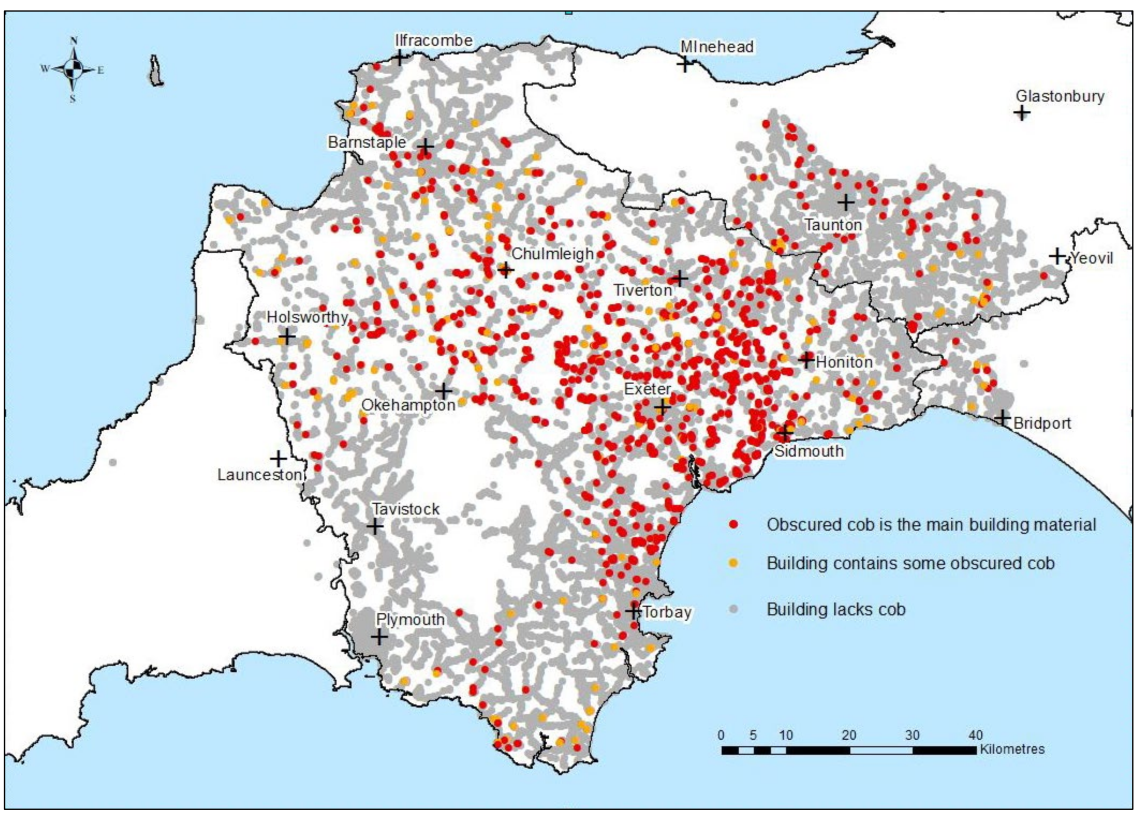

Figure 5. Distribution of buildings with obscured cob.

Appendix. Cob Buildings in Devon

Cob, a walling material made of subsoil and straw with cow dung as an optional extra, built up in layers on a stone footing (Schofield and Smallcombe, 2007), is widely used for all kinds of building in Devon except churches. Where the cob is exposed, it has been assigned Material Code 10; where it is entirely covered in render it has been assigned Material Code 42. In this case, its identification is dependent on aspects of the building characteristic of cob such as a stone footing, strong batter, rounded corners, few openings for windows or doors and no more than 1.5 storeys in height.

In order to provide some justification for the identification of cob in buildings where it is entirely covered in render, the descriptions of listed houses in the database believed to be partly made of cob were compared with the listed building citations. The results are set out in Table 1.

Table 1. Rendered cob (Material Code 42) in listed houses

	Listed building citations	
Database	Has cob	No cob
Has cob	399	39
No cob	14	

The table implies that there is an overestimate of the use of cob in this way of about 10 percent compared to the citations (39 out of 438 houses) partly offset by a failure to recognise cob in 14 houses where it is mentioned in the listed building citations. The architects who prepared the citations did not get to look inside the houses in many cases so they also depended on the exterior appearance; in these cases, there is no reason to believe they were more accurate than this survey. Consequently, the identification of rendered cob in houses in the survey, and by implication, in outbuildings and walls too, is accepted as a reasonably accurate approximation.

Table 2 shows a breakdown of cob buildings by building type. Attention is drawn to the contrast between houses where most cob buildings have a rendered exterior, and outbuildings, where the cob is exposed in most buildings. It seems that an effort is made to maintain cob houses in a good state of repair but that outbuildings have in a significant proportion of cases been neglected and allowed to fall into disrepair.

The table also illustrates in the last column the large proportion of buildings in Devon that include a cob element. Note that this is the proportion of buildings in the survey which have a visible stone (or cob) built element, not all buildings. Still, the proportions of 12% of houses, 15% of outbuildings and 7% of buildings of all kinds is impressive and is probably greater than for other counties in England (Devon Earth Building Association, 2015).

Table 2. Cob buildings by building type

Type of building	**Visible**	**Inferred**	**Total**	**Per cent of all buildings**
Church	1	1	2	0.07%
House	34	1398	1432	12.26%
Outbuilding	271	131	402	15.16%
Wall	61	92	153	1.49%
Total	**367**	**1622**	**1989**	7.23%

One further feature of cob houses is worthy of note and is illustrated in Table 3. More than 70% of them have thatched roofs compared to just 13% of all houses. One might speculate that older houses are both more likely to be made of cob *and* to have thatched roofs and this explains the association. Alternatively, it might be an unintended consequence of the listing process.

Table 3. Roofing material of cob houses

Roofing material	**Cob Houses**		**All Houses**	
	Number	**Per cent**	**Number**	**Per cent**
Not recorded	79	5.53%	1845	15.83%
Asbestos and polycarbonate	7	0.49%	43	0.37%
Corrugated iron	12	0.84%	38	0.33%
Metal	1	0.07%	21	0.18%
Mock-slate	19	1.33%	241	2.07%
Shingles	4	0.28%	12	0.10%
Slate	221	15.48%	4804	41.22%
Thatch	1018	71.29%	1529	13.12%
Tiles	67	4.69%	3122	26.79%
Total	**1428**	**100.00%**	**11655**	**100.00%**

11, Artificial Stone

Material Code 11 covers a range of man-made materials designed to resemble natural stone. Nearly 500 buildings incorporate such material so it is by no means a rarity although most occurrences are represented by minor repairs especially to the dressings of prestige buildings.

Figure 1. South porch of St Eustacius' church, Tavistock. The green Hurdwick Stone of the walling is repaired with neutral artificial stone resembling concrete more than the Hurdwick Stone. The jamb on the left is of Roborough Stone.

Figure 2. West elevation of Ugbrooke House. The artificial stone of which the west wall is made has been marked out with outlines to look like snecked construction and the material resembles Ugbrooke Sandstone of which the rest of the house is constructed. Each “stone” has been finished so as to mimic the effect of the mason’s chisel. The dressings are of red sandstone (Material Code 144).

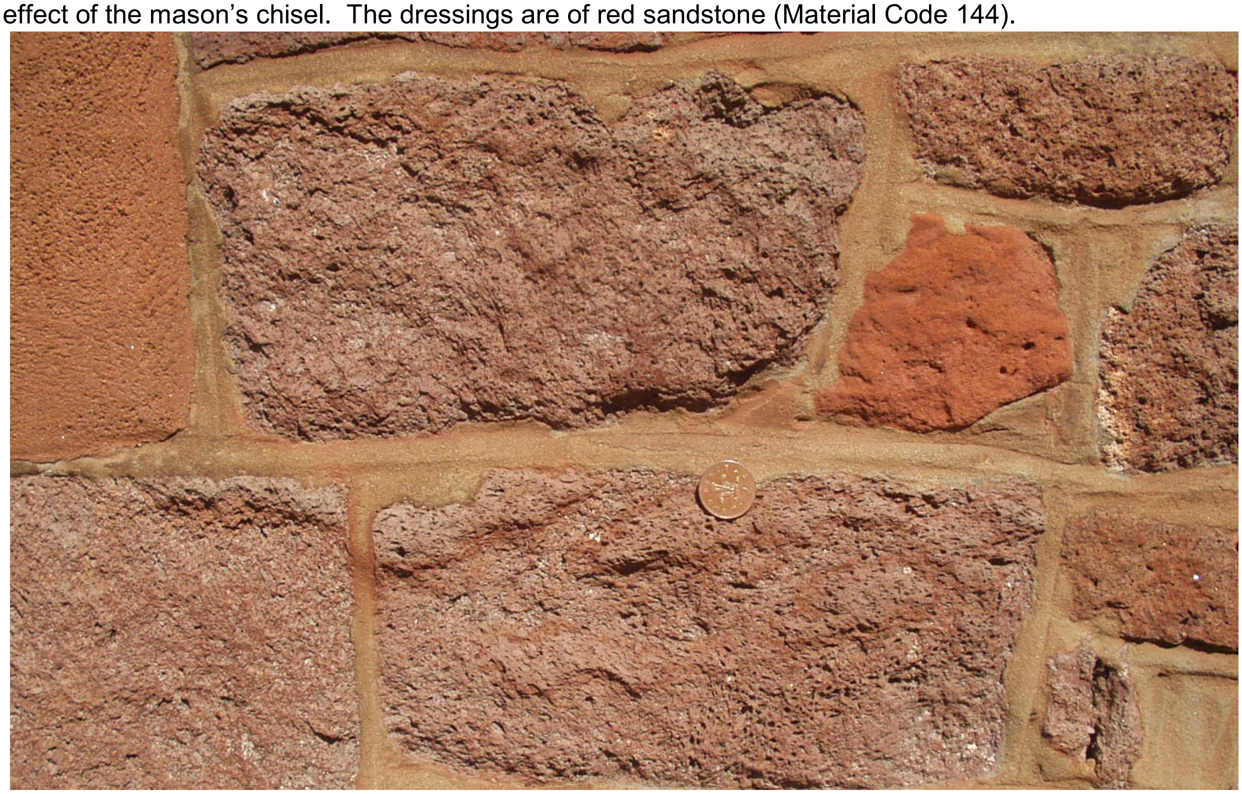

Figure 3. Chapter House of the Church of the Holy Cross, Crediton. The main building stone is pink Exeter volcanics from Posbury Clump with one smaller piece of red sandstone towards the right. The block of smooth stone top left is a skimming of artificial material designed to repair the original stonework and to mimic the volcanics. The repairs were applied in Victorian times and were not successful since water got in behind them and the skimmings spalled off.

Figure 4. Tea by the Taw Restaurant, Barnstaple. Most of the building including the quoins and dressings is of Doulting Stone but the wall facing the river (on the left of the photo) is of artificial stone carefully matched for colour with the Doulting Stone.

13, Calcareous sandstone (Upper Greensand)

Grey medium-grained calcareous sandstone from the Upper Greensand Formation is assigned Material Code 13. The rock consists of poorly sorted grains of translucent quartz and chalky calcite set in sparse powdery calcite cement. The proportions of quartz and calcite grains vary and varieties where one greatly preponderates over the other are common. Green glauconite and black iron oxides derived from it are widespread. Bedding is present in many blocks, defined by variations in grain size, composition of the clasts, degree of cementation and colour but is typically not strongly expressed (Figures 1 and 2). The rock is rather porous because of the sparse nature of the cement. However, the presence of fine-grained carbonate cement encourages the growth of characteristic crimson algae which helps to distinguish this sandstone from those from the Permian and Triassic, especially on north-facing walls (Figure 4). Because of these algae and the presence of at least some cement, it is hard to distinguish between the separate grains which appear to be set in an amorphous groundmass under the hand lens, in contrast to the Permian and Triassic sandstones of the area, where the individual grains can usually be easily differentiated.

This sandstone also grades into the sandstone assigned Material Code 14 (Salcombe Stone) through increase in grain size, reduction in proportion of fines and increased brown pigment, that assigned code 16 (Eggardon Grit), through an increase in the proportion of very well rounded coarse quartz grains, those assigned codes 29 and 84 through an increase in the proportion of glauconite and that assigned code 52, through elimination of quartz clasts in favour of calcite.

Calcareous sandstone of this kind (Material Code 13) occurs in the topmost (Bindon Sandstone) member of the Upper Greensand and was formerly quarried around Whitestaunton, Chard, Tytherleigh, Chaffcombe and elsewhere on the Devon-Somerset border and is widely used for building there. There may be other former stone quarries yet to be identified. Its natural occurrence is restricted to localities where the Upper Greensand is overlain by chalk. The stone is of good quality and is easily shaped so it has a wide distribution used for quoins and dressings throughout the Blackdown Hills and beyond (Figures 5 and 6). It has no specific name but stone of this kind has been called calcareous grit, malm, malmstone, malm rock, Whitestaunton Stone and Whitestaunton Limestone (see also Howe, 2001, p167). The term Membury Stone encountered a few times in the literature may refer to this kind of building stone. Tatton-Brown (1998) notes additional names for Upper Greensand sandstone including Hurdcott Stone and Potterne Stone.

Figure 5 shows the distribution of all kinds of Upper Greensand sandstone (Codes 13,14,16, 29, 52 and 84). The main concentrations around Chard are of sandstone, the calcareous grit of Donovan and Prudden (in Orbach and Pevsner, 2014), coded 13 (Figure 6), around Seaton-Sidmouth, coded 14 (Salcombe Stone) and around Blackborough, coded 84 (glauconitic sandstone). Outliers in central and west Devon are mainly stone used for churches that incorporate Beer Stone dressings. It seems that where the masons took the trouble to haul Beer Stone for the dressings, they also brought along some calcareous sandstone for the quoins where the local stone was hard to dress neatly.

The stone is widely used in Forde Abbey and is particularly finely displayed in the ribs of the roof of the undercroft now used as the tea room, alternating with Ham Hill Stone. It is likely that it was quarried at the complex of workings, now filled in, called Bloody Pits, the site of executions following the Monmouth Rebellion, just north of Tytherleigh.

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Howe, J.A., 2001. *The Geology of Building Stones.* Facsimile edition. Donhead Publishing Ltd.
Orbach,J. and Pevsner, N, 2014. *The Buildings of England. Somerset: South and West.* Yale University Press.
Tatton-Brown, T.W.T. (Ed.), 1998. *Building with Stone in Wessex over 4000 years.* The Hatcher Review 5(45), 60pp.

Figure 1. 22 Boden Street, Chard.

Figure 2. Detail of 22 Boden Street, Chard. Rubble of pale grey calcareous sandstone and some brown chert. Width of view about 60cms.

Figure 3. Chard Museum. Wall of dressed chert laid in courses with quoins of grey calcareous sandstone.

Figure 4. Tower of St Cuthbert's, Widworthy. Wall of chert rubble with quoins of calcareous sandstone showing the growth of characteristic crimson algae.

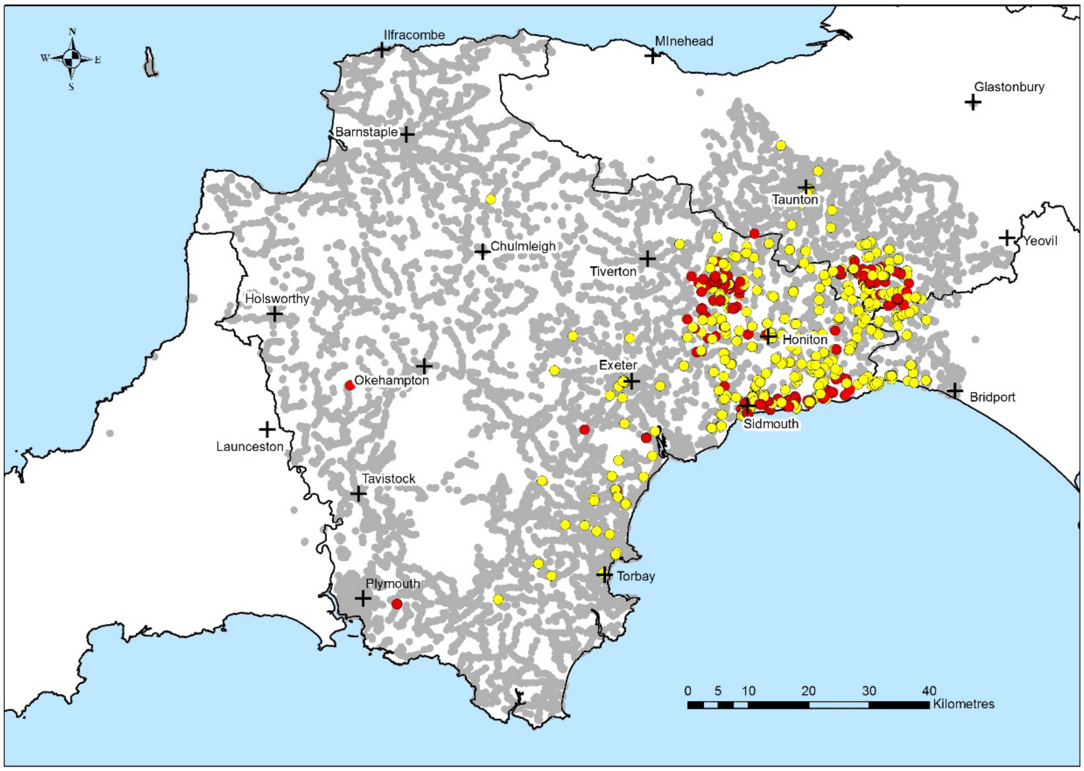

Figure 5. Distribution of all Upper Greensand sandstone in buildings. Red symbols, the sandstone is the main building material; yellow symbols, the sandstone is a subsidiary building material; grey symbols, building lacks visible Upper Greensand sandstone.

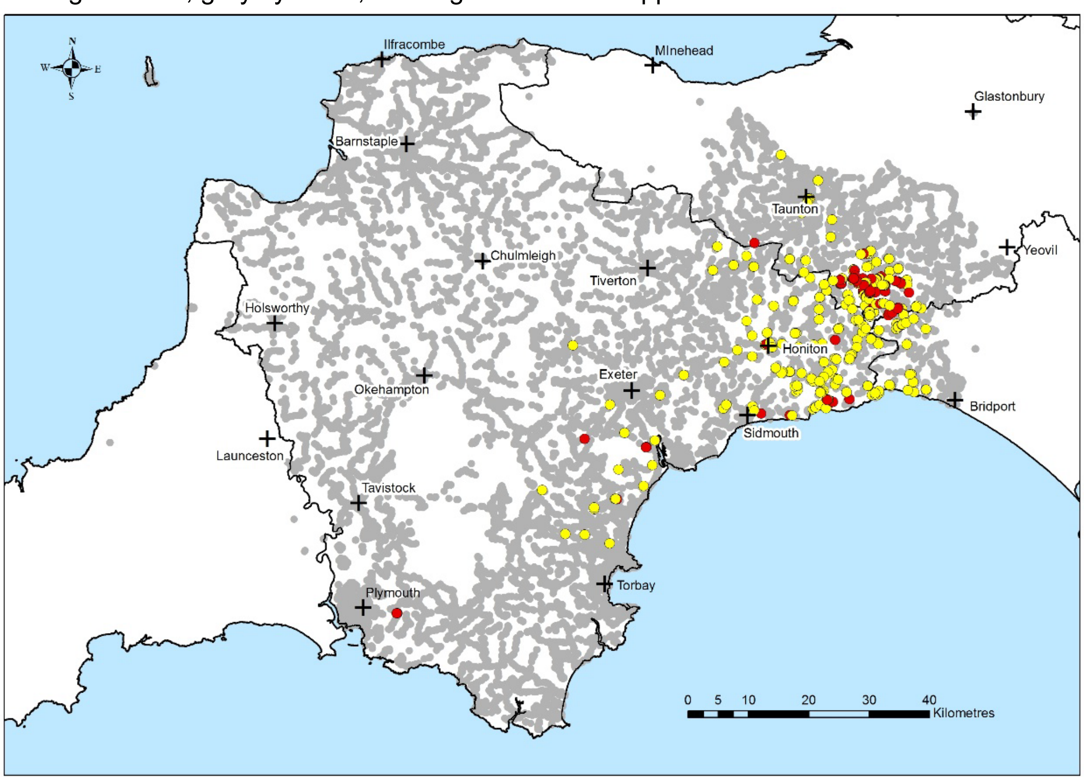

Figure 6. Distribution of calcareous grit (Code 13) in buildings. Legend as Figure 5.

14, Salcombe Stone (Upper Greensand Formation)

Brown, grey-weathered medium- to coarse-grained calcareous sandstone (Figures 1-3) called Salcombe Stone after Salcombe Regis where the main quarries are located, is composed of subrounded to subangular clasts of calcite with subordinate quartz, set in a porous calcareous cement (Figure 4). Clasts are poorly sorted and a fraction of very coarse, very well-rounded quartz grains, resembling desert sand, occurs in some blocks. Salcombe Stone grades into the calcareous sandstone of the Chard area (Material code 13) through an increase in the proportion of fine-grained cement, an increase in the proportion of quartz clasts and loss of the distinctive brown colour. However, it is difficult to tell these rock-types apart in buildings and there is likely substantial overlap in their appearance and lithology.

Salcombe Stone is widely used for building around the source quarries at Salcombe and Dunscombe and most famously, is the main visible external building stone of Exeter Cathedral. The traditional quarries have been reopened from time to time for repair to the cathedral and other local churches but there is no permanent present production.

Salcombe Stone is won from the topmost member of the Upper Greensand Formation (Figure 5) which generally lacks chert nodules (Bindon Sandstone member of Gallois, 2004 and Top Sandstone of Jukes-Brown and Hill, 1900). The main former quarry lies a short distance southeast of Salcombe Regis church but there are numerous other former quarries on the hillside north of the road from Branscombe and Street towards the west, at Dunscombe Farm and in Lincombe. The old quarry at Dunscombe was extended in the Twentieth Century to provide stone for the repair of Exeter Cathedral and was also used for building St. Francis' church, Woolbrook, Sidmouth in the 1930s.

Figure 1. St Winifred's, Branscombe, south wall of chancel. Brown Salcombe stone weathered grey with red algae towards the base. Dressings are of Beer Stone, partly preserved with white paint.

Figure 2. St Giles' church, Sidbury. Lower part of the tower is of Salcombe Stone ashlar with Beer Stone Inserts; upper part is of chert rubble with Salcombe Stone quoins. Dressings are mainly of Beer Stone including the bas reliefs which came from elsewhere in the church. Repairs to the stone of the tower are in finer-grained Salcombe Stone, possibly from Dunscombe.

Figure 3. St Mary's, Ottery St. Mary, west end. The lower part of the wall of the nave is of Salcombe Stone ashlar. The upper part of the wall is coursed rubble, of mud pebble conglomerate from the Otter Sandstone. Note the polychrome relieving arch over the grouped lancets composed of alternating Salcombe Stone and mud pebble conglomerate from the Otter Sandstone.

Figure 4. Texture of Salcombe Stone showing poorly sorted clasts of both quartz and calcite, including shell fragments. St Francis' church, Woolbrook, Sidmouth. Width of photo. 2cm.

Figure 5. Kempstone Rock, at the top of the coastal cliff just west of Weston Combe, of brown-weathered Salcombe Stone. (the locality is called Rempstone Rock on 1:10,000 scale OS mapping).

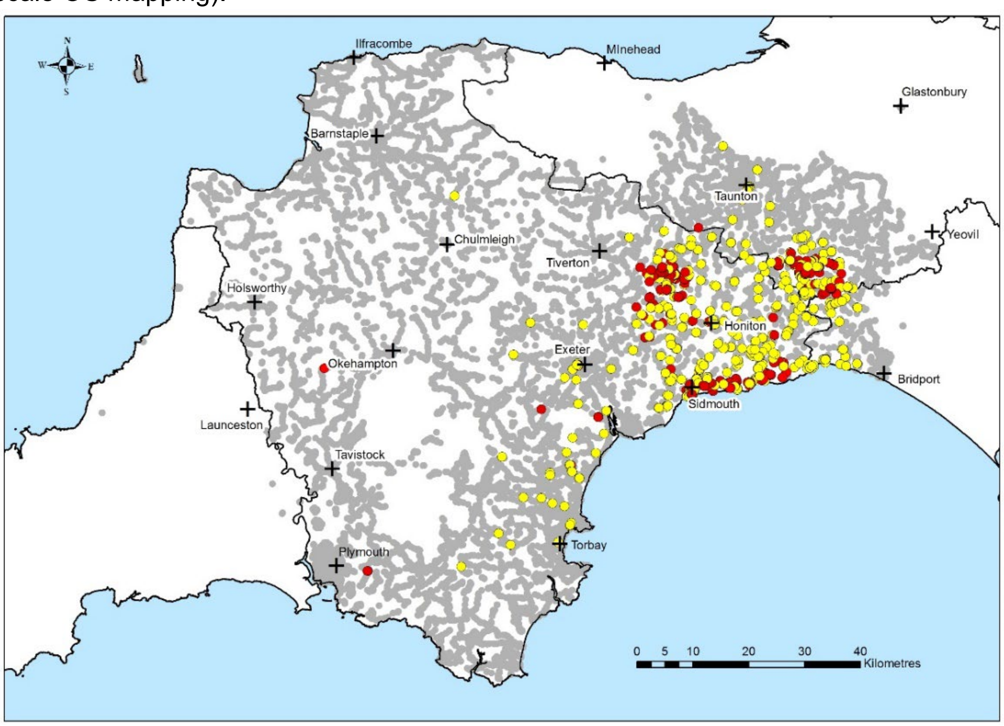

Figure 6. Distribution of Upper Greensand sandstone in buildings. Red symbols, Upper Greensand sandstone is the main building material; yellow symbols, building contains some Upper Greensand sandstone; grey symbols, building lacks this kind of sandstone.

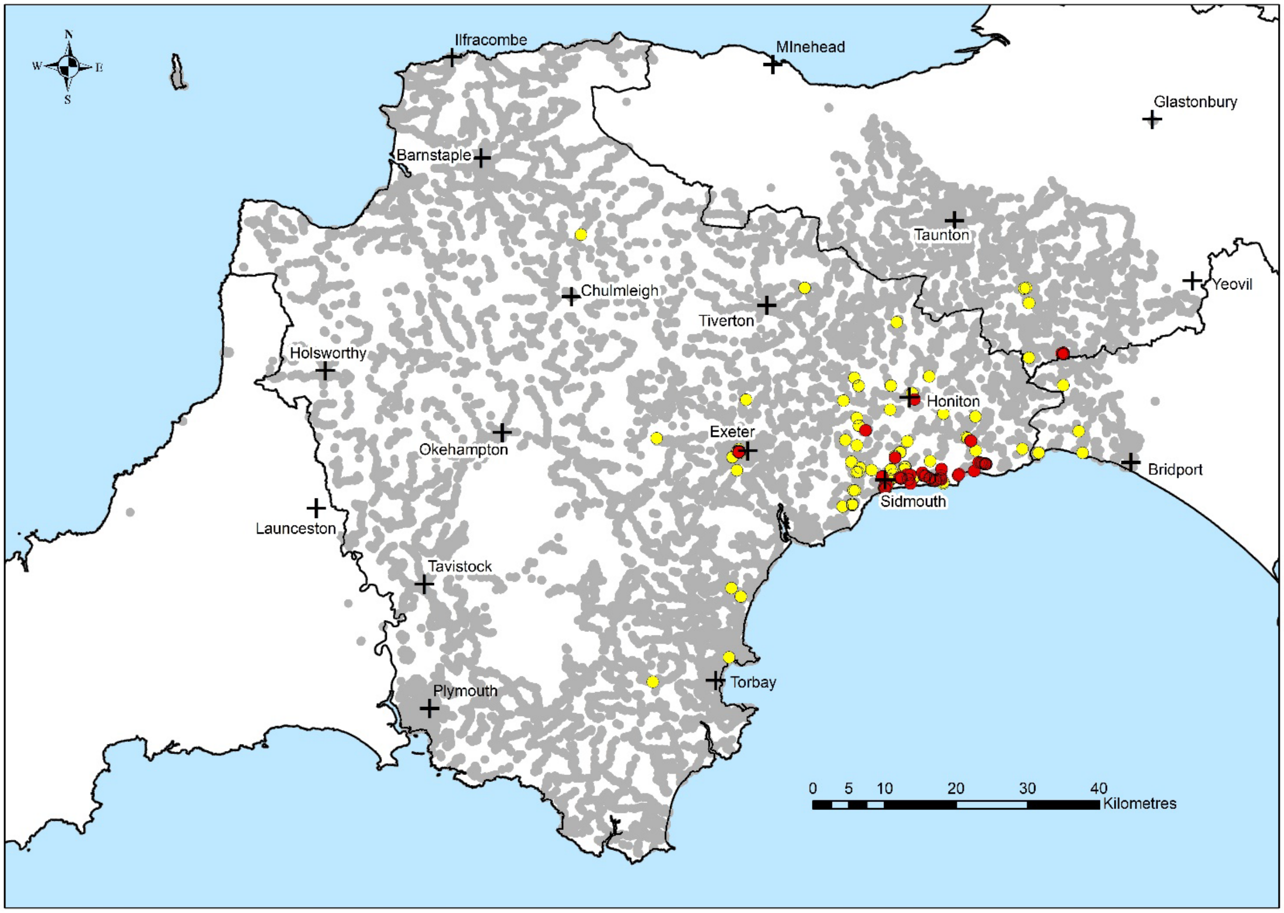

Figure 7. Distribution of Salcombe Stone in buildings. Legend as Figure 6.

Figure 6 shows the distribution of all Upper Greensand sandstone in buildings. Salcombe Stone is the main contributor to the concentration of buildings containing Upper Greensand sandstone along the coast (Figure 7). It is relatively well known because of its use for the building of Exeter Cathedral but is quite restricted in its distribution compared to sandstone of the same age won from the quarries around Chard (Code 13).

References

Gallois, R.W., 2004. The stratigraphy of the Upper Greensand (Cretaceous) of south-west England. *Geoscience in south-west England,* **11,** 21-29.

Jukes-Brown A.J. and Hill, W., 1900. The Cretaceous Rocks of Britain I: The Gault and Upper Greensand of England. *Mem. geol Surv. UK.*, HMSO.

15, Bioclastic Limestone (Inferior Oolite)

The limestone is primrose-yellow in colour and consists of medium-grained fragments of calcite, set in yellow, porous micrite cement enclosing abundant much smaller grains of calcite and in many cases has a rubbly texture (Figure 1). The larger grains are cream in colour, almost square in outline and equidimensional and are probably crinoid ossicles (Figure 2). They tend to be quite sparsely distributed in the rock, isolated in the finer-grained matrix of smaller fossil fragments and micrite cement. The colour of the rock is yellow or primrose (Figures 3-5), distinctly lighter in shade than either the Junction Bed or Ham Hill Stone or more strongly pigmented Inferior Oolite limestone given the Material Code 18 which is darker in colour and tends to have more obvious and widely distributed oolites. The limestone usually lacks an oriented fabric parallel to the bedding although the latter is in many cases visible in building stone through variations in texture and composition across the bedding. Blocks are of variable thickness but can exceptionally be up to 1m thick, at least as thick as those from the Junction Bed and Ham Hill. However, blocks are typically smaller - about the same size as a brick although typically somewhat deeper.

This kind of limestone can be confused with low quality Ham Hill Stone where shell fragments define the bedding fabric. It can also be confused with cream-coloured and yellow varieties of Upper Greensand sandstone but may be distinguished under the hand lens by the lack of quartz clasts. It resembles Moolham Stone but has equant clastic grains, in contrast to the shard-like grains of the latter, and is much lighter yellow in colour, with fewer fossils.

Inferior Oolite limestone is used in buildings in a zone more or less coincident with its outcrop, extending south from the Seavingtons and Lopen in the north to Chideock in the south (Figure 6). Numerous old quarries are known to have produced building stone in this zone and a few continue to provide stone for repairs. Bioclastic limestone lacking obvious oolites (Material Code 15) tends to be concentrated in the north of this distribution (Figure 9) although there is considerable overlap with the darker more strongly oolitic variety (Material Code 18).

The Inferior Oolite of the study area is thin compared to its occurence further north, with many disconformities. Building stone was mainly won from near the top of the formation (Top Limestone, Burton Limestone) in the Parkinsoni Zone but building stone was also quarried from other parts of the formation where its quality was not too badly compromised by the enclosed fossils (Richardson 1915).

Reference

Richardson, L., 1915. Report of an excursion to Bridport, Beaminster and Crewkerne, April 9th to 14th (Easter),1914. *Proceedings of the Geologists' Association* **26(1),** 47-78.

Figure 1. Garden wall, Farthings, Abbey Street, Hinton St George. The primrose yellow colour and nodular structure are typical of the Inferior Oolite limestone coded 15. The darker orange and black blocks are coded 18.

Figure 2. Garden wall, Farthings, Abbey Street, Hinton St George. Detail of homogeneous block showing disseminated coarse grains of paler calcite, probably crinoid ossicles.

Figure 3. 14-20 West Street, Crewkerne (Davis' Almshouses). Quoins and dressings of Ham Hill Stone.

Figure 4. Church Hall, Crewkerne, former grammar school where Capt. Hardy of Trafalgar fame went to school.

Figure 5. Manor Farmhouse, Lower Street, Merriot.

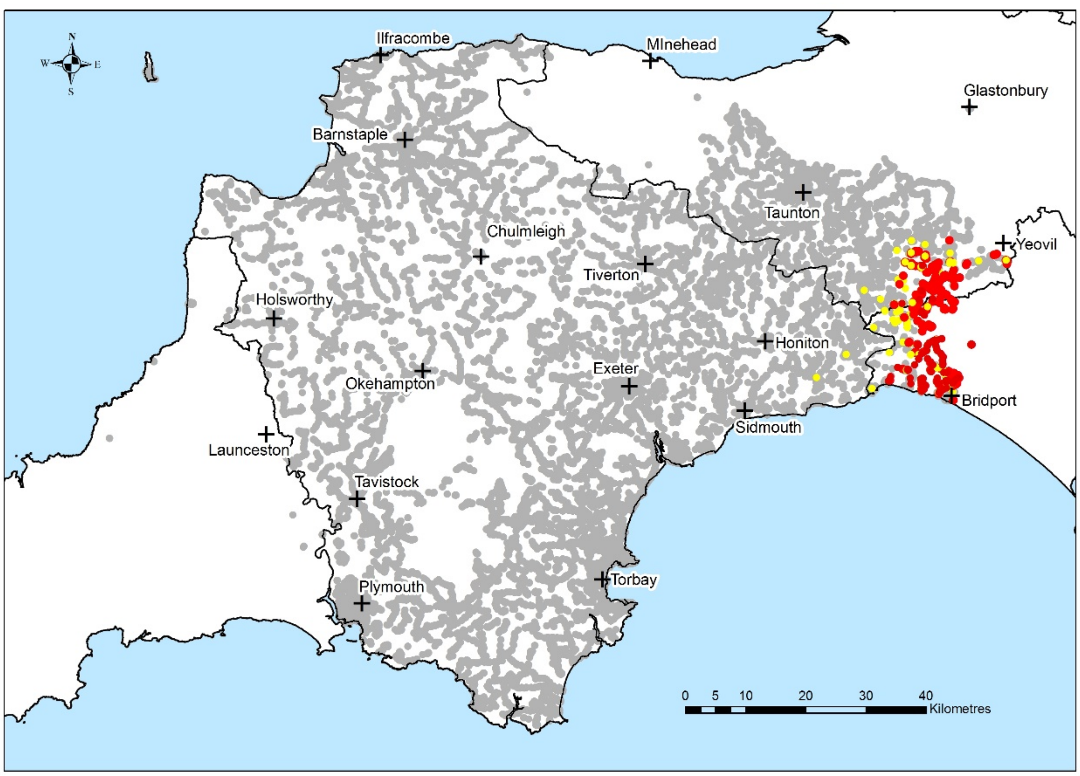

Figure 6. Distribution of Inferior Oolite limestone in buildings of the study area (Material Codes 15 and 18). Red symbols, the limestone is the main building material; yellow symbols, the limestone is a subsidiary building material; grey symbols, the building lacks visible Inferior Oolite limestone.

Figure 7. The Swan Inn, Church Street, Crewkerne. The gable end is of Inferior Oolite coursed rubble; the front façade is of Ham Hill Stone ashlar, a common arrangement in West Dorset and South Somerset.

Figure 8. Intimate street scene, off Market Street, Crewkerne. The houses are made of Inferior Oolite limestone laid mainly as coursed rubble.

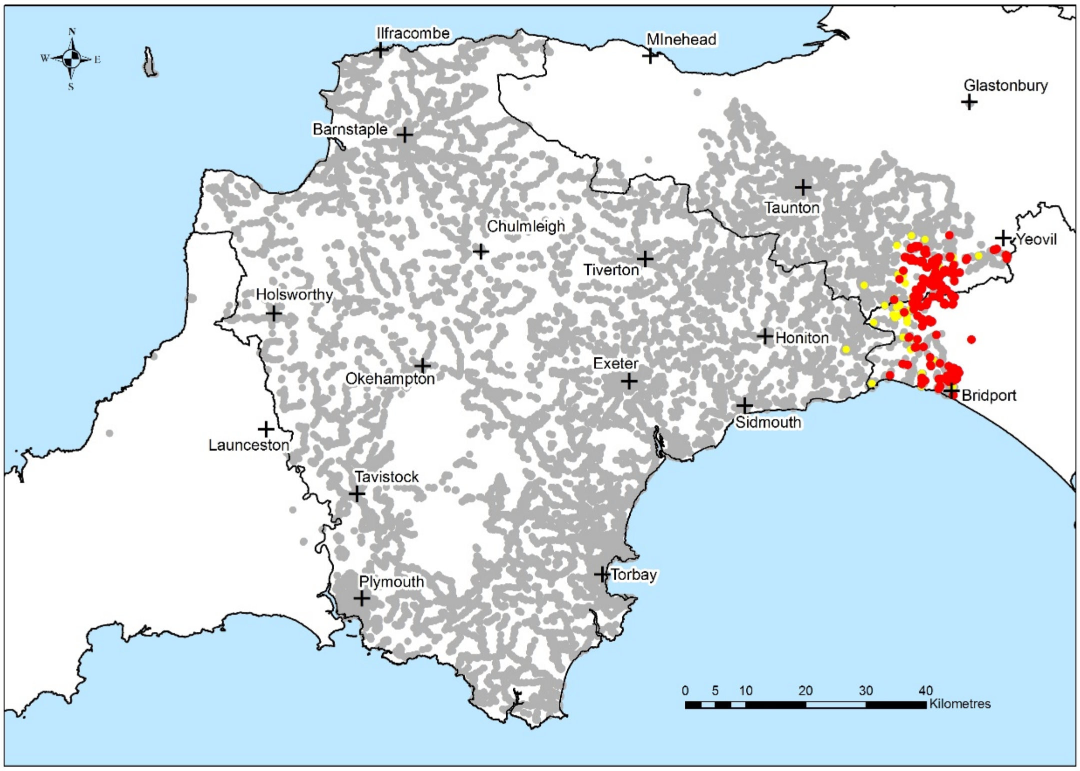

Figure 9. Distribution in buildings of Inferior Oolite limestone lacking obvious ooliths (Code 15). Legend as Figure 6.

16, Eggardon Grit (Upper Greensand)

This informal name is applied by some authors to sandstone with coarse-grained to very coarse-grained translucent well-rounded quartz grains set in a carbonate cement. The rock is poorly cemented and pale grey to pale brown in colour. It is distinguished from other Upper Greensand sandstones by the noticeable presence of larger-than-normal well-rounded quartz clasts possibly of wind-blown origin mixed with more normal quartz and subordinate calcite grains. The coarse-grained sandstone is associated around Winsham with brashy poorly sorted medium-grained yellow sandstone composed, like other Upper Greensand sandstones, of both quartz and calcite clasts set in a calcareous cement but distinguished here by the inhomogeneous and very friable nature of the rock.

The main rock-type can be matched in exposures of the Eggardon Grit, a coarse-grained sandstone from the Bindon Sandstone member of the Upper Greensand exposed on Eggardon Hill and nearby parts of west Dorset. Many of the occurrences in buildings of this kind of sandstone are in west Dorset. However, there are a number elsewhere (Figure 1). Overlap and confusion with other Upper Greensand sandstones is certainly possible.

The correspondence of the Eggardon Grit with the Bindon Sandstone, the topmost members of the Upper Greensand Formation of west Dorset and East Devon respectively is unproven.

Reference

Woods, M.A., Wood, C.J., Wilkinson, I.P. and Lott, G.K.,2009. Erratum to "The Albian–Cenomanian boundary at Eggardon Hill, Dorset (England): An anomaly resolved?" *Proc. Geol. Assoc.* **120,** 108–120.

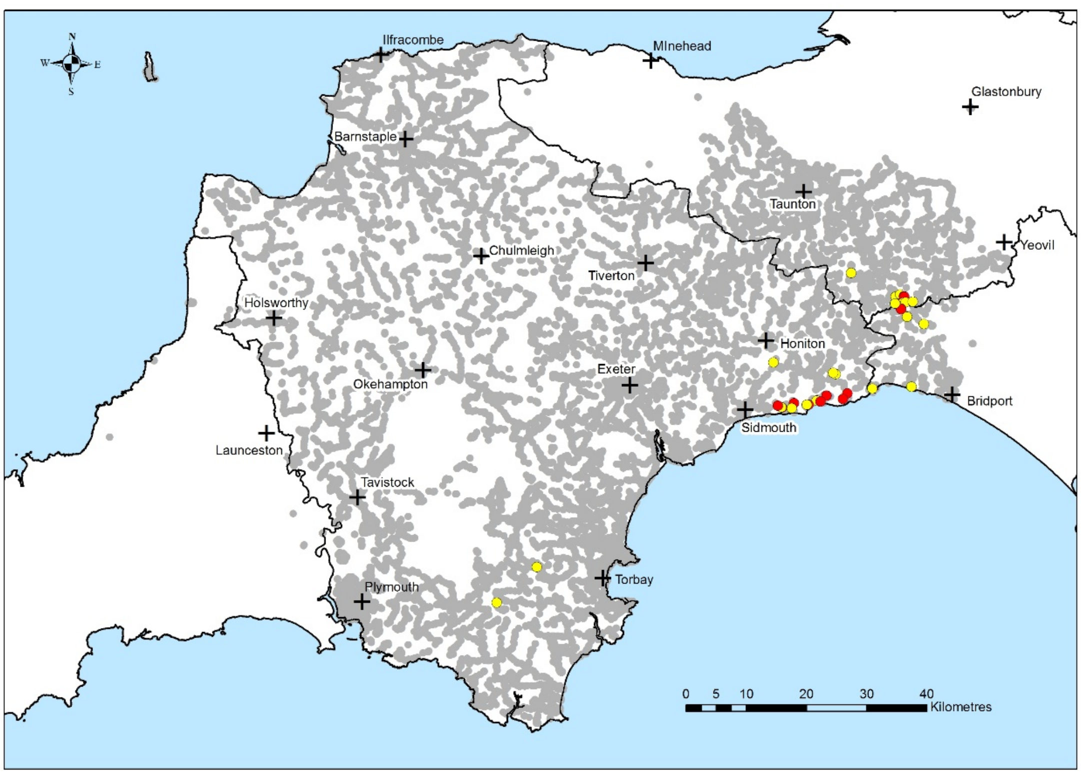

Figure 1. Distribution of Eggardon Grit in buildings. Red symbols, Eggardon Grit is the main building material; yellow symbols, Eggardon Grit is a subsidiary building material; grey symbols, building lacks Eggardon Grit.

18, Oolitic Inferior Oolite limestone

Oolitic limestone from the Inferior Oolite is a brown, yellow, or ochre limestone with black, ochre and purple iron-rich streaks and patches and is distinguished from limestone coded 15 mainly by darker pigmentation. It is composed of fine-grained powdery calcite (micrite) in which are set plentiful fossil fragments including some large part or complete fossil bivalves and belemnites. Parts of it are oolitic; the ooliths are in places filled with a green or black mineral but mostly the oolite filling has fallen out of the surface of building blocks and their locations are expressed by spherical pinholes, most easily visible under the hand lens (Figure 1). The limestone lacks fine bedding or oriented bedding fabric. However, the bedding planes can usually be easily identified by compositional, colour and textural changes.

Oolitic limestone coded 18 grades into the primrose-coloured variety (Material Code 15) but is distinguished by darker colour and more abundant oolites. It differs from Ham Hill Stone through a lack of oriented bedding fabric defined by flat shell fragments, and powdery rather than sparry cement and from Junction Bed limestone (Beacon Limestone) by less obvious nodular or conglomeratic structures, more abundant oolites and fewer fossils, especially belemnites. The distribution of this kind of limestone in buildings mirrors the outcrop of the Inferior Oolite (Figure 4). It preponderates over other kinds of Inferior Oolite limestone in the south around the Marshwood Vale and Chideock and is much less widespread towards the north (Figures 5).

It is not clear that this variety of limestone comes from a different part of the Inferior Oolite succession from stone coded 15 (qv).

Figure 1. Ochre oolitic limestone, garden wall, Farthings, Abbey Street, Hinton St George. Width of crinoid ossicle, about 5mm.

Figure 2. Nos. 18-25, Green Street, Hinton St George.

Figure 3. One Sunnyside and Advent Cottage, Main Street, Chideock.

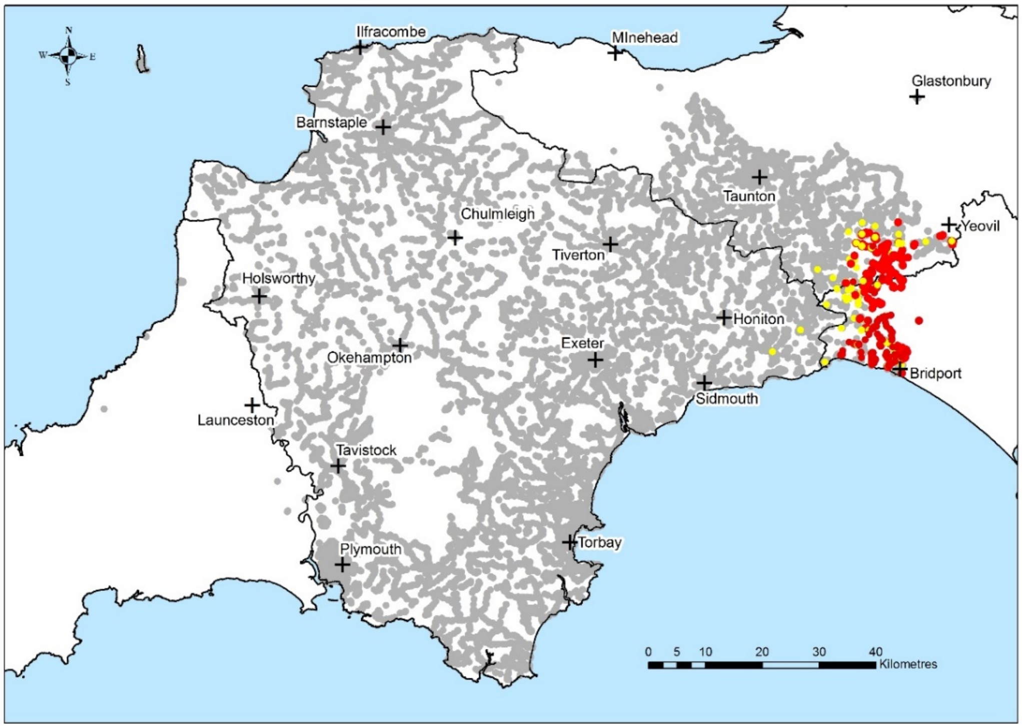

Figure 4. Distribution of Inferior Oolite limestone in buildings (Material Codes 15 and 18). Red symbols, the limestone is the main building material; yellow symbols, the limestone is a subsidiary building material; grey symbols, building lacks Inferior Oolite limestone.

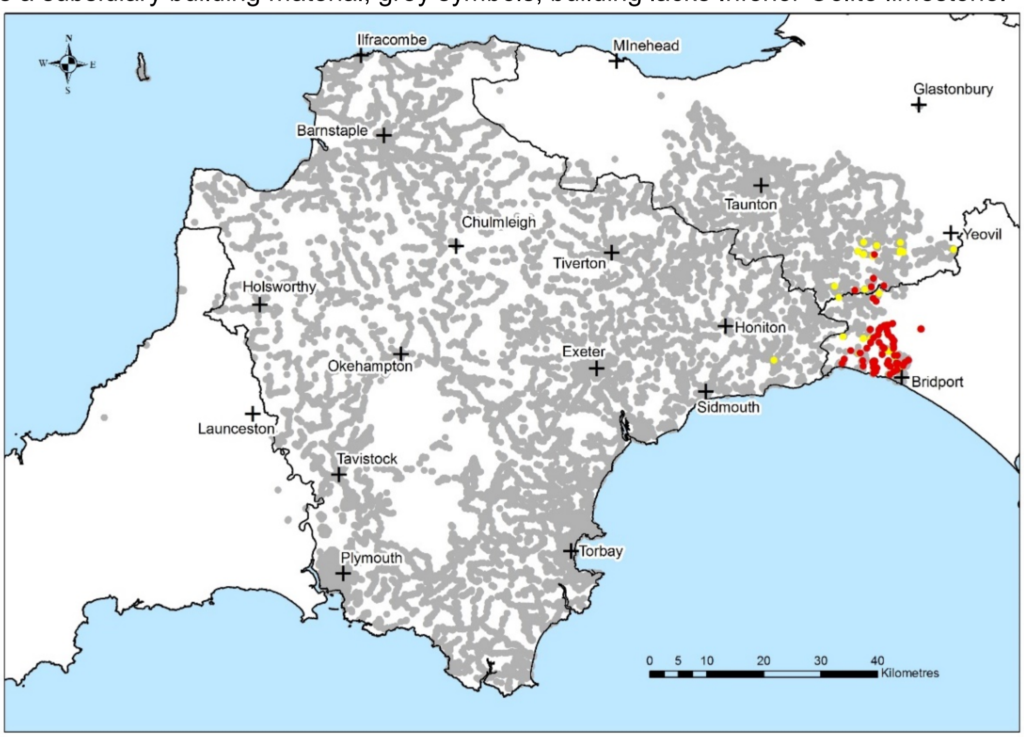

Figure 5. Distribution of oolitic Inferior Oolite limestone (Material Code 18) in buildings. Red symbols, the limestone is the main building material; yellow symbols, the limestone is a subsidiary building material; grey symbols, the building lacks this kind of limestone.

19, Forest Marble

The Forest Marble of west Dorset is a grey- and fawn-mottled, fawn-weathered hard impervious coarse-grained shelly limestone with sparite cement (Figure 1). The shell fragments are mainly of oyster-type species. They lie in the bedding so that the rock appears well bedded throughout, in contrast to most other Jurassic limestones of the area. The rock weathers to a dark brown or grey colour and is consequently not very decorative (Figures 2 and 3). Blocks tend to be smaller than those of other limestones, somewhat smaller than a standard brick and thinner. Distinguishing features of the building stone are strong bedding throughout, which differentiates it from Junction Bed and Inferior Oolite limestone, grey colour of at least some parts of most blocks (Figure 1), small size of blocks and sparry cement with numerous voids (Figure 1), which distinguishes it from Ham Hill Stone.

Forest Marble quarried within the area of study is largely restricted to the extreme southeast although similar rock is also used in the Hardingtons and Cokers southwest of Yeovil (Figure 5). Well known quarries now closed are at Bothenhampton and there are several others extending eastwards from here along the outcrop of the Forest Marble. The rock is durable and was used for cobbles and paving as well as walls in Bridport. It was also widely used for the footings of brick buildings to prevent moisture wicking up through the bricks.

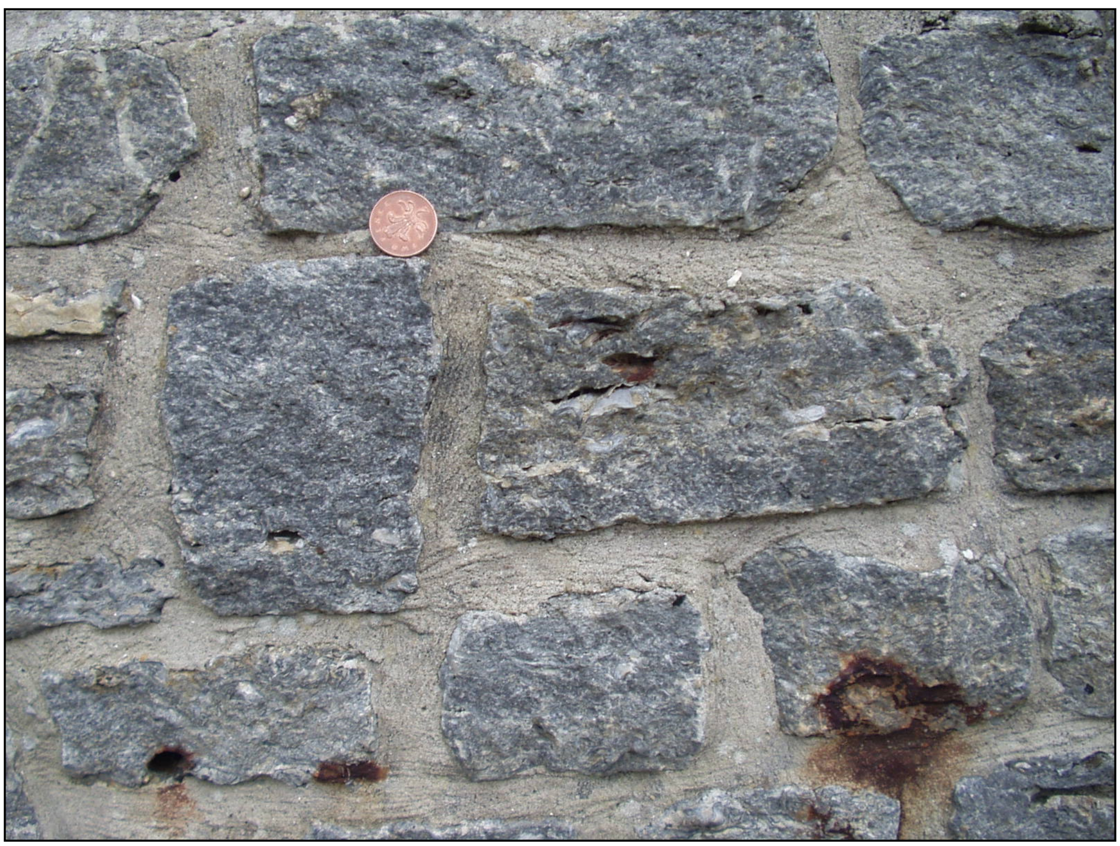

Figure 1. Golden Cap Holiday Park Shop, Seatown. From a modern quarry, perhaps Stalbridge Quarry.

Figure 2. Bridge and causeway over the River Brit, east of St Swithin’s Road, Bridport.

Figure 3. 6 and 8 Diments Gardens, Bridport.

Figure 4. Roadside wall, new development, Pymore.

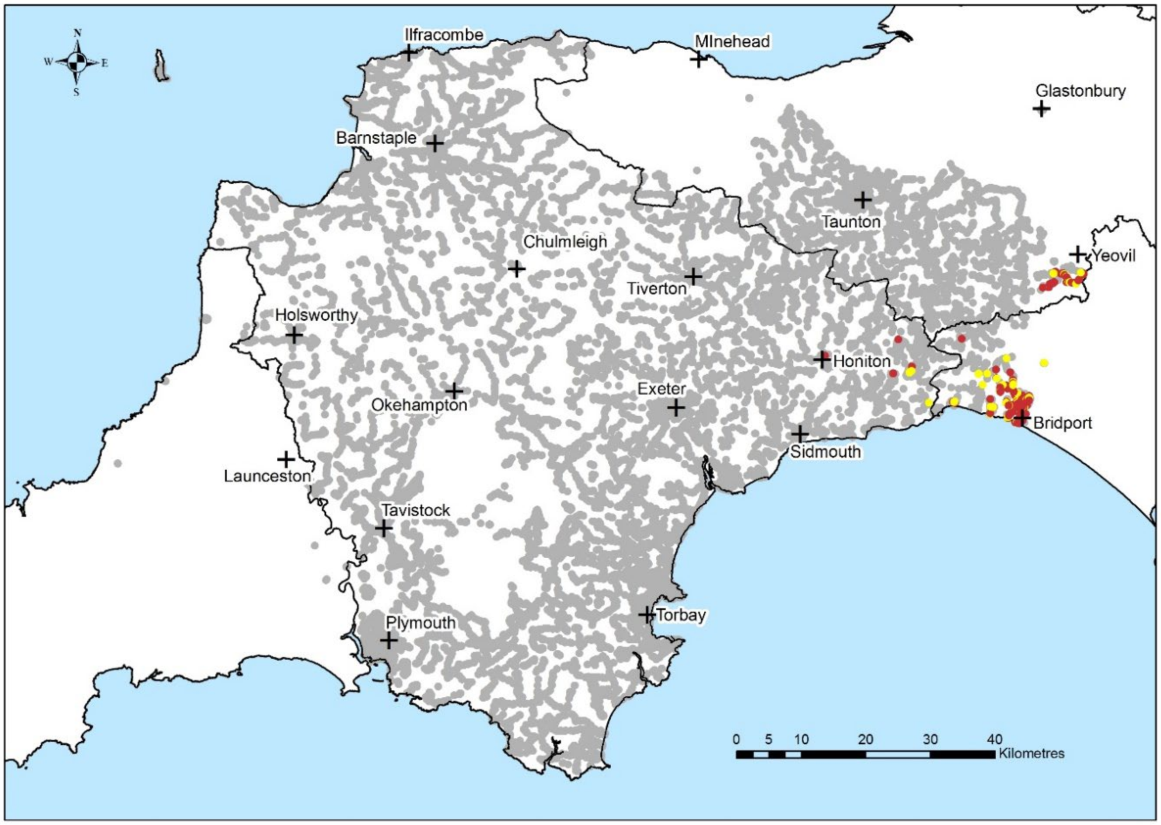

Figure 5. Distribution in buildings of Forest Marble with Material Code 19. Red symbols, buildings is made mainly of Forest Marble; yellow symbols, Forest Marble is a subsidiary building material; grey symbols, building lacks visible Forest Marble.

20, Bath Stone (Great Oolite)

Bath Stone is a pale yellow homogeneous medium- to fine-grained oolitic limestone (Figures 1-4, 8 and 9). The oolites are up to 1mm across and are obvious under the hand lens. They are spherical inclusions either filled with yellow or greenish mineral or more commonly, lacking filling and forming holes in the surface of Bath Stone building blocks (Figure 6 and 7). Oolites are plentiful, ubiquitous and evenly distributed but tend not to be close packed. They are set in a pale grey or white more resistant sparite matrix. The stone fractures through the oolites rather than through the surrounding matrix. Bedding is defined in some cases by scattered flat shell fragments (Figure 6) but it is not usually prominent and cannot be discerned in most blocks.

The colour of the fresh stone is pale yellow but weathered stone takes on a range of colours including deep yellow, pale grey and neutral. Bath Stone blocks are often richly covered in lichen and algae including a crimson variety which makes identification difficult. Lichen starts to grow at sites where the oolites have fallen out and gradually extends over the face of the rock.

Bath Stone is one of the premier building stones of England. It is quarried in the Bath area and some quarries are still active. It is widely used in the area of study (Figure 10). While there are several town buildings entirely finished in Bath Stone, it is mainly used for dressings, especially of Victorian churches or for the repair of the dressings of medieval churches where the original stone is no longer produced (Figure 11).

Figure 1. Decorative gatepost of carved Bath Stone with little columns of red sandstone, Stoneleigh, No 79 South Rd, Taunton.

Figure 2. Guildhall Shopping Centre (formerly the Civic Hall) Exeter.

Figure 3. St Peter’s church, Sidford. Decorative Bath Stone string courses and dressings.

Figure 4. St David’s railway station, Exeter. The lower storey is of Westleigh Limestone; the upper storey, and most quoins and dressings are of Bath Stone.

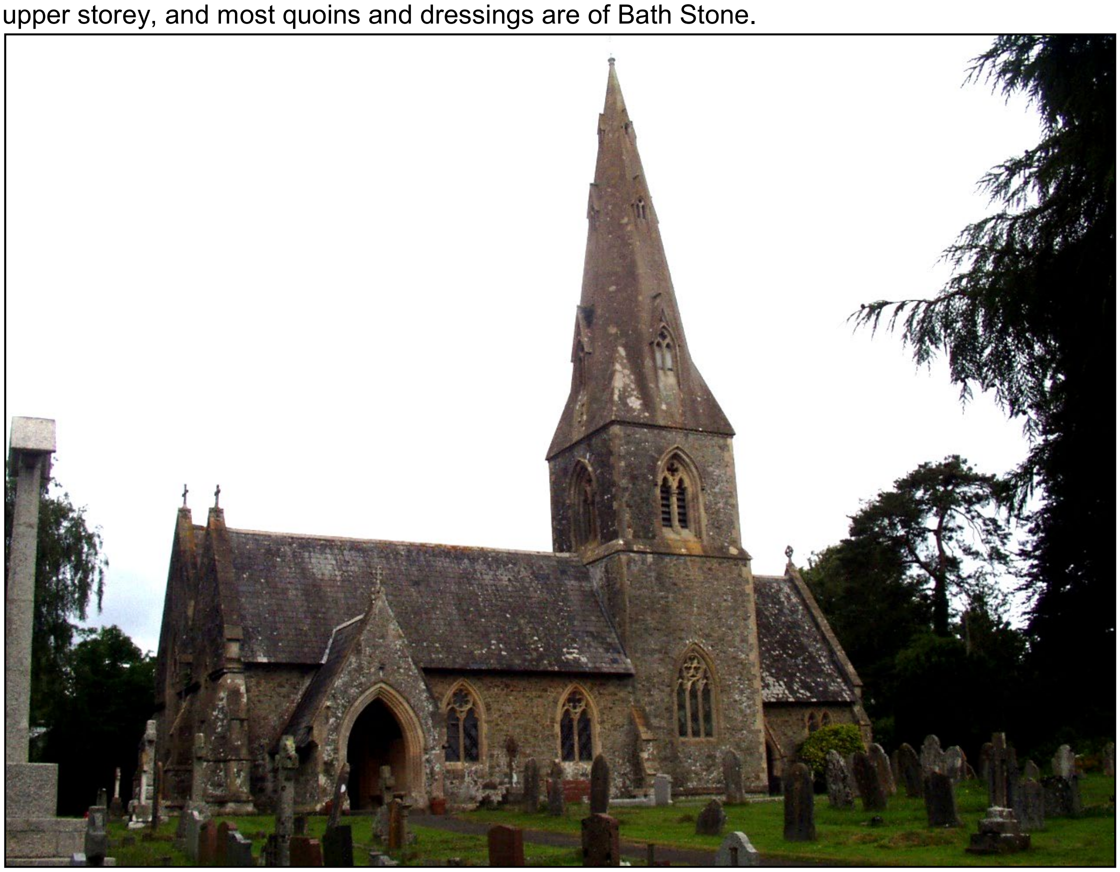

Figure 5. St Matthew’s, Landscove. Quoins and dressings are of Bath Stone.

Figure 6. Booking Hall, railway station, Axminster. Oolites are about 1mm across. Aligned shell fragments define a crude bedding fabric in this example but are not always present.

Figure 7. Detail of the photo above. The rock typically breaks round the oolites, most of which fall out of the exposed surface.

Figure 8. Lloyd's Bank, Exmouth. The walling is of mid-Devonian limestone from Torbay on a plinth of granite, and with dressings of yellow Bath Stone and purple Pocombe Stone (Exeter volcanics).

Figure 9. Bodmin Street, Holsworthy. Handsome C19 villa of dark grey limestone with Bath Stone quoins and dressings.

Figure 10 shows the distribution of buildings containing Bath Stone. Rather few of them are made mainly of this prestige stone brought in from outside the region but the stone is nevertheless very widely used across the region as a minor constituent of buildings. Figure 11 shows that most of the occurrences are in churches where the stone is mainly used for the dressings round windows and doors and less frequently for the quoins. Bath Stone was widely used for these parts of medieval churches during the repairs and rebuilding of the Nineteenth Century.

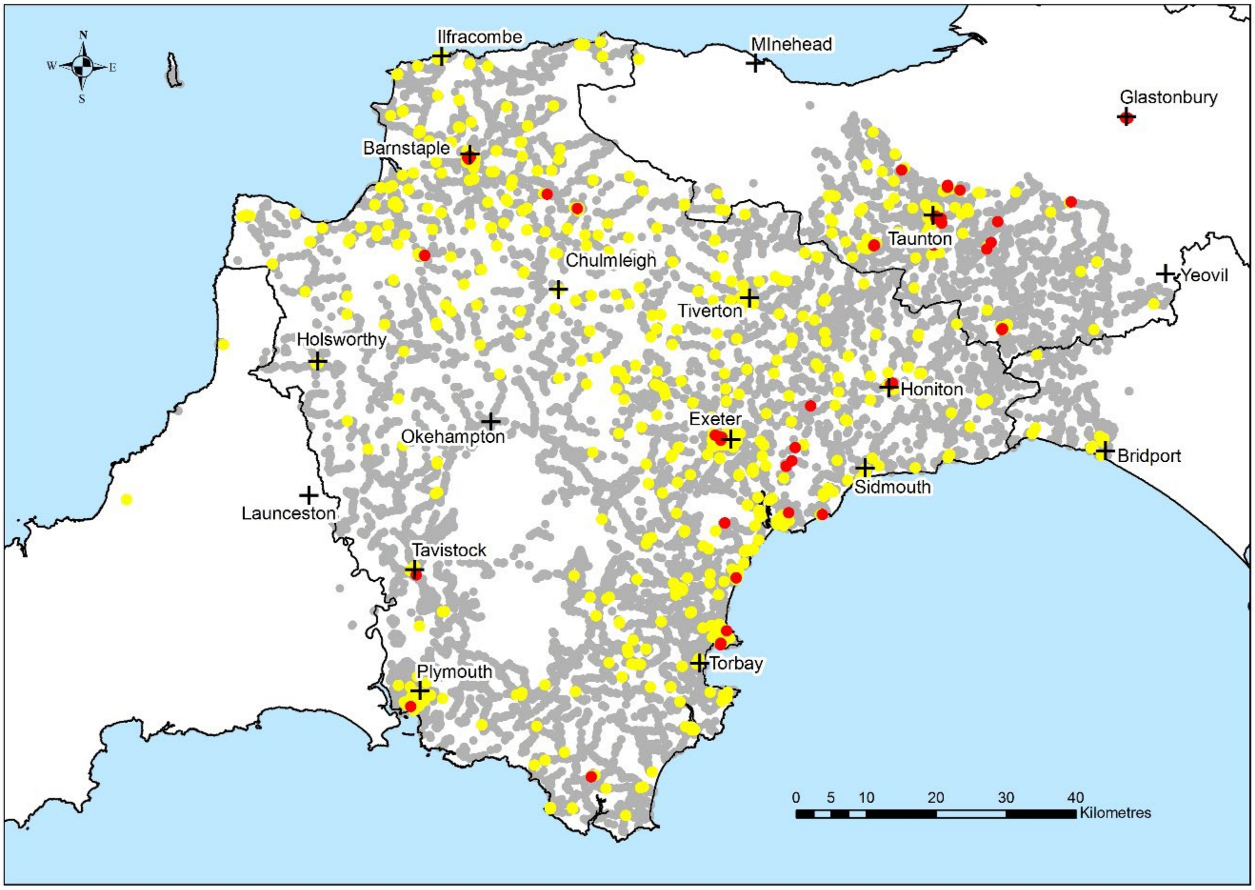

Figure 10. Distribution of Bath Stone is buildings. Red symbols, Bath Stone is the main construction or finishing material; yellow symbols, Bath Stone is a subsidiary material; grey symbols, Bath Stone was not observed.

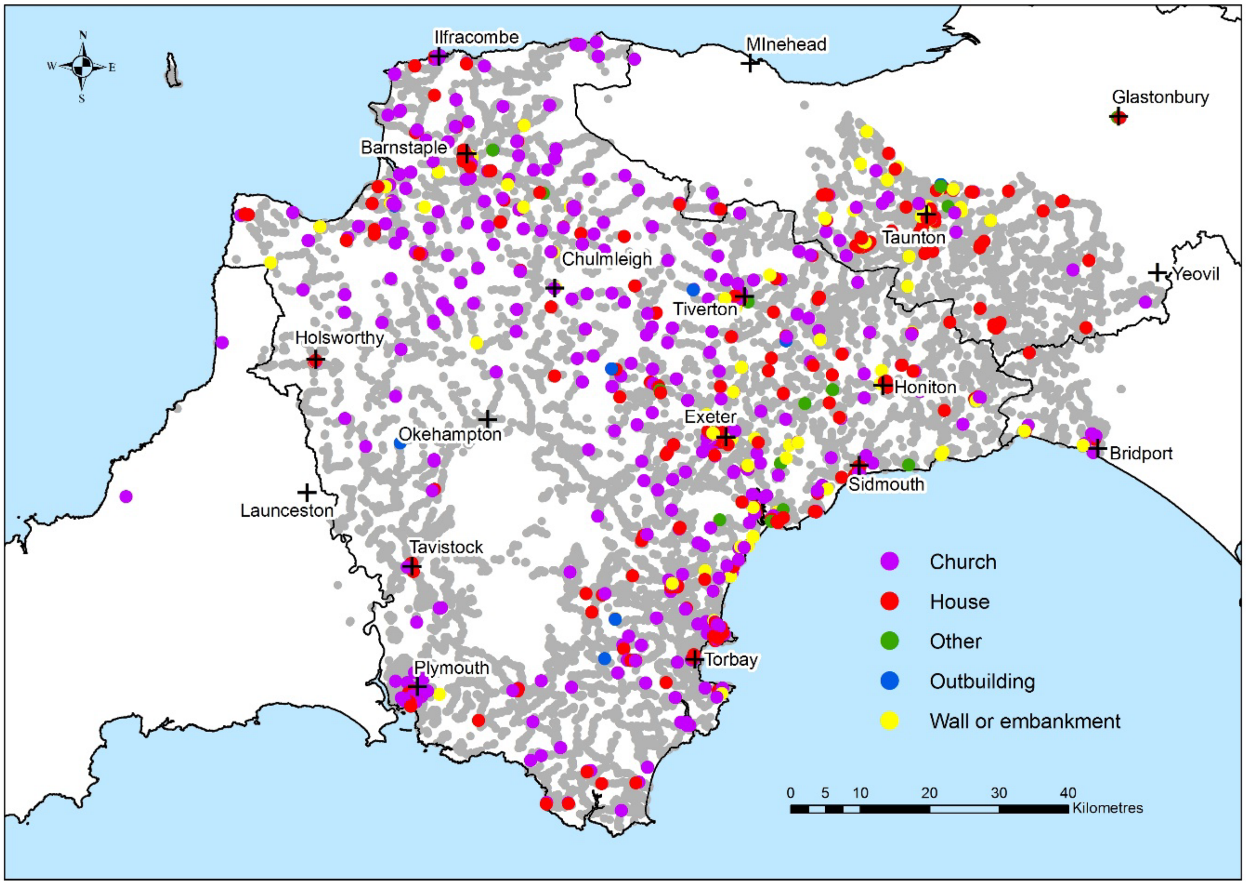

Figure 11. Distribution of Bath Stone in buildings by building type.

22, Junction Bed (Eype Mouth Limestone member of the Beacon Limestone Formation)

Pink, iron-shot conglomeratic and nodular limestone in buildings is referred to the Junction Bed or Beacon Limestone Formation. The cobble-sized fragments or nodules that make up the limestone may represent surface hard grounds broken up by contemporaneous erosion and redeposited. They are typically surrounded by stromatolite-like laminated limestone consisting of layers of calcarenite 2-3mm thick alternating with limonitic layers 1mm thick. These lie in and define the bedding and also enclose and surround the nodules, which include rolled ammonites (Figure 1). Parts of the limestone are very fine-grained (porcellanous) and parts are oolitic. The oolites are composed of greenish, black or ochre iron minerals. They are sporadic, erratically distributed and not very abundant.

The limestone layer is hard, durable and strongly cemented. Pink and crimson are very characteristic colours and distinguish this limestone from all others of the area (Figure 1), but parts are also ochre, fawn or yellow. The rock contains many fossils, especially thick-shelled bivalves and ammonites, some large (Figure 1). The limestone can be identified in walls even where covered with dirt, by the extremely irregular hackly fracture surfaces that define the blocks (Figure 2).

Figure 1. Fallen block below Doghouse Hill showing pink pigmentation, hard pebbles of fine-grained limestone and an ammonite set in a laminated more strongly pigmented matrix.

Figure 2. House wall, Sea Town. The ochreous blocks with very irregular surfaces and some pink pigmentation below the pencil, in the lower left and top left corners are of Junction Bed limestone. The rounded grey blocks are fine-grained sandstone probably from the Thorncombe or Down Cliff Sands.

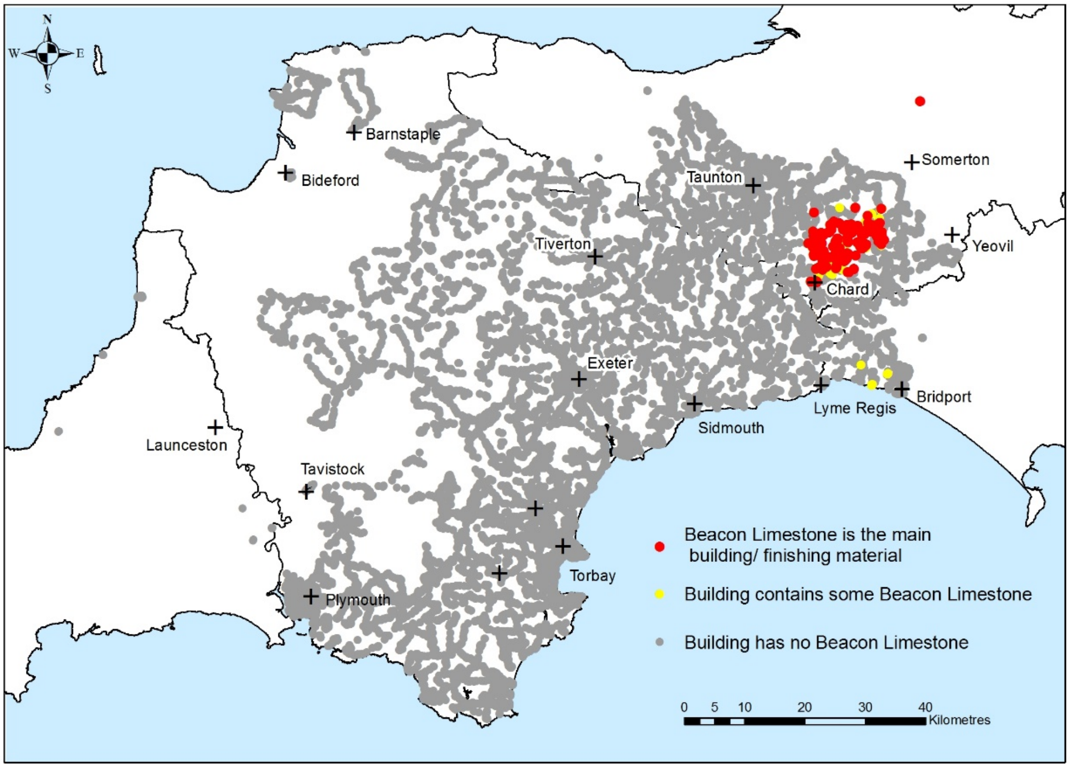

Figure 3. Distribution of Beacon Limestone (Codes 22 and 66) in buildings.

Limestone of this type coded 22 comes from the upper part of the Beacon Limestone Formation (Eype Mouth Limestone member) and has been found in buildings close to the coast around Sea Town and Symondsbury (Figure 3), in every case subordinate to some other building material. It is possible that most of the Beacon Limestone used has been collected from the beach below Doghouse Hill and Thorncombe Beacon where boulders of it are abundant. In spite of this, it appears to have been little used for building. Limestone from the lower part of the Beacon Limestone, coded 66, is much more widely used but between Chard and Yeovil (see Code 66 and Figure 3), not on the coast.

23, Wooden lintels

Wooden lintels mainly to window openings but also to some doorways attract Code 23, entered into the Dressings 1 or Dressings 2 field of the main database table for buildings which have a stone-built element. Wooden lintels are used in all manner of houses and outbuildings from the most tumble-down to the smartest recently built houses. A selection is reproduced in the photographs below. Table 1 compares the occurrence of wooden lintels in the buildings of the project area with the total of all buildings with a stone-built element by building type. Outbuildings and houses are the most likely to have wooden lintels with outbuildings about twice as likely to include them as houses.

Table 1. Distribution of wooden lintels by building type

Building type	**Per cent with wooden lintels**
Church	0.1%
House	6.9%
Other	0.0%
Outbuilding	13.5%
Wall or embankment	0.1%
All buildings	4.0%

Figure 1. Home Cottage, Compton Road, South Petherton.

Figure 2. Street Raleigh Farm, Street Raleigh. Lintels and window frames are all made of hardwood.

Figure 3. Heasley Mill, North Molton. The building was formerly a miners' lodging house.

Figure 4. Cobble Cottage, Chittlehampton.

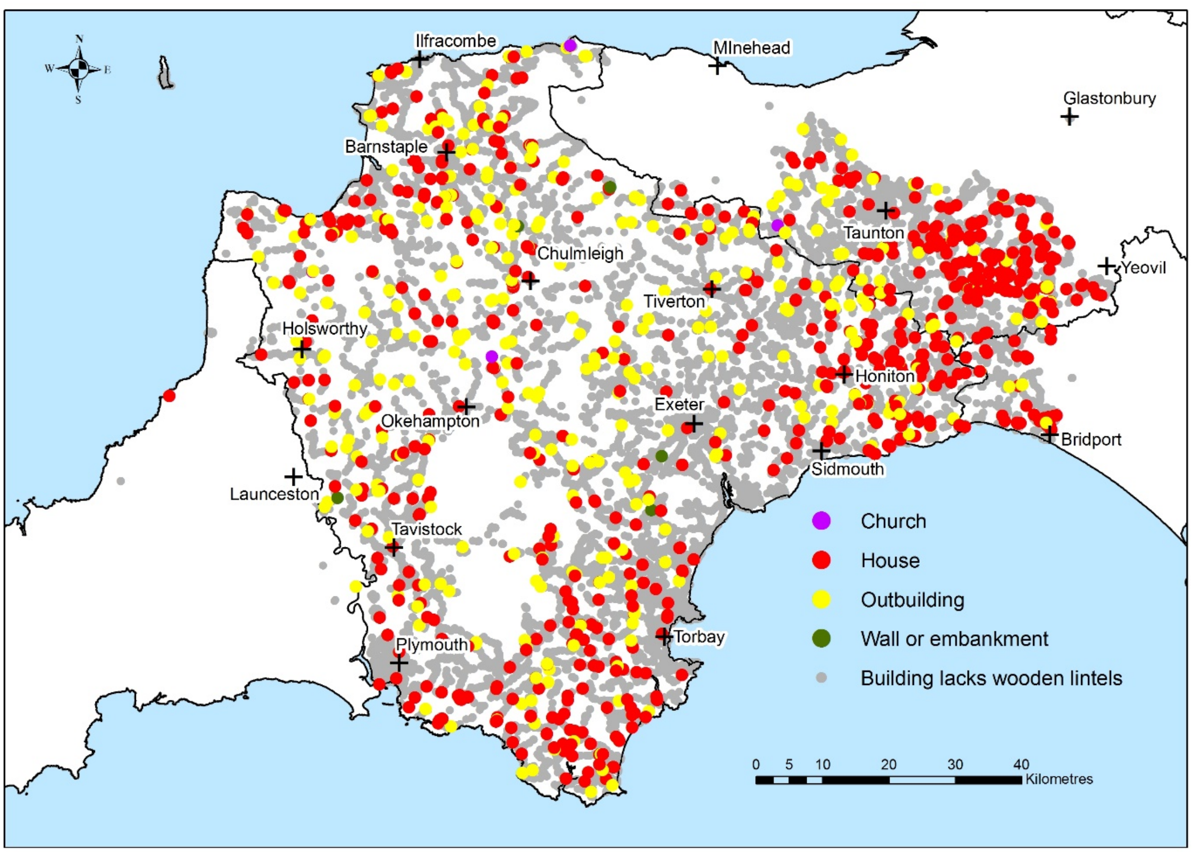

Figure 5. Distribution of buildings with wooden lintels.

Figure 5 reinforces the data of Table 1, confirming the preponderance of houses and outbuildings with wooden lintels and the lack of churches and (less surprisingly) walls and embankments with these features. The concentration of houses showing this feature in southwest Somerset is unexplained.

27, White Lias Limestone

Limestone traditionally called the White Lias is a fine-grained pale grey- to white-weathering very fine-grained or granular limestone occurring below the Blue Lias succession and is topmost Triassic in age. It lacks obvious fossils and bedding structures and building blocks of it appear uniform (Figures 1 and 2). The pale colour is characteristic. It is associated in many buildings with Blue Lias limestone but may be distinguished not only by its paler colour but also by the poorly defined bedding and greater thickness of the building blocks (Figures 3 and 4).

It is distinguished from Portland Stone by a lack of oolitic structure and from Beer Stone by either very fine grain size or by more granular, almost sugary texture of the calcite grains and much harder nature. It is distinguished from Blue Lias limestone by paler colour, grey when fresh and cream-coloured when weathered and is harder and less muddy. The White Lias limestone occurs as a series of beds up to 6 metres thick below the Blue Lias and does not lend itself to building in courses like the Blue Lias. Most Victorian White Lias buildings are constructed as random rubble (Figure 2). However, the limestone beds at the base of the Blue Lias *(pre-Planorbis)* are also pale grey in colour and some of these limestones have probably been included in the White Lias category of building stone in error.

White Lias is or was exposed in the base of many Blue Lias quarries including those in Devon. The main centre of production was along the south side of the Vale of Taunton Deane around Curry Rivel and Langport (Figure 5). It is not currently worked.

Figure 1. South side of nave, St James' church, Hambridge.

Figure 2. The School House, Isle Abbots. The walls and quoins are of White Lias limestone. The dressings round the window are of Ham Hill Stone with a relieving arch of brick. The wall also contains a few blocks of Blue Lias limestone.

Figure 3. South aisle of St Mary's church, Stoke St Mary. Rubble wall of White and Blue Lias limestone, partly rendered. Note that the White Lias blocks are usually thicker than the Blue Lias ones. The quoin on the right is of Ham Hill Stone and the dressings round the window of Bath Stone.

Figure 4. Outbuilding, Holly Farm, Mere Green. Decorative use of White Lias blocks spanning several courses of Blue Lias limestone.

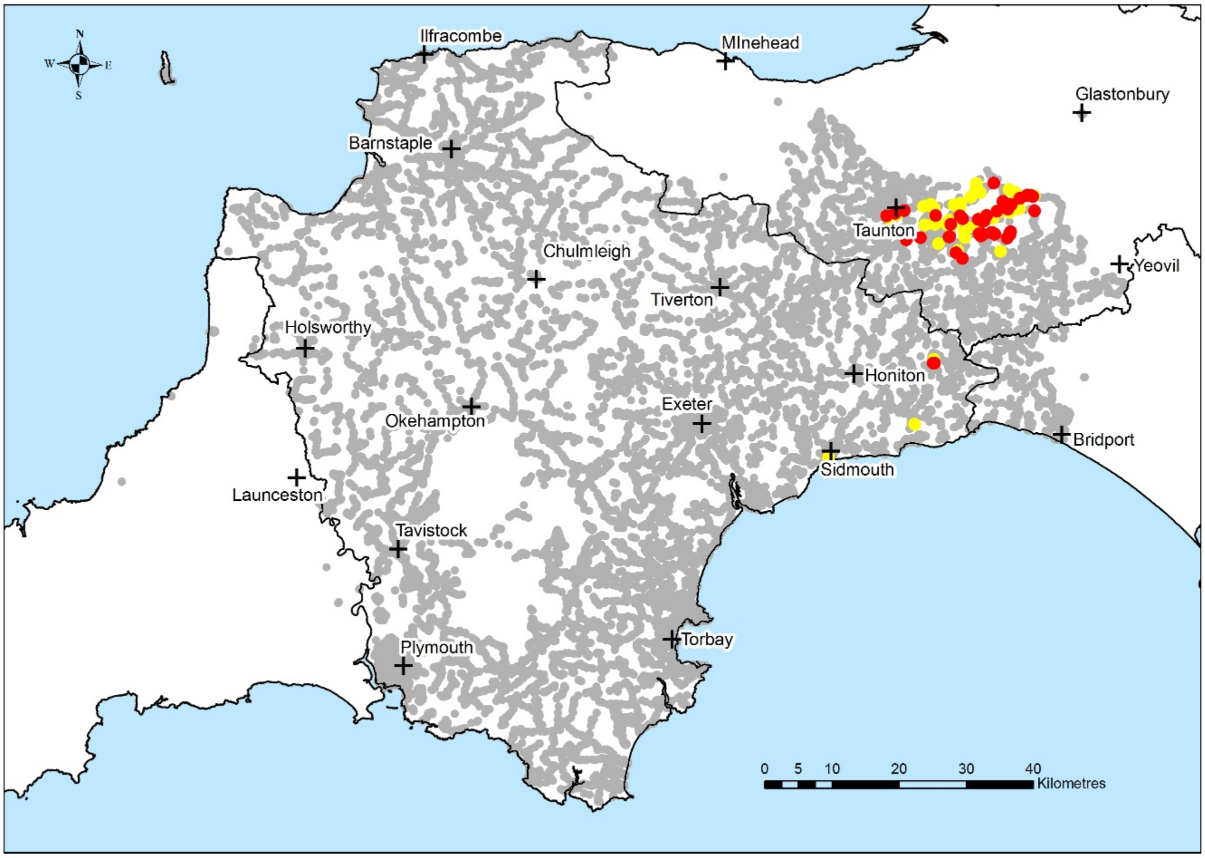

Figure 5. Distribution of White Lias limestone in buildings. Red symbols, White Lias limestone is the main building material; yellow symbols, White Lias limestone is a subsidiary building material; grey symbols, building lacks White Lias limestone.

28, Grey Devonian and Carboniferous Limestone (undifferentiated)

This group includes limestone of various ages and origins that cannot be confidently linked to a specific origin because of a lack of distinctive features. It typically is dark grey to medium grey, medium-grained with an indurated texture that makes the differentiation of individual calcite grains on fresh surfaces difficult, either because they are intergrown or have merged with the matrix through recrystallisation (Figure 1). Bedding is present in some blocks but many occurrences in buildings lack obvious bedding or show evidence of deformation and shearing that has destroyed or obscured it. White coarse-grained calcite veins are common and are particularly striking in dark grey varieties of the rock. The code includes as a subset, dark blue-grey limestone with a dense network of white calcite veins likely from a single source similar to the stone illustrated in Figure 2 of Code 31 limestone.

Grey limestone of this kind is easily distinguished from Blue Lias limestone through being coarser grained, lacking a mud fraction and being much harder. However, it grades into other categories of Devonian and Carboniferous limestone. The code is used for those cases where distinctive features are lacking, where the rock is poorly exposed or where a more specific code has yet to be assigned. The building stone is distinguished from that assigned Code 31 by the absence of red staining.

Recrystallised limestone of this kind is widespread in buildings especially in a zone extending north from Torbay through Exeter towards Taunton (Figure 2). Concentrations in the north reflect the possibility that limestone assigned this code is in fact from Westleigh and Bampton quarries but lacks any distinctive features that would allow it to be confidently assigned to those sources.

In those cases where the limestone is clearly not of local origin, the rock-types assigned Code 28 are mainly used for walls, embankments, bridge parapets and other C19 and C20 public works and quite seldom for houses. It has been widely used for modern repairs to walls made of other kinds of limestone or to replace structures made of other local limestone so as to blend in as far as possible with the local stone. It no doubt has various origins from quarries in the Devonian and Carboniferous possibly from as far afield as Cannington and the Mendips.

Figure 1. Grey limestone lacking distinctive features. Wall north side of Jetty Marsh Rd, Newton Abbot.

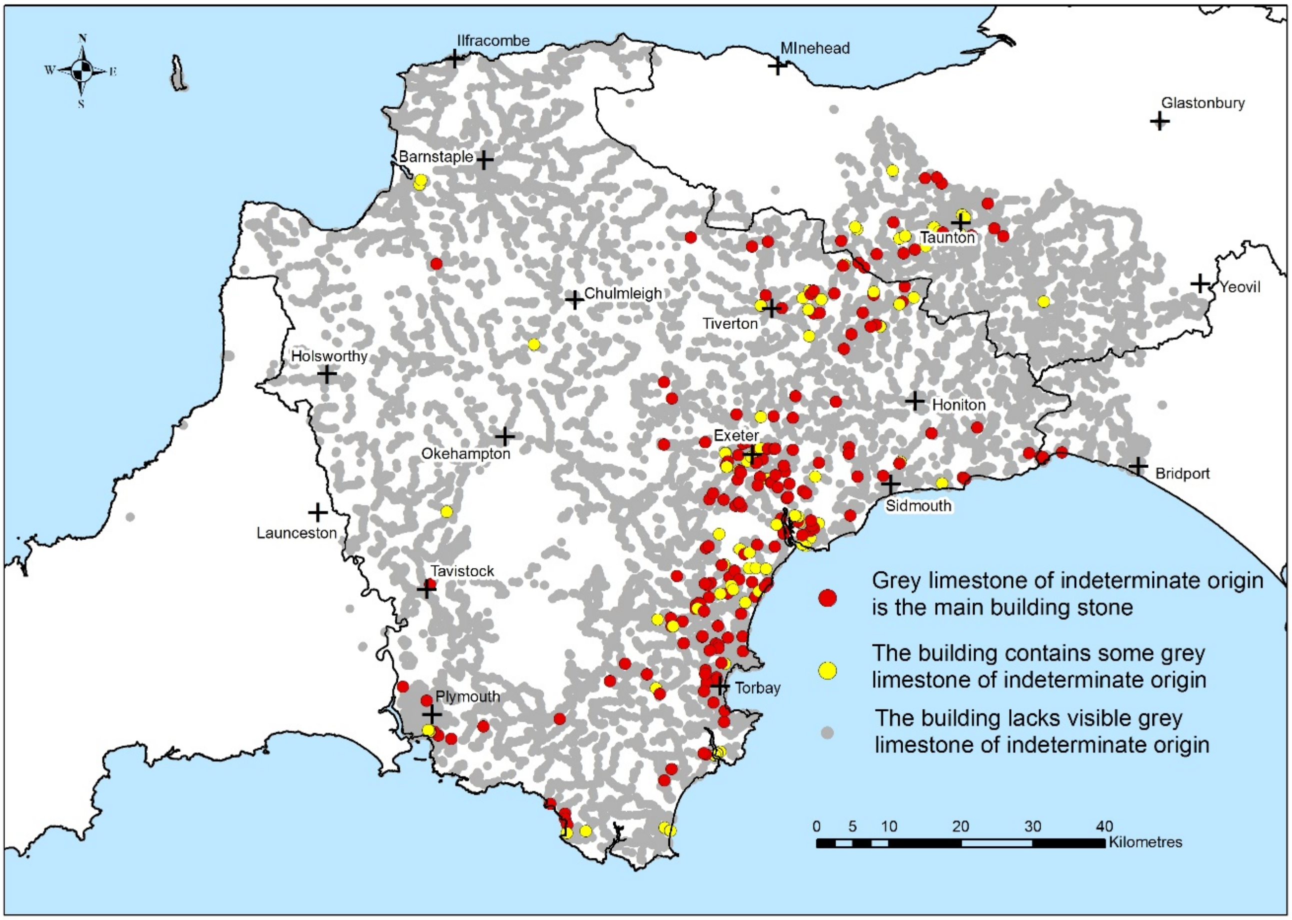

Figure 2. Distribution of grey limestone (Code 28) in buildings.

31, Grey Indurated Limestone with purple staining (Devonian/Carboniferous)

Grey locally purple-tinged or stained indurated limestone. The rock is mainly medium grained but includes blocks with a range of grain sizes from coarse to very fine-grained (porcellanous). It is hard and tough. It typically has irregular sub-parallel partings which may be bedding, crude foliation or shear planes but some blocks are relatively homogeneous and massive without oriented fabric or partings. Blocks tend to be irregular in shape reflecting the fact that partings and oriented fabrics are weak or absent. However, calcite veins are common and limestone marbled through by calcite knots and veins is widespread. The rock-type is distinguished from that assigned Material Code 28 only by the presence of purplish, red, orange or ochre staining.

Like Rock-type 28, rocks assigned Material Code 31 probably group together limestones of various origins from the Devonian and Carboniferous of the Torbay, Chudleigh, Ashburton, Westleigh, Cannington and Mendip areas. The stone being used for an embankment under construction in Torquay assigned this code came from Rokeby Quarry in County Durham according to the builder. In another case where the source of the stone could be identified, it was recycled stone from Dunkeswell and indeed, in several cases, the presence of adhering render, stucco and plaster indicates that the stone has been used before and recycled. While the code probably covers stone of different origins, that illustrated in Figure 2 is a distinctive and widely recognised type likely with an origin in a single quarry.

The limestone is widely used in the eastern half of the study area (Figure 4). This distribution requires critical review to see to what extent it is dependent on the assignment of similar limestone further west to local mid-Devonian sources. It is used almost exclusively for walls, gambions, embankments, bridge parapets, beach armour and other public works of C19 and C20 age or for the repair and extension of older buildings.

Figure 1. Cowley Bridge Road, Exeter. Blocks are laid with bedding parallel to the surface of the wall.

Figure 2. Priests Hill, Kentisbeare.

Figure 3. Kingston Court, Kingston St Mary. According to the builder, this new wall is made of Morte Slate sourced locally, Delabole Slate, Otter Sandstone from Capton Quarry, and purple-stained limestone from buildings knocked down in Dunkeswell.

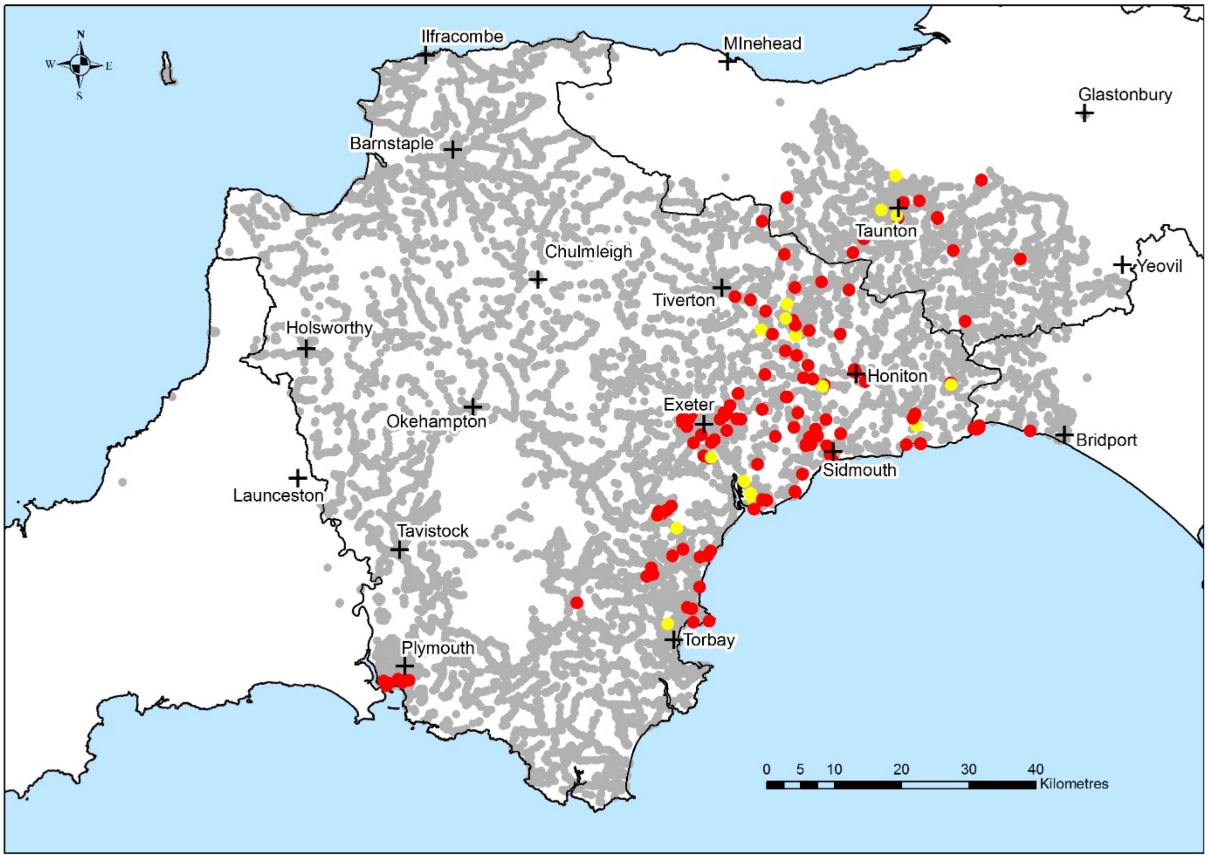

Figure 4. Distribution of purple limestone (Code 31). Red symbols, purple limestone is the main building material; yellow symbols, purple limestone is a subsidiary building material; grey symbols, building lacks visible purple limestone.

32, Granite

Granite of all kinds used for building in the project area is given Material Code 32. The code covers all medium- and coarse-grained granitic rocks so no doubt includes some syenites and granodiorites as well as true granites. By far the best represented is Dartmoor granite but granite from Lundy Island, Bodmin Moor and other exotic sources is also represented and these are described first.

Topsham

Igneous and metamorphic rocks of various kinds including granite (Figure 1), diorite, dolerite and gneiss are incorporated in the buildings of Topsham; about 10 per cent of the buildings in the survey displaying some stonework contain some granite, a remarkably large proportion considering how distant possible sources are. The stone may have found its way to Topsham as ballast in the ships plying the wool trade with the Low Countries although the latter is an unlikely ready source of igneous and metamorphic rocks. The Dutch bricks characteristic of Topsham were used for this purpose. However, Topsham was for many years the port of Exeter and had trading links with many different parts of the world so, if the ballast theory is correct, the stone could have come from several different parts of the Atlantic seaboard including The Lizard.

Beach Armour

Large boulders of durable rock-types are used at various places around the coast of the South West peninsula to protect the beaches during storms. There are records in the database of the use of granite of various types for this purpose at Sidmouth, Exmouth, Paignton, Bude and Instow. In addition, it is known that the granite used in the sea defences at Lyme Regis came from Spain, Portugal and China.

Lundy

The buildings on Lundy Island are made of the local granite (Figures 2 and 3). It is composed of feldspar, quartz and biotite (Figure 4) and is of average grain size for granite. It is even grained compared to typical Dartmoor granite and much lighter in tone, perhaps the more reliable difference that allows it to be distinguished from the latter. It is used for building in adjacent parts of Devon (Figure 5) and where identified with reasonable certainty, a corresponding note is recorded in the database. However, it has not been given a separate material code.

Bodmin Moor

The pale grey granite used in Bude is believed to come from Bodmin Moor. Some occurrences are porphyritic, some are even grained, of quartz, feldspars and typically both visible muscovite and biotite. Similar granite is used in Northwest Devon but no systematic effort has been made to differentiate in from other kinds of granite.

Decorative

Exotic granite of various kinds is used for decorative effect in the facades of prestige buildings but usually only as a minor constituent, Polished granite cladding is used for part of the façade of several late C19 bank buildings. Pink granite is used as part of the decorative scheme of several buildings (Figure 6) and granite is the material of choice for the balls topping off the fancy gateposts at the entrances to great houses and other prestige buildings (Figure 7).

Dartmoor

Dartmoor granite is by far the most widely used for building in the area of study. It is grey or rarely yellowish or pinkish (Figures 8 and 9), with a coarse-grained groundmass mainly composed of quartz, feldspars and biotite typically enclosing lath-shaped alkali feldspar phenocrysts twinned on the Carlsbad law up to 5cm in maximum dimension (Figure 10). In many cases the phenocrysts have a common orientation (Figure 11). The granite may contain angular inclusions of the country rock especially in buildings near the margin of the granite (Figure 12), and more rounded inclusions no more than 10cm across richer in biotite than the enclosing granite and finer grained, interpreted originally as partly digested sedimentary inclusions but possibly representing a separate immiscible granitic melt. The granite is also characterised by knots up to 10cm across enriched in tourmaline (Figure 11).

Granite building blocks tend to be approximately equidimensional or somewhat flattened in the plane of the predominant joint direction and range up to very large in size (Figures 13 and 14). The tendency for the granite to split into prism-shaped blocks has been widely exploited for the creation of monolith gateposts of unrivalled durability (Figures 15 and 16). Granite monoliths have been used in situations where wood would be the normal choice, (Figures 17, 18 and 19) including also the open sides of linhays and butterwalks and other arcades.

The coarse grain size of the granite precludes its use for fine detailing and in many cases, granite dressings, for example of medieval churches where it is widely used both on and away from Dartmoor, tend to be simple and forceful rather than especially decorative (Figure 20). Nevertheless, many fine buildings with simple decoration in the area of study are made of Dartmoor granite (Figures 21, 22 and 23) and granite monolith gateposts may be shaped to decorative effect (Figure 24), or granite detailing may enhance the appearance of a simple building (Figure 25).

Granite quoins and dressings are widely used in buildings otherwise made of less durable stone. Mention has already been made of medieval churches where this is a common practise (Figure 20) but the same applies to secular buildings (Figures 26-28). Large slabs of granite are also widely used for the coping of bridge parapets, not only on Dartmoor but also some distance away from the granite contact especially to the north (Figure 29).

Figure 30 shows the distribution of granite in buildings on and around Dartmoor. As expected it greatly predominates on the granite outcrop and around its margin. Every building to a close approximation is here made of granite and the landscape is dominated by drystone walls made of granite (Figure 31).

Figure 32 shows the distribution of granite in buildings by building type. Part of the distribution shows, as expected, granite incorporated into higher status buildings such as churches at greater distances from the granite outcrop than lower status buildings such as houses and outbuildings. However, the expected pattern does not hold for walls and “other” types of building. Figure 33 provides an explanation. It shows the distribution of granite monoliths and illustrates that the wide dispersion of granite as part of walls or as free-standing posts is due to its use as monolith gateposts. It seems that Dartmoor granite was much in demand for this purpose, one supposes because, once having made the considerable effort to collect and set up your monolith, you need not worry about this aspect of farm fencing for the rest of your life.

Figure 1. Garden wall of Woodlands, Globefields, Topsham. Mainly composed of pale grey limestone from Torbay but including some blocks of yellowish granite of unknown origin (illustrated) and dark green dolerite.

Figure 2. Some of the buildings in the main settlement on Lundy Island, of the local granite.

Figure 3. Ruined quarryman's accommodation, Lundy. The pale grey colour of the granite is characteristic.

Figure 4. Close-up of Lundy granite showing the texture which is typically even-grained, lacking obvious alkali feldspar phenocrysts or with alkali feldspars only slightly larger than the groundmass crystals. The main minerals are feldspars, quartz and biotite. Old lighthouse, Lundy.

Figure 5. Back of the Methodist chapel, Old School Lane, Fremington. The wall is of pale grey granite without phenocrysts probably from Lundy, and Codden Hill Chert.

Figure 6. The Guildhall, Plymouth. The elaborately detailed façade is mainly of local mid-Devonian limestone with some Portland Stone detailing and red granite pillarettes

Figure 7. Entrance to the churchyard, St Lawrence' church, Bigbury. The wall and gateposts are of the local slate from the Bovisand Formation. The gateposts are topped by granite balls.

Figure 8. Church House, South Tawton


Figure 9. Forder Cottages, Ponsworthy

Figure 10. Entrance gateway to Teignmouth Castle. The granite contains alkali feldspar phenocrysts with more-or-less random orientation.

Figure 11. Monolith gatepost, west side of North Road, Holsworthy. The granite has roughly aligned feldspar phenocrysts and dark knots enriched in tourmaline.

Figure 12. Inclusion of dark slate or hornfels attached to granite block. Church of St John the Baptist, Leusdon.

Figure 13. St Peter's church, Lewdon, south side of nave. Slate and granite rubble walling with huge blocks of Dartmoor granite used for the quoins and granite dressings round the large Perpendicular window.

Figure 14. Drystone wall made of huge granite moorstones, approach to Fernworthy Reservoir.

Figure 15. Monolith granite gateposts, Two Bridges, Dartmoor.


Figure 16. Typical rough-hewn monolith granite gatepost. David Ball Bull Hire, Milton Abbot.


Figure 17. Wooden footbridge set on granite monolith uprights. Sampford Courtenay.

Figure 18. Roundhouse, Bradstone Manor.

Figure 19. Jambs of former double doors made of single prisms of granite. Outbuilding, 100m west of St Andrew's church, Tavistock.

Figure 20. Tower of St Michael's church Kingsteignton. The dressings of the west door and the window above are of Dartmoor granite with very large shaped blocks used for the doorway. The relieving arches are of alternating grey mid-Devonian limestone and red Permian sandstone. The walls are of grey limestone.


Figure 21. Disused gateway to Stover House, Teigngrace.

Figure 22. Late medieval almshouses remodelled 1637, Moretonhampstead.

Figure 23. Drakesweed, Plymouth Road. Tavistock. The former grammar school's external walls are made entirely of granite.

Figure 24. Shaped granite monolith gateposts at entrance to the churchyard, West Alvington.

Figure 25. Lodge at entrance to Devington Park (formerly Exvale Hospital), of red breccia with quoins and dressings of granite.

Figure 26. Ford Street Charity, Tavistock, of Hurdwick Stone with granite lintels to the ground floor windows.

Figure 27. The Cottage, Walkhampton. The walls are of microgranite and spotted slate. The quoins and lintels are of granite. The lintels are each made of a single stone carved to look like relieving arches.

Figure 28. Nos 1 and 2 Rectory Road, Bridestowe. Crackington Formation sandstone with quoins and dressings of Dartmoor granite.

Figure 29. Bridge over the mill leat, Peter Tavy. The parapet is of altered gabbro with coping of Dartmoor granite.

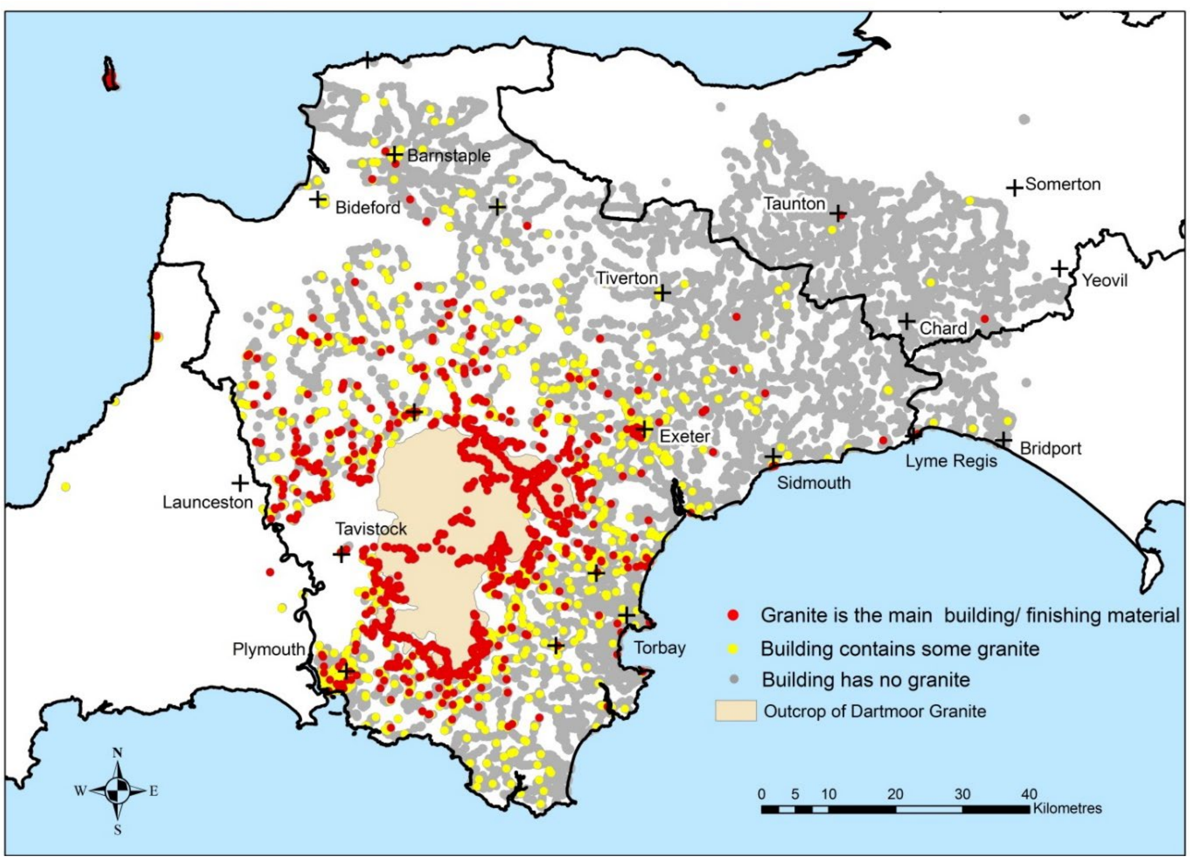

Figure 30. Distribution of granite in buildings.

Figure 31. Dartmoor landscape. Field boundaries are defined by drystone walls built partly to control grazing and partly to clear the stone off the land.

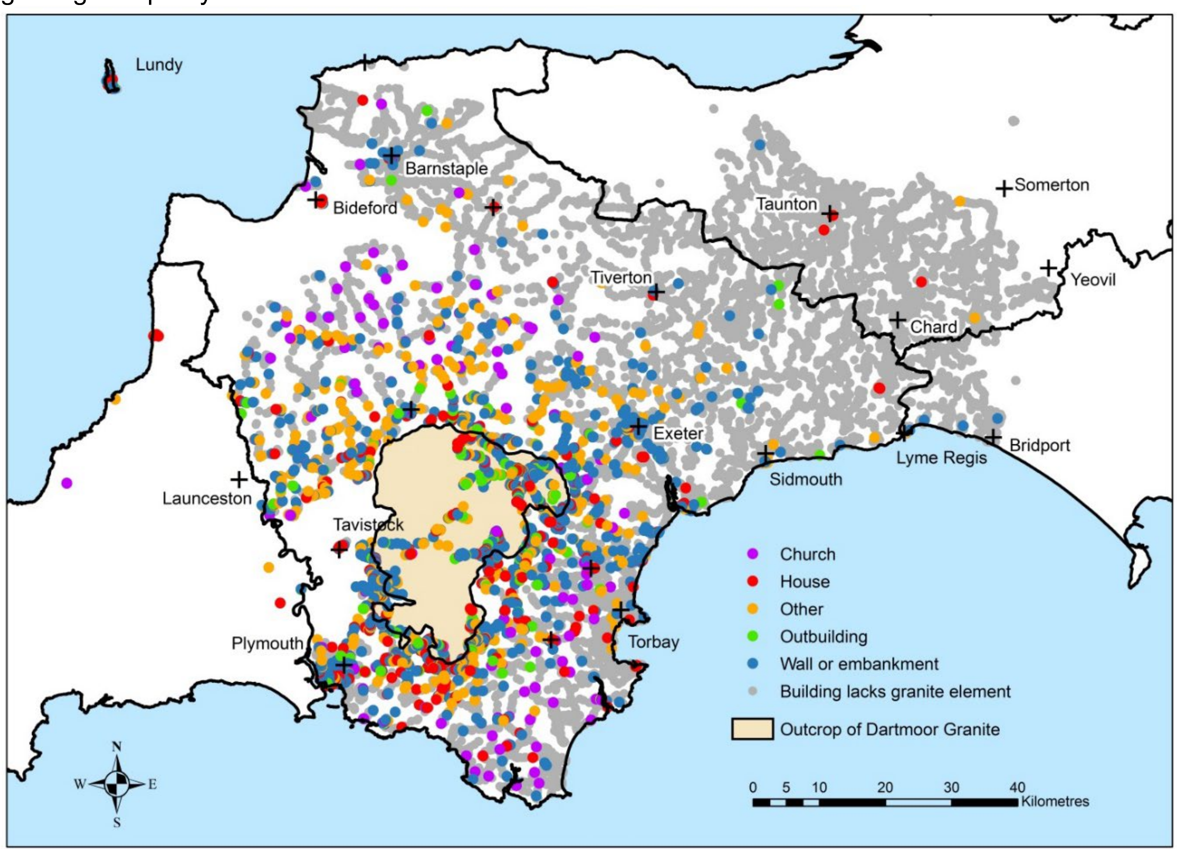

Figure 32. Distribution of granite in buildings by building type.

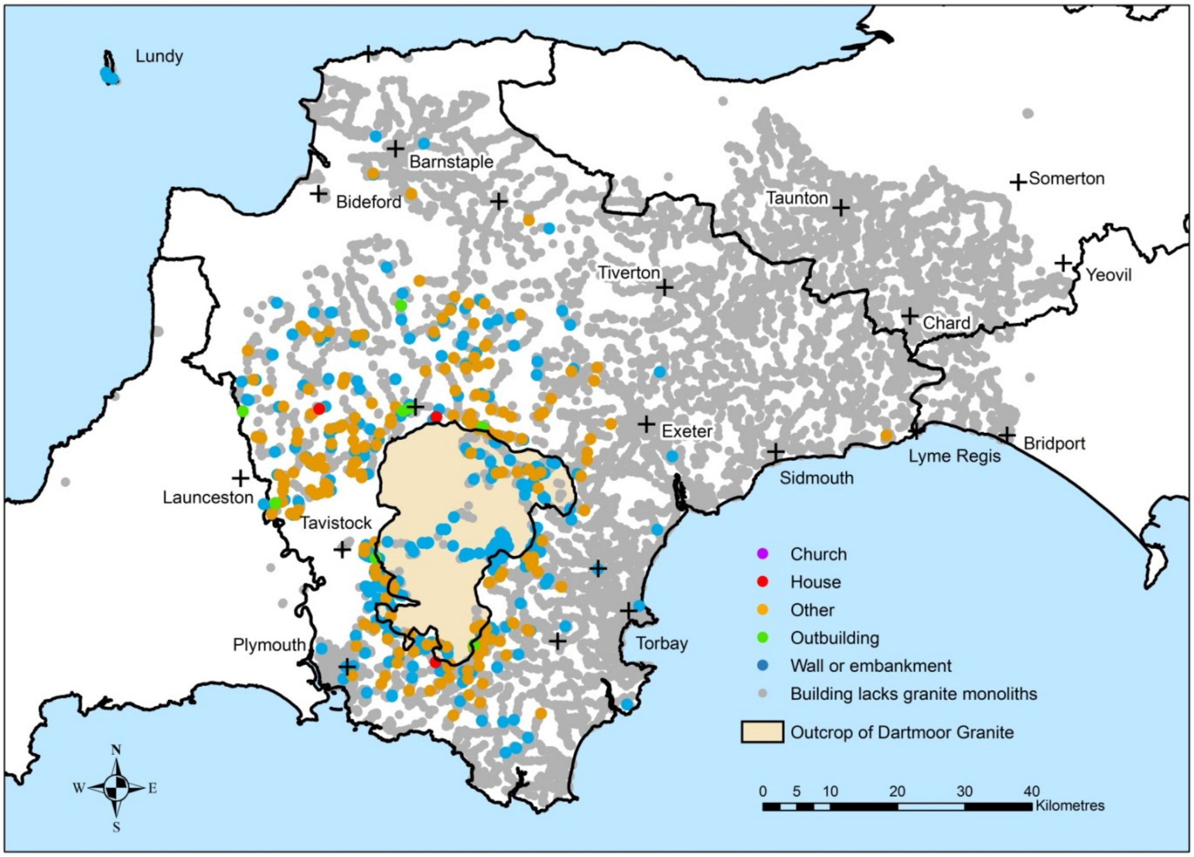

Figure 33. Distribtion of builing types containing granite monoliths.

36, Well-rounded Quartzite Pebbles and Cobbles (Budleigh Salterton Pebble Beds Formation)

The building material consists of well-rounded cobbles and pebbles mainly of grey, yellow, brown and liver-coloured quartzite derived from the Budleigh Salterton Pebble Beds (Figures 1-4). The suite includes a small proportion of pebbles and cobbles usually less well rounded, of black fine-grained rock, probably schorl (quartz-tourmaline). The surfaces of cobbles have in many cases curvilinear traces of internal fractures or discontinuities. Carefully sized pebbles are quite widely used for a decorative finish to walls (Figure 4). The cobbles are known as "Budleigh Buns" or "popples" in the local vernacular, hence "Newton Poppleford" where the cobbles are widely used for building.

Figure 1. St Luke's Church, Newton Poppleford. The photo shows rounded cobbles of quartzite from the Budleigh Salterton Pebble Beds and yellowish chert breccia from the Clay with Flints. However, elsewhere the wall is mainly made of Otter Sandstone and mud-flake conglomerate.

Figure 2. Wall on the west side of Little Knowle, Budleigh Salterton. Quartzite cobbles are mixed with Otter sandstone and mud flake conglomerate.

Figure 3. Little Knowle (east side), Budleigh Salterton. The wall is of mixed “Budleigh buns” and mud-flake conglomerate from the Otter Sandstone. The coping is of carefully sized quartzite pebbles and the gateway of mud-flake conglomerate from the Otter Sandstone.

Figure 4. Decorative finish of sized "Budleigh Buns". North side of Flower Street, Woodbury. The coping is of grey Torbay limestone.

The Budleigh Salterton Pebble Beds Formation is beautifully exposed in the sea cliffs at the town of that name and the pebbles are widely used as a decorative facing there and in nearby towns and villages. The hard quartzite pebbles are very persistent in the soil profile and form a large proportion of the surface deposits of Woodbury and nearby Commons north of the town. Pebbles extend in the soils to both east and west of the high ground of the commons and form a significant proportion of the beach cobbles at Budleigh and to the east, and their use in buildings follows this distribution (Figure 5).

In this south part of the outcrop of the formation, no example of the use of the whole of the conglomerate as building material has been seen, only of the constituent pebbles without their enclosing matrix. Although the outcrop continues to the north, buildings that make use of individual Budleigh Salterton pebbles are seldom seen north of Plymtree. However, conglomerate with prominent pebbles of grey limestone also referred to the Budleigh Salterton Pebble Beds Formation (see Material Code 127) is widely used in the Vale of Taunton Deane (blue and purple symbols on Figure 5), extending as far south as Willand and Bradfield. The contrast is very marked. It arises because the provenance in the south is believed to be from Brittany and the composition of the gravel was inimical to the formation of a coherent matrix, while in the north, the source is more local and includes abundant limestone. This has led to a much stronger calcareous cement such that the conglomerate can be fashioned into building blocks without falling apart. In former times the limestone cobbles were also picked from the surface for burning and the outcrop is marked by widespread lime kilns.

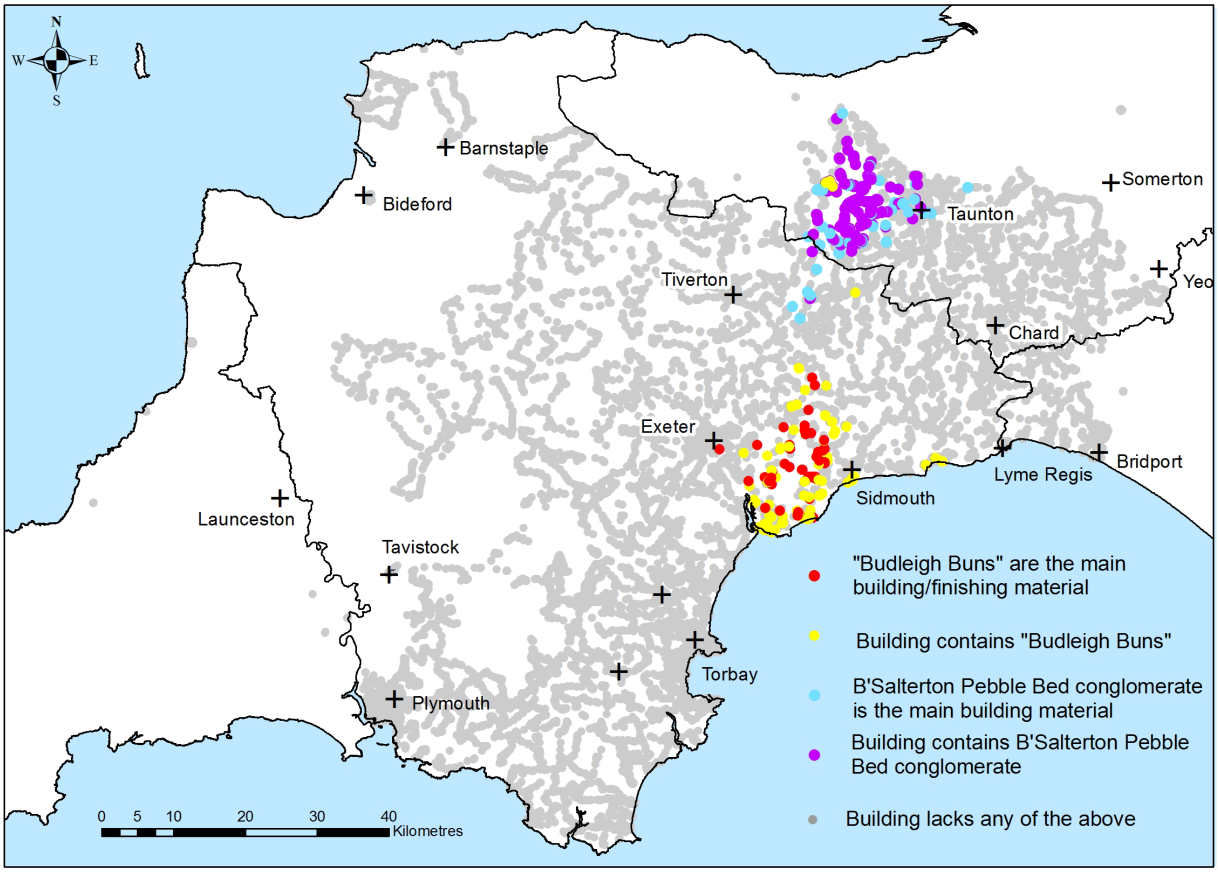

Figure 5. Distribution of Budleigh Salterton Pebble Beds in buildings.

37, Portland Roach

Portland Roach is a tough, cream-weathered medium-grained clastic limestone with numerous shell fragments. Its distinctive feature is the presence of negative casts of bivalves and gastropods especially *Aptyxiella portlandica*. The original shells, made of aragonite, have been dissolved away, leaving a shell-shaped hole in the limestone where they once were (Figure 1). In some cases, an internal cast made of lime sand that filled the inside of the shell during deposition is also preserved.

It is the most durable of the Portland building stones but is not much used in the area of study (Figure 2). Its use in the Cob at Lyme Regis is often commented upon in the literature and it also forms the coping of the new wall on the east side of Charmouth Road extending down from the big car park to the town centre. The boulders beside the road where it turns parallel to the Axe Estuary in Axmouth are also of this stone and there are a few other minor occurrences in Colyford, Taunton, Knowstone, Shillingford and Bridport.

Figure 1. Negative casts of bivalves and gastropods in Portland Roach used for the facing of the Cob, Lyme Regis.

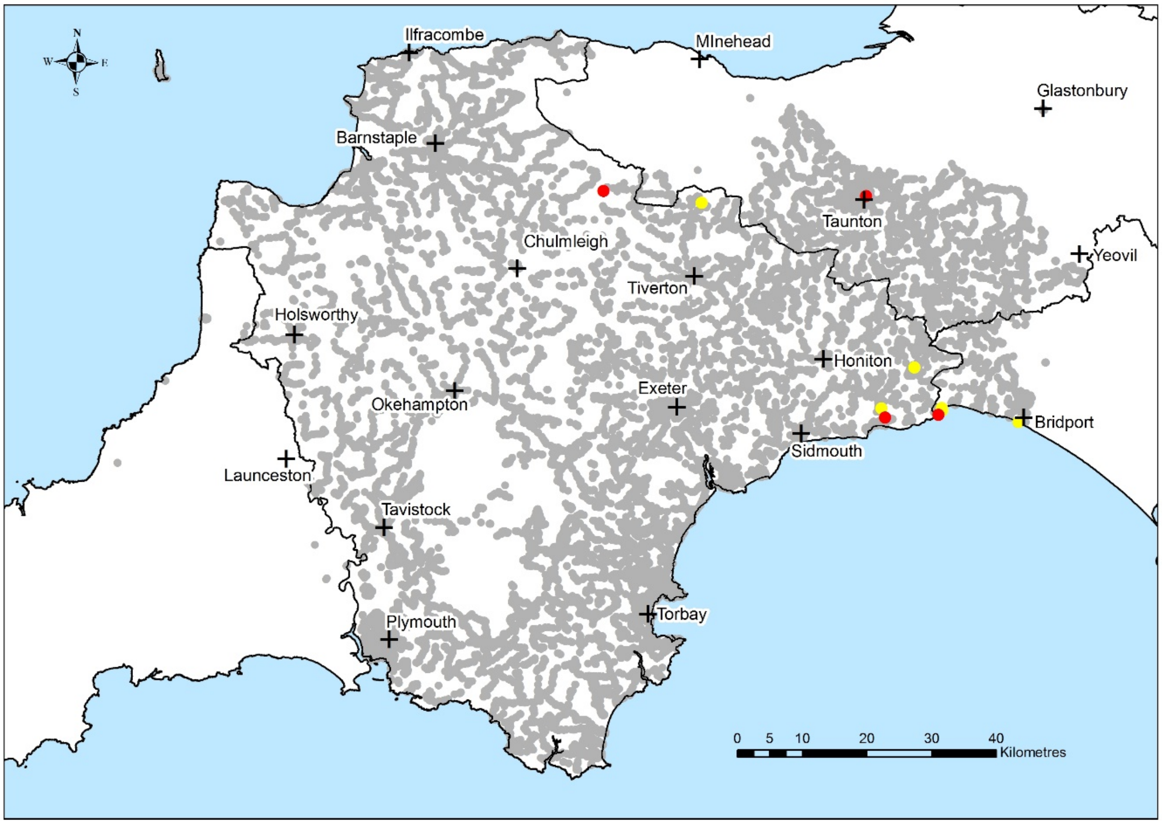

Figure 2. Distribution of Portland Roach in buildings. Red symbols, building is mainly of Portland Roach; yellow symbols, building contains some Portland Roach; grey symbols, building lacks visible Portland Roach.

42, Rendered (cob?)

Most cob walls in Devon are finished with a layer of render or stucco to preserve them from moisture. The presence of cob in these cases is based on inference from architectural aspects of the buildings. For the purpose of populating the database, at least two of the following must be present before cob is suspected in the construction of a building; footing of stone or brick to a wall finished in render or stucco (Figures 3, 5 and 8); batter - wall significantly thicker at the foot than at the top and consequently sloping inwards when viewed from outside (Figures 1, 5 and 6); exceptionally thick walls; bulging and irregular walls; use of buttresses to support bulging walls (Figure 2); distorted openings for doors and windows; few small opening (Figures 1, 2, 5 and 6); with few exceptions, no more that 1½storeys high; rounded quoins and window opening (Figures 1, 5, 6 and 7); coping of tile or slate to protect free-standing walls from rain (Figures 3 and 8).

Figure 1. Little Thatch, Harpford

Figure 2. Hall's Farm, Metcombe

Figure 3. Payhembury, opposite Old Stones Cottage. The stone footing and elaborate slate coping suggests cob construction beneath the render.

Figure 4. The Digger's Rest, Woodbury Salterton.

Figure 9 shows the distribution of cob buildings in the study area where the cob is covered with plaster or render. In these cases, rendered cob was not observed in buildings directly but was inferred from aspects of their architecture. However, comparison with the listed building citations indicates that the number of rendered cob buildings has been underestimated rather than overestimated.

Houses greatly exceed other kinds of rendered cob building in the study area. This contrasts with the proportions of houses with exposed cob and no doubt reflects the higher standards of maintenance of cob houses compared with outbuildings and walls (compare the proportions of houses and other kinds of cob buildings in Table 1). Cob buildings are quite evenly distributed across the study area but with slightly greater proportions near the outcrop of the Triassic and Permian red beds extending north from Sidmouth and Exmouth to the Somerset border (Figure 9), reflecting the fact that good building stone is scarce in this zone (Barr, 2007). Conversely, cob buildings are absent in west Devon from the A38 to Launceston in the north to Plymouth in the south and along the north coast (Figure 9). The reasons are unknown.

Cob is widely used on the outcrop of the Crackington and Bude Formations in central Devon but is relatively sparsely distributed in the Blackdown Hills and around Dartmoor, perhaps here also reflecting the availability or otherwise of quality building stone.

Further remarks about building with cob in Devon are presented in the Appendix.

Table 1. Cob buildings in survey at end of January 2008

	Number of buildings		
Building type	Exposed cob	Rendered cob	Total
Church	0	1	1
House	30	1339	1369
Outbuilding	242	121	363
Wall or embankment	59	87	146
Total	331	1547	1878

Figure 5. Decorated cob cottage on a footing of sandstone from the Crackington Formation. Chapple Lane, Sampford Courtenay.

Figure 6. The Duke of York public house, Iddesleigh. The distorted gable end on the right-hand side suggests there might be some timber framing also.

Figure 7. Clematis Cottage and Rose Cottage, Yeoford. Clematis Cottage (nearer) has rounded quoins and is 1 ½ storeys high. Rose Cottage has few openings.

Figure 8. Entrance to Polsloe Priory precinct, Exeter. Rendered cob on a footing of red breccia, red sandstone and Exeter volcanics with new tile coping. The dressings round the door are of Exeter volcanics.

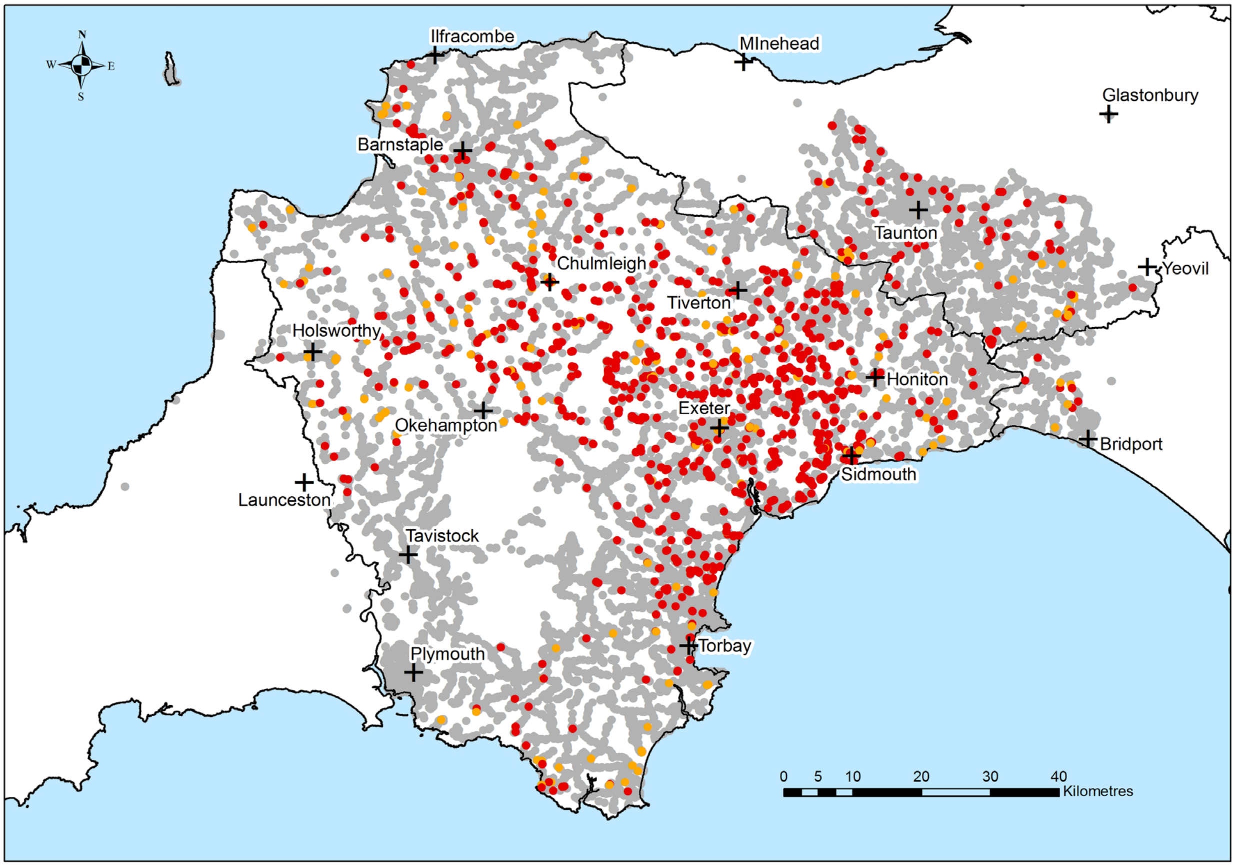

Figure 9. Distribution of buildings containing rendered cob. Red symbols, cob is the main construction material; orange symbols, cob is a subsidiary building material; grey symbols, building lacks cob.

Appendix. Cob Buildings in Devon

Cob, a walling material made of subsoil and straw with cow dung as an optional extra, built up in layers on a stone footing (Schofield and Smallcombe, 2007), is widely used for all kinds of building in Devon except churches. Where the cob is exposed, it has been assigned Material Code 10; where it is entirely covered in render it has been assigned Material Code 42. In this case, its identification is dependent on aspects of the building characteristic of cob such as a stone footing, strong batter, rounded corners, few openings for windows or doors and no more than 1.5 storeys in height.

In order to provide some justification for the identification of cob in buildings where it is entirely covered in render, the descriptions of listed houses in the database believed to be partly made of cob were compared with the listed building citations part way through the survey. The results are set out in Table 1.

Table 1. Rendered cob (Material Code 42) in listed houses

	Listed building citations	
Database	Has cob	No cob
Has cob	399	39
No cob	14	

The table implies that there is an overestimate of the use of cob in this way of about 10 percent compared to the citations (39 out of 438 houses) partly offset by a failure to recognise cob in 14 houses where it is mentioned in the listed building citations. The architects who prepared the citations did not get to look inside the houses in many cases so they also depended on the exterior appearance; in these cases, there is no reason to believe they were more accurate than this survey. Consequently, the identification of rendered cob in houses in the survey, and by implication, in outbuildings and walls too, is accepted as a reasonably accurate approximation.

Table 2 shows a breakdown of cob buildings by building type. Attention is drawn to the contrast between houses where most cob buildings have a rendered exterior, and outbuildings, where the cob is exposed in most buildings. It seems that an effort is made to maintain cob houses in a good state of repair but that outbuildings have, in a significant proportion of cases, been neglected and allowed to fall into disrepair.

The table also illustrates in the last column the large proportion of buildings in Devon that include a cob element. Note that this is the proportion of buildings *in the survey* which have a visible stone (or cob) built element, not all buildings. Still, the proportions of 12% of houses, 15% of outbuildings and 7% of buildings of all kinds is impressive and is probably greater than for other counties in England (see Devon Earth Building Association, 2015).

Table 2. Cob buildings by building type

Type of building	Visible (Code 10)	Inferred (Code 42)	Total	Per cent of all buildings
Church	1	1	2	0.07%
House	34	1398	1432	12.26%
Outbuilding	271	131	402	15.16%
Wall	61	92	153	1.49%
Total	**367**	**1622**	**1989**	7.23%

One further feature of cob houses is worthy of note and is illustrated in Table 3. More than 70% of them have thatched roofs compared to just 13% of all houses. One might speculate that older houses are both more likely to be made of cob *and* to have thatched roofs and this explains the association. Alternatively, it might be an unintended consequence of the listing process.

Table 3. Roofing material of cob houses

Roofing material	Cob Houses		All Houses	
	Number	**Per cent**	**Number**	**Per cent**
Not recorded	79	5.53%	1845	15.83%
Asbestos and polycarbonate	7	0.49%	43	0.37%
Corrugated iron	12	0.84%	38	0.33%
Metal	1	0.07%	21	0.18%
Mock-slate	19	1.33%	241	2.07%
Shingles	4	0.28%	12	0.10%
Slate	221	15.48%	4804	41.22%
Thatch	1018	71.29%	1529	13.12%
Tiles	67	4.69%	3122	26.79%
Total	**1428**	**100.00%**	**11655**	**100.00%**

Reference

Devon Historic Buildings Trust, 1992. *The Cob Buildings of Devon 1: History, Building Methods and Conservation.* 4pp.

44 and 56, Wood

Buildings containing an external element made of wood are given one of these codes; they have equal standing. They exclude timber-framed construction which has its own code, and hanging shingles. They include houses where the window surrounds – oriels, dormers, mullions and transoms are made of wood, and walls which have a wooden palisade above the stonework. However, wooden sills do not attract these codes since they have their own (23, qv) and are very common in all kinds of buildings.

Since construction in wood is somewhat to one side of the main purpose of the study, it is likely that the record of these architectural details is incomplete and some, even many, buildings with wood visible from the outside have not found their way into the database. In any case, only buildings with at least one element made of stone are included.

Even with these restrictions, the ways in which wood is incorporated in the buildings included in the survey are many and various. They include weatherboard and cladding of all kinds (Figure 1), wooden window and door surrounds as mentioned above (Figure 2), wooden pillars, for example for the front of linhays and butterwalks and wooden extensions. Houses with exposed wooden beams - mock timber framing - are also included. Very common is the covering of the gable end of buildings above the top of the wall up to the apex of the roof with wooden boards (Figure 3). In many of these cases it is believed that this feature marks the replacement of the end of a half-hipped roof, likely covered in thatch originally, and in some cases this possibility has been mooted in the field notes. However, this seems less likely where the building still has a thatched roof or in the case where the gable end has a door right up against roof ridge or indeed, is all of modern construction.

Also quite common are outbuildings where the lower parts of the long walls are of stone and the upper parts of wood boards. In some of these cases, the boards (and concrete blocks and corrugated iron) are believed to replace original cob and in a few cases, both original damaged cob and wooden repairs can be seen. Finishing in wood is not restricted to smaller dwellings and outhouses and many modern houses and blocks of flats in an urban setting have a wooden element in their exterior cladding (Figure 4).

Buildings with wooden exterior parts are about evenly distributed across the study area (Figure 6), as are those with boards in the apex of the gable end perhaps replacing hipped or half-hipped roofs. There are about the same number of houses and outbuildings in the category but this contrasts with the proportions of houses and outbuildings in the whole survey where houses preponderate in a proportion of about 4 to 1; this reinforces a general impression that, with important exceptions especially in modern buildings, wood is a rather lowly construction material more suitable to outbuildings than to houses. However, notable buildings with wooden exterior parts include Broadhembury House, enlarged and modernised by Harbottle Read in the early C20, the Priest’s House in Holcombe Rogus (C16), Huntsham Post Office (C19/20, Figure 5) and Cricklepit Mill in Exeter.

Figure 1. Tumbledown outbuilding, Ledstone Farm near Buckland Tout-Saints with new corrugated iron roof. The walls are made of stone rubble, stone slabs set on end and boards. Photo © Mr Stuart Brighton.

Figure 2. The Library, Wiveliscombe.

Figure 3. Outbuilding 430m southwest of the crossroads at Lamerton Green.

Figure 4. Lloyds Bank, Plymouth. The façade is made of Portland Stone with stained wooden panels.

Figure 5. Huntsham Post Office. Photo © Mr Norman Thompson.

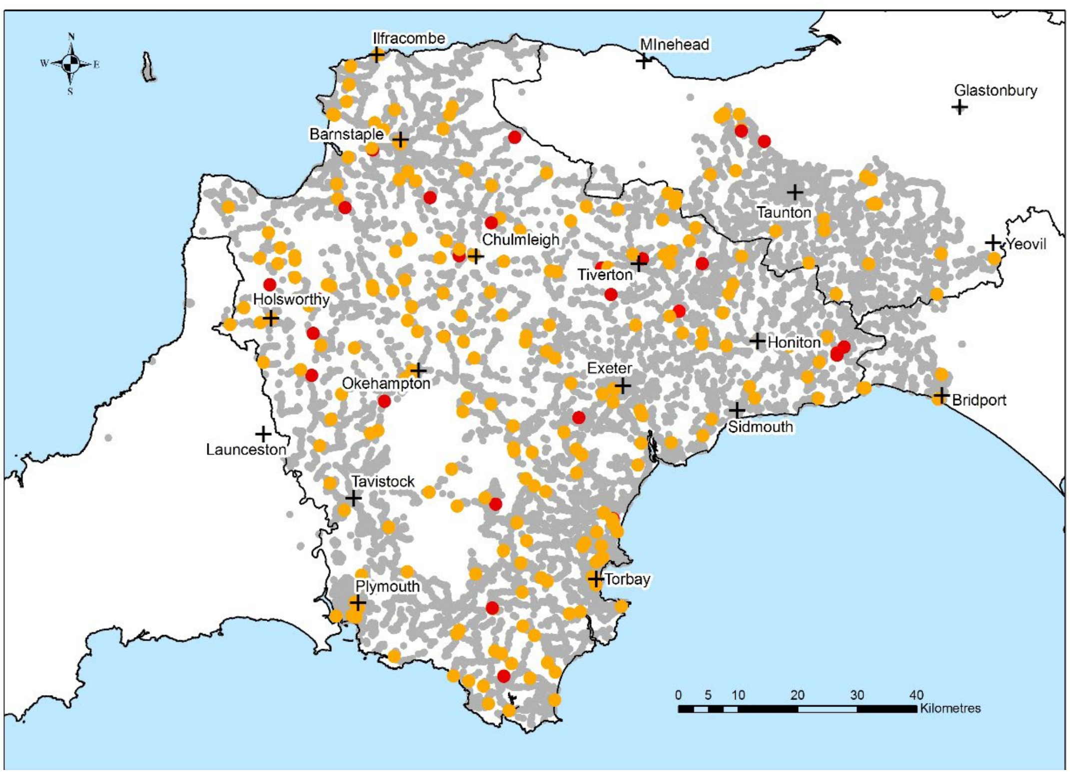

Figure 6. Distribution of wood in buildings that also have a stone-built element. Red symbols, wood is the principal building material; orange symbols, wood is a subsidiary building material; grey symbols, building lacks visible external woodwork.

45, Concrete

Buildings that include concrete as well as some visible stonework are included in the survey. The concrete may occur as the lintels, jambs or sills of window or door openings (Figure 1), as repairs or alterations to stone walls or outbuildings (Figure 4), as part of stone roadside walls, especially the coping where it typically takes the form of thin preformed slabs (Figure 2) or a rounded top to the wall, in some cases with sharp slate inserts, perhaps to discourage small boys from climbing over (Figure 3). In this survey, the term is restricted to building material that retains the appearance of concrete (e.g. Figure 5). Concrete walling where an attempt has been made to disguise it as stonework is given the code 11, artificial stone.

Buildings that include visible external concrete as well as stonework are about evenly distributed across Devon (Figure 6).

Figure 1. Post Office and stores, Black Torrington. Concrete lintels to ground and first floor windows.

Figure 2. Thin concrete coping to a roadside wall of Pickwell Down sandstone, Foxhunters Inn, West Down.

Figure 3. Rounded concrete capping with sharp slate inserts on top of a wall of Pilton Formation sandstone, George Nympton Road near junction with South Street, South Molton.

Figure 4. Outbuilding of Router Farm between Lifton and Chillaton, of Codden Hill Chert with doorway filled by concrete blocks.

Figure 5. Part of the Southernhay development, Exeter. The beams and roof support are of concrete. The cladding is of Plumpton Red Lazonby sandstone from Stencliffe Stone of Penrith.

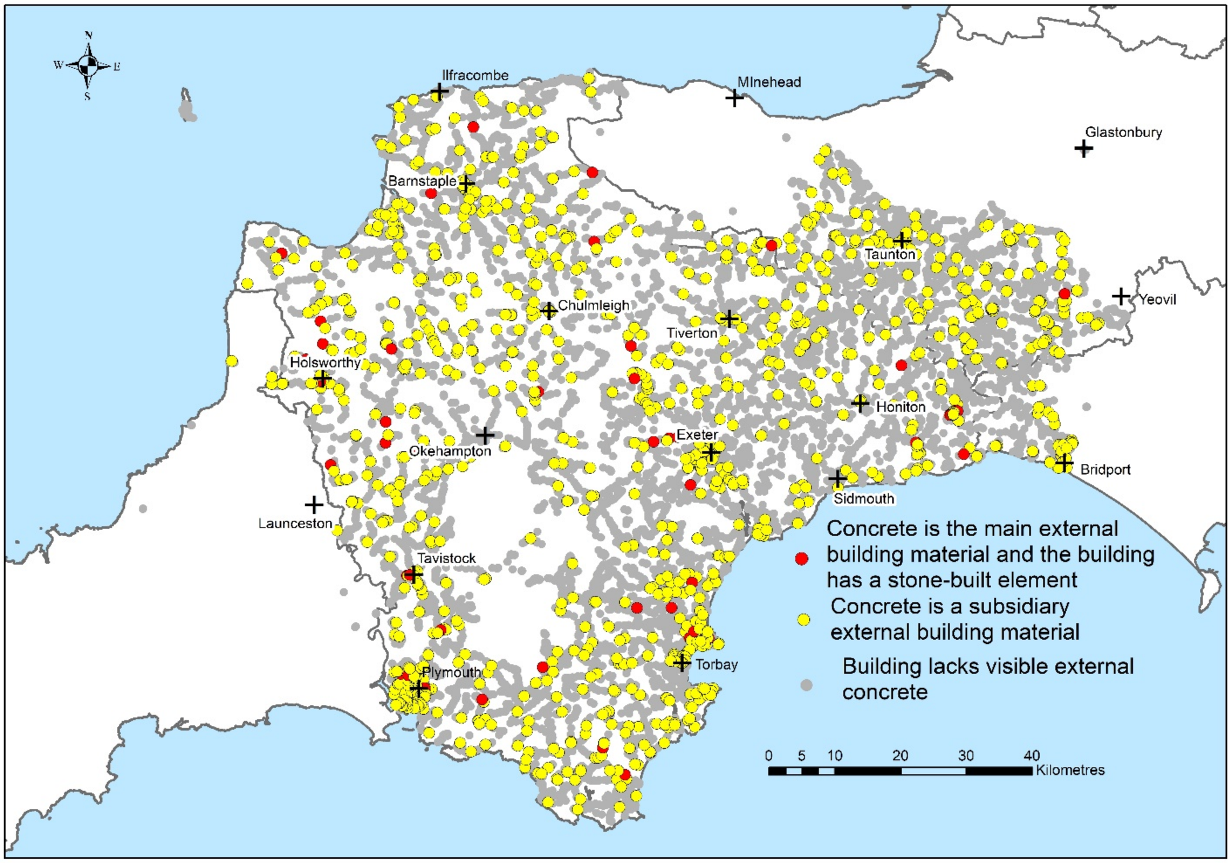

Figure 6. Distribution of stone-built buildings containing visible concrete

46, Timber-framed

Buildings held together by a framework of vertical and horizontal timber beams with cross-bracing. The walls are filled in with nogging of bricks, daub etc. which are not load-bearing. There are rather few houses, mostly located in the towns, known to be timber-framed, compared with other parts of England (Figure 9), Timber framing has proved to be difficult to identify from outside appearance. Also, confusion is caused by fake timber framing, some of it well executed. Timber framed porches to houses of more conventional construction are more common and timber framing on lower walls of cob is also relatively common. Timber framing is most surely identified by the presence of jetties supporting the upper stories of houses and may be accompanied by distorted window and door openings. Nearly all the timber-framed buildings in the survey have been confirmed through the listed building citations. However, a large number of timber-framed listed buildings are present in Ashburton, none of which were correctly identified from their outside appearance during the survey.

Figure 1. Tudor House, Tudor Street, Exeter.

Figure 2. Café Nero, Market Cross, Taunton. Originally (1578) the town house of the Portmans.

Figure 3. Manor Hotel, Fore Street, Cullompton.

Figure 4. Lamb and Flag public house, Blagdon Hill. The porch is jettied and supported on timber posts.

Figure 5. Luton Barn Bed & Breakfast, Luton.

Figure 6. Nos. 1 (York House) and 4, The Quay, Dartford (left- and right-most of the houses facing across the water), dating from 1893 and 1664 respectively.

Figure 7. Rupert White Interiors showroom, Bampton.

Figure 8. Annex to the Highwayman Inn, Sourton. I think this must be spoof timber framing.

Although not very evident from the illustrations, many timber framed houses in towns in the west country have timber gable ends presented to the street corresponding to the width of the medieval burgage plot with stone side walls the ends of which may or may not be visible (Figures 2 and 3).

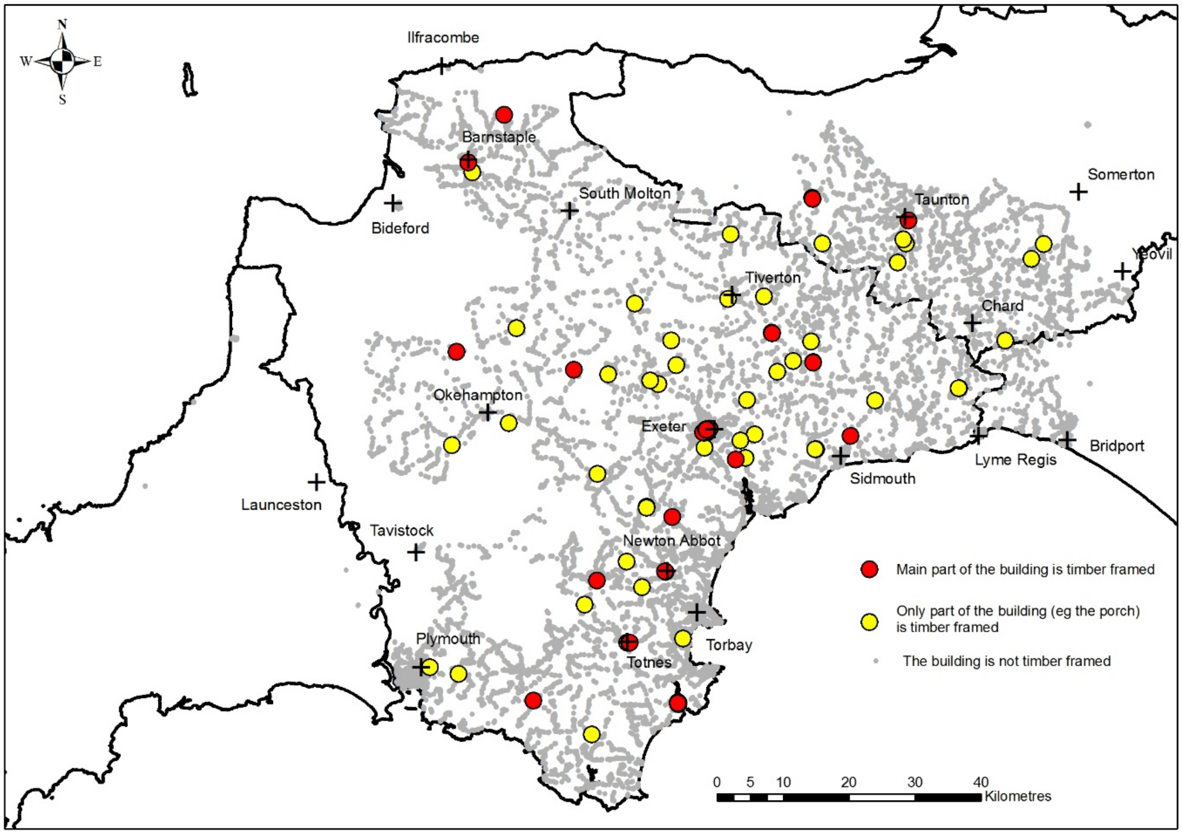

Figure 9. Distribution of timber-framed buildings.

49, Doulting Stone (Middle Jurassic)

Doulting Stone is a yellow to pale grey medium- to coarse-grained clastic limestone, mainly composed of large subangular single crystals of calcite. These are predominantly equant and closely packed and are very characteristic of this building stone. However, in some blocks they are joined by flatter grains, perhaps shell fragments and here and there through the rock there are much larger fragments which are obviously pieces of shell. The clastic grains are set in a matrix made up of finer-grained sand, mainly carbonate but including maroon and green parts and all is set in a sparse carbonate cement. On weathering, the matrix tends to be less prominent and is the preferential site for the initiation of lichen or algal growth so that in many cases, when the rock is examined, it appears as if the larger single grains of calcite are sutured together with very little matrix material. In other examples the distinction between clasts and matrix is less well marked. The appearance is one of grains connected by carbonate outgrowths forming a network of solid material with voids between. In still other cases, the surface is continuous and has a greasy appearance - in these cases the effect is probably caused by a thin surface layer of dripstone deposited since the block was put in place.

Other than the occasional larger shell fragment which lies in and defines the bedding, sedimentary structures are noticeable by their absence. The rock appears almost homogeneous.

Doulting Stone is used sparingly in the area of study mainly for the dressings of churches It is distinguished from Bath Stone by completely clastic texture and lack of oolites and from a distance with difficulty, by its coarser texture.

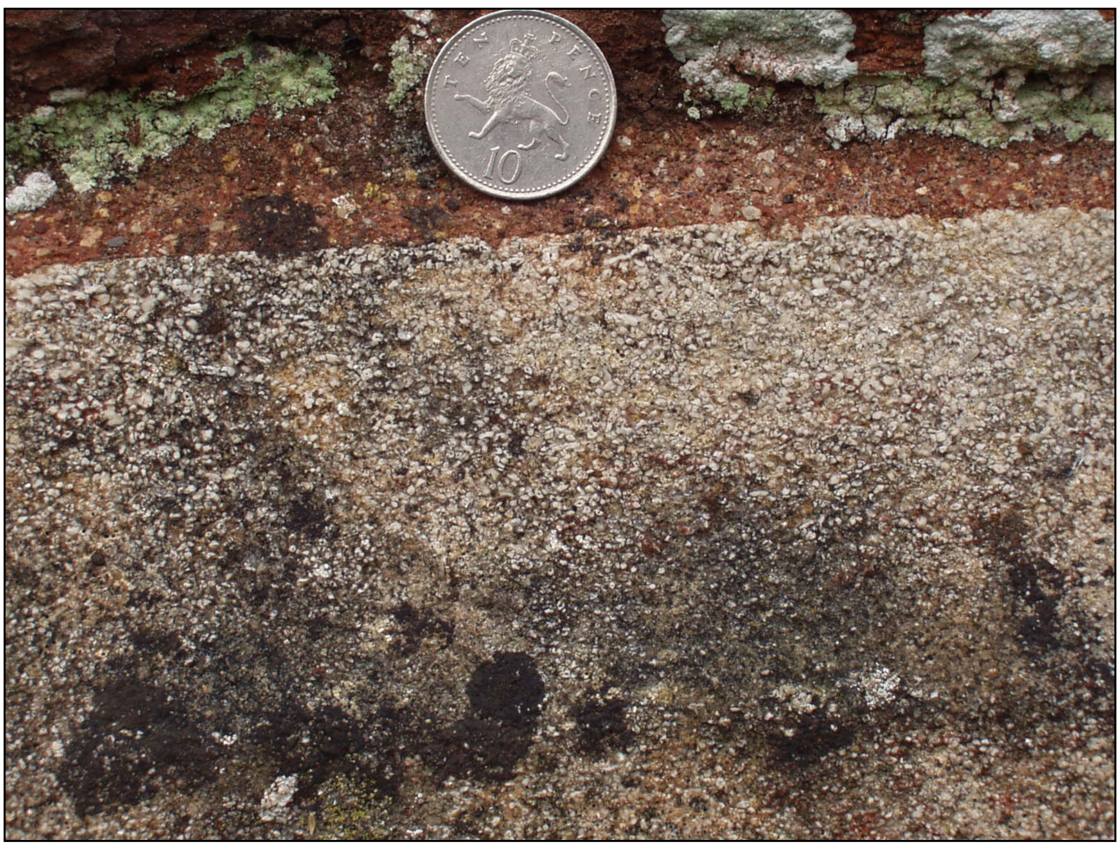

Figure 1. Detail of the Doulting Stone dressings of St Matthew's church, St Matthew's Road, Torquay.

Figure 2. Grey's Almshouses, East Street, Taunton. The window dressings are of Doulting Stone. The string course, plaque and shedding course above the footing are of Ham Hill Stone.

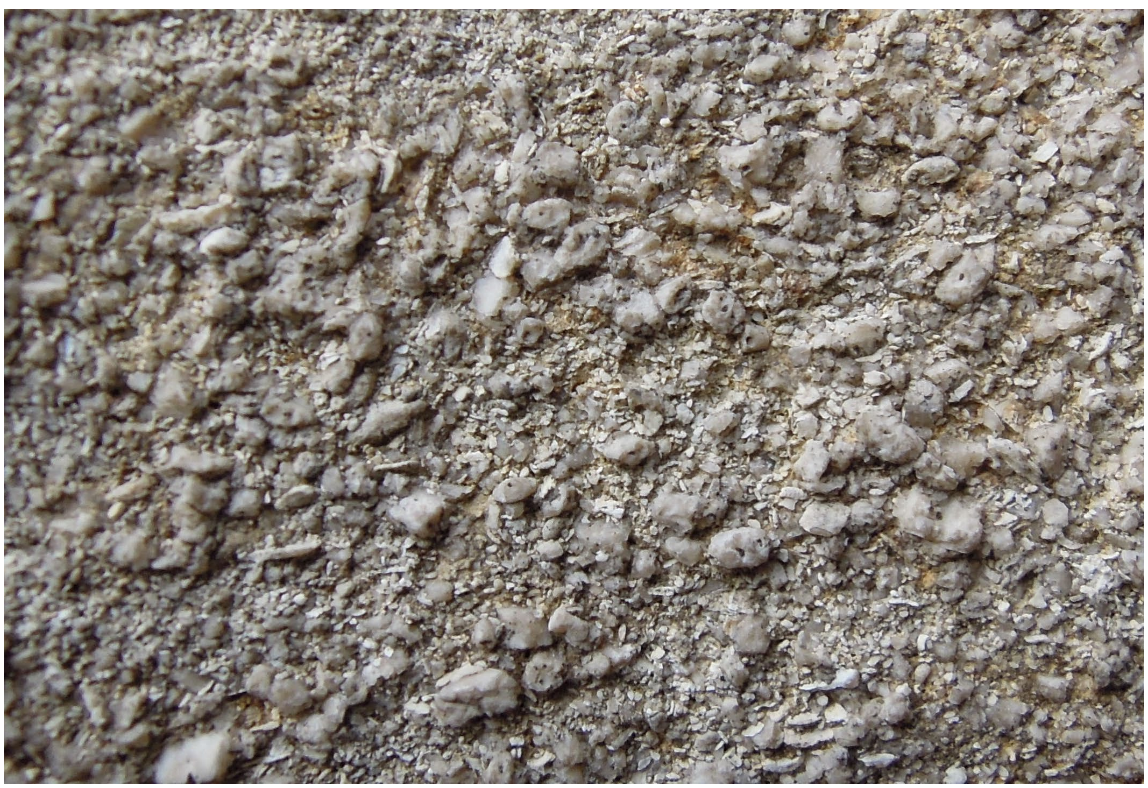

Figure 3. Dressings at the back of St Petroc's church Exeter. The larger fragments tend to have a square outline about 2mm across and may show a dimpled face. They are believed to be crinoid ossicles.

Figure 4. Torquay railway station. The paler of the two kinds of stone used for the dressings is Bath Stone; the darker and better preserved is Doulting Stone.

Figure 5. Former railway buildings, West Bay; all of Doulting Stone.

Figure 6. Methodist church, South Molton. The pale yellow dressings are of Doulting Stone. The darker yellow string courses towards the bottom of the façade are of Ham Hill Stone. The little pillars each side of the main doorway are of Devon Marble. The rest of the wall is of grey middle-Devonian limestone.

Figure 7. Tea by the Taw Restaurant, Barnstaple. The wall facing the river (left hand side of photo) is of artificial stone, the rest is finished in Doulting Stone.

Figure 8. West door, parish church, Langtree. The doorway dressings are of alternating Doulting Stone (pale) and Hatherleigh Stone (dark brown). The wall is otherwise made of very dark-stained sandstone believed to be from the Bude Formation.

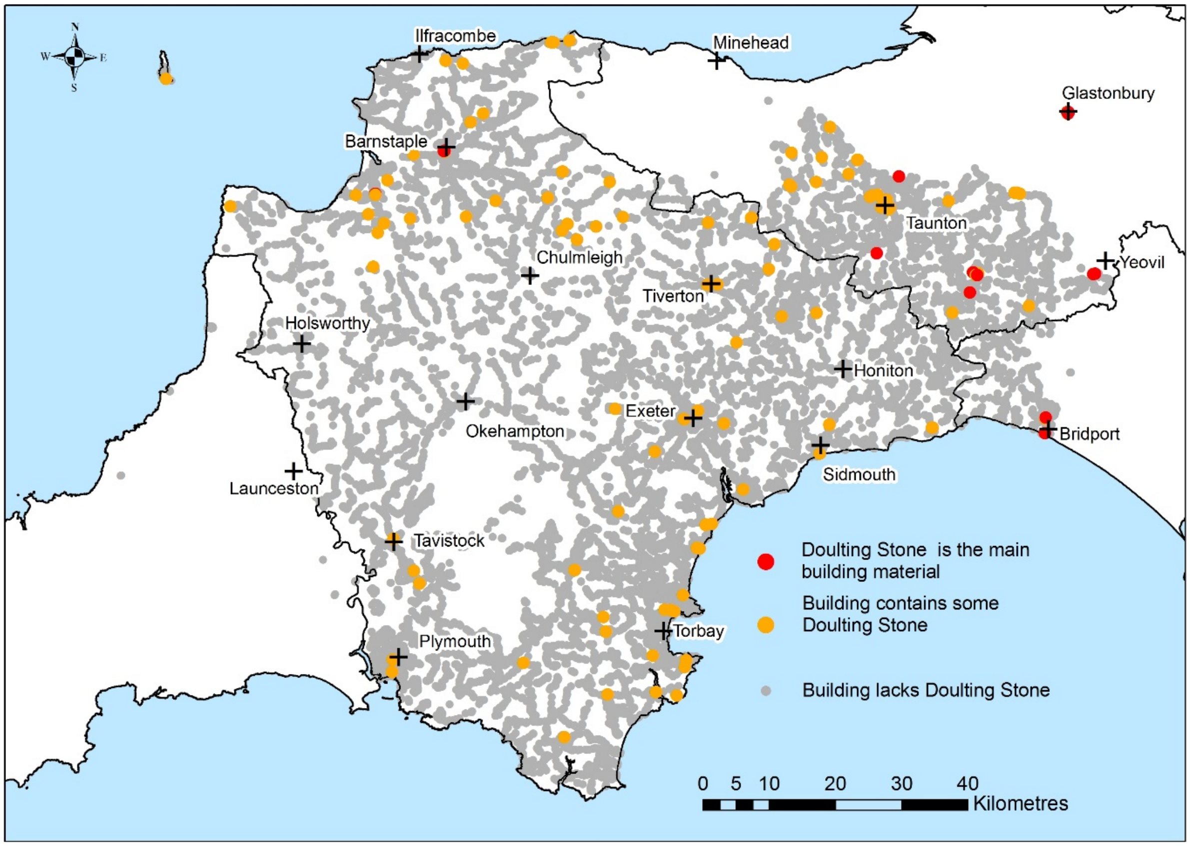

Figure 9. Distribution of buildings containing Doulting Stone.

52, Cream-coloured medium-grained Calcareous Sandstone (Upper Greensand Formation)

The sandstone is medium- to fine-grained, composed of subangular grains of calcite set in a fine-grained matrix. The rock weathers pale grey and on such weathered surfaces, the calcite clasts stand out from the matrix which is usually obscured by surface lichen and dirt. In this state it resembles other Upper Greensand sandstones and is closely comparable to Rock-type 13. However, Beer Stone that has not spalled but shows grey-weathered surfaces has the same appearance of calcite clasts standing proud of a grey-weathered surface. There is therefore some doubt in individual cases whether this is an Upper Greensand sandstone or a variety of Beer Stone. Rock of this kind used for the window mullions at Higher House, Branscombe is called Salcombe Stone in the listed building citation. Exactly similar rock used in the construction of Hole House, Branscombe is called Beer Stone in the citation. Some examples contain quartz and glauconite grains as well as calcite ones and these may be more confidently referred to the Upper Greensand.

In many cases, this rock-type occurs in association with Beer Stone, for example in several churches in the Newton Abbot area where Beer Stone is used for the dressings and this rock-type for the quoins. In these cases it is lithologically distinct from Beer Stone (Figures 1 and 2). Nevertheless, the association itself suggests that rock-type 52 has been imported along with the Beer Stone used for the dressings and might even come from the same quarry.

Further work is required to finally resolve the origin of this sandstone. During the survey, it was referred to the Upper Greensand Formation.

Figure 1. South aisle of St Michael's church, Kingsteignton. The eastern bays are composed of local red sandstone with a few pale grey blocks of calcarenite from the Upper Greensand (Rock-type 52). The window tracery is of Beer Stone.

Figure 2. Tower of St John's church, Plymtree. The quoins of the buttresses and relieving arch over the door are a mixture of Exeter Volcanic Series lava and pale grey calcarenite (Rock-type 52). The dressings of window and door are of Beer Stone. The rubble wall is a mixture, mainly of Bude Formation sandstone with some Exeter Volcanic Series lava.

54, Imported Red Sandstone

Red sandstone that differs in its detailed lithology from stone believed to have local sources is assigned Lithology Code 54. Most examples are of medium-grained sandstone, usually well cemented and typically lacking visible bedding or distinctive textures or structures. There are only 6 examples, mostly as a minor constituent of the dressings of prestige buildings or churches (Figures 1 and 2). In the case of the red sandstone used as cladding in the Princesshay development in Exeter, the stone is known to come from near Penrith and is called Plumpton Red Lazonby sandstone (Figure 3).

Figure 1. Decorative gatepost, east side of South Road, Taunton. Made of Bath Stone with short pillars of red sandstone.

Figure 2. The Guildhall, Plymouth. The wall is mainly of local mid-Devonian limestone with dressings of Portland Stone and granite and little pillars of red sandstone of unknown origin.

Figure 3. Fat Face, Roman Walk, Exeter.

55, Corrugated Iron and other Metal Building Materials

Buildings made of corrugated iron other than for the roof were recorded in the database only where they contained other building materials of interest or latterly, where they seemed of particular interest, for example because they are finished entirely in corrugated iron. The map (Figure 1) therefore greatly underestimates the distribution of corrugated iron buildings but approximates more closely to buildings that contain visible stonework as well as corrugated iron cladding. The code includes a few buildings with metal uprights and lintels and bridges over railway lines where the parapet is made of metal.

The great majority of the buildings recorded in the database are garages and outbuildings on farms (86 out of a total of 108). There are a few houses with walls of corrugated iron (Figure 2) but no churches. The distribution is quite even across the area of study (Figure 1). Many of the farm buildings are ramshackle (Figure 4) but a surprising number especially modern buildings that appear to be entirely made of corrugated iron are in good repair (Figures 3 and 5-10). As with wooden boards, corrugated iron is used in some buildings to fill the gap in the gable end between the top of the wall and the roof line and it is suspected that in some of these, corrugated iron is replacing original hipped or half-hipped roof lines covered with thatch (Figure 4).

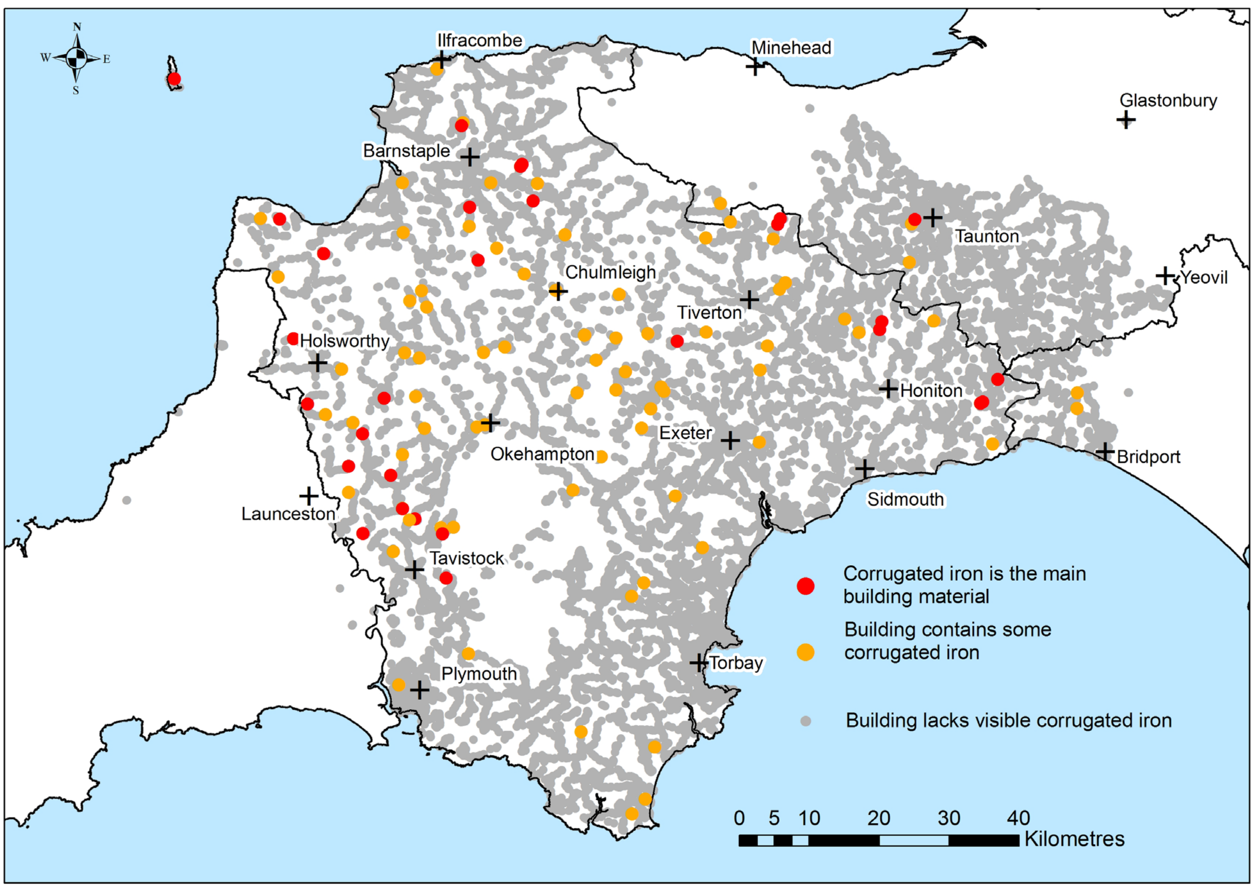

Figure 1. Distribution of buildings with corrugated iron walls.

Figure 2. Sunnyside, near Broadwoodwidger. House and outbuilding clad almost entirely in corrugated iron with matching roof.

Figure 3. Outbuilding, West Croft Farm, Halwill

Figure 4. Outbuilding, Allercombe Farm, Ashill. Corrugated iron cladding in the apex of the gable end. The building is otherwise composed of cob on a chert rubble footing with a tile roof. Unusually, parts of the gable end other than the footing are of stone. It is probable that the tiles replace original thatch and the gable end was probably originally half hipped.

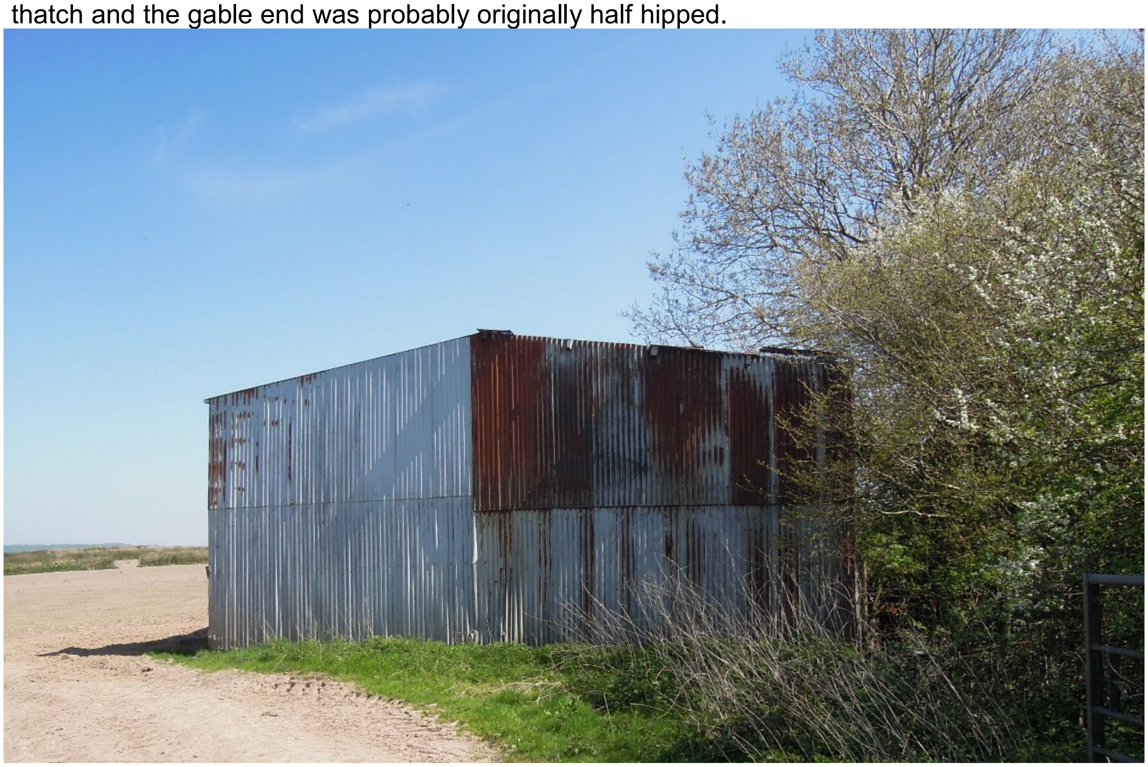

Figure 5. All-corrugated outbuilding of rudimentary design. Whiddon Lane, north of Marwood.

Figure 6. All-corrugated hut. Thorne Moor, 2.4km west of Broadwoodwidger

Figure 7. Brewery, north of Tetcott.

Figure 8. Village Hall, Milton Abbott. The hall was recently refurbished. The planning authority insisted that the hall should retain the corrugated iron finish.

Figure 9. Village Hall, North Brentor.

Figure 10. Village Hall, Harracott.

58, Westleigh Limestone (Carboniferous)

The limestones from the group of quarries around Westleigh are mainly grey, very fine- to medium-grained and strongly bedded. They range from dark grey to almost white in colour, but darker hues are typical and help to distinguish this group of rock-types from limestone from Torbay and Plymouth. Purplish staining is quite common and near the source quarries, grey Westleigh limestone in buildings is interbedded with brown and fawn varieties. Some blocks or parts of them are homogeneous and some are banded and laminated by grain size and colour. Bands and laminae can usually be traced for considerable distances and tend to be regular and persistent and lack much evidence of disruption by folding or shearing. However, some blocks contain coarse calcite veins and knots.

Some building blocks contain bands from 3 to 50mm thick of black chert (Figures 1-3 and 5). Like the bedding, the bands tend to be regular and persistent but in some cases, bands are broken up into layers of discontinuous chert nodules, much longer and wider than they are thick, but with rounded terminations in the bedding planes. Chert is not always present (Figure 6). In some cases, the rock also contains thin bands of quartzite with or without some shale. Both chert and quartzite have cross joints approximately perpendicular to the bedding.

Material Code 58 refers to the most widespread and abundant variety of Westleigh Limestone in buildings, with relatively homogeneous rock layers up to 60cm thick separated by thinner bands of black chert. In a few examples seen, the stone contains goniatites and thin-shelled bivalves. Variants given separate material codes include those with fine lamination defined by grain size, colour and composition (Code 139), more homogeneous coarse-grained limestone with a salt-and-pepper aspect caused by colour contrast between the clastic grains and the matrix carbonate (Code 104) and very dark grey limestone typically with a deep ochre weathered skin (Code 137).

Westleigh limestone is distinguished from limestone from Torbay and Plymouth by more prominent and delicately-defined bedding and lamination, general lack of deformation structures and textures and generally darker shade of grey pigmentation. The colours of the stone in buildings are more “muddy” than those of the mid-Devonian limestones used in the south. The presence of black chert bands is the surest way of differentiating between the two groups but chert is not always present and this limits its usefulness in identifying the source of the building stone. Limestone assigned Code 58 grades into other kinds of limestone from the Westleigh and Bampton Limestone Groups through an increase in the variability of the rock-types used. Near the source quarries, a combination of variable weathering along the bedding planes, especially along the contacts of limestone, chert, quartzite and shale and the practice of laying the stones with the bedding parallel to the facing of the walling, leads to a wide variety of colours in walls made of this rock-type and a rather pleasing effect. However, the better quality stone tends to be uniformly grey in colour.

Westleigh Limestone assigned Code 58 is distinguished from that assigned Code 139 by thicker homogeneous beds, fewer colour laminae and more plentiful chert bands.

Figure 1. St Mary's, Uffculme. Dark grey limestone with black chert bands.

Figure 2. Coping of roadside wall, Smithincote. Pale grey limestone with black chert bands.

Figure 3. Grey fine-grained limestone with black chert bands, outbuilding, Upcott, Somerset.

Figure 4. Ayshford Chapel with Ayshford House behind. Mainly Westleigh Limestone with some Exeter volcanics and breccia from Sampford Peverell. Beer Stone dressings around the windows are repaired with Doulting Stone.

Figure 5. Electricity substation, Ferry Road, Topsham, at junction with Follet Road. Note the black chert bands and the “muddy” colour of the stone which contrasts with the colour of limestone from Torbay and Plymouth.

Westleigh Limestone is the main building stone around the source quarries near Burlescombe on the Devon-Somerset border (Figure 7). It is also widely used in both Taunton and Exeter and in the towns and villages along the route of the railway, especially for Nineteenth Century buildings. St David’s station in Exeter, made mostly of Bath Stone, nevertheless has a footing of Westleigh limestone. The stone was also extensively used for the construction of the Grand Western Canal and much was transported along the canal to Tiverton for the burning of lime. Most of the quarries are now closed but Westleigh Quarry is still in operation, mainly for the production of aggregate. Buildings incorporating the laminated varieties of Westleigh Limestone (Code 139 - qv), appear to be concentrated in central Exeter. The reason for this is the subject of ongoing research.

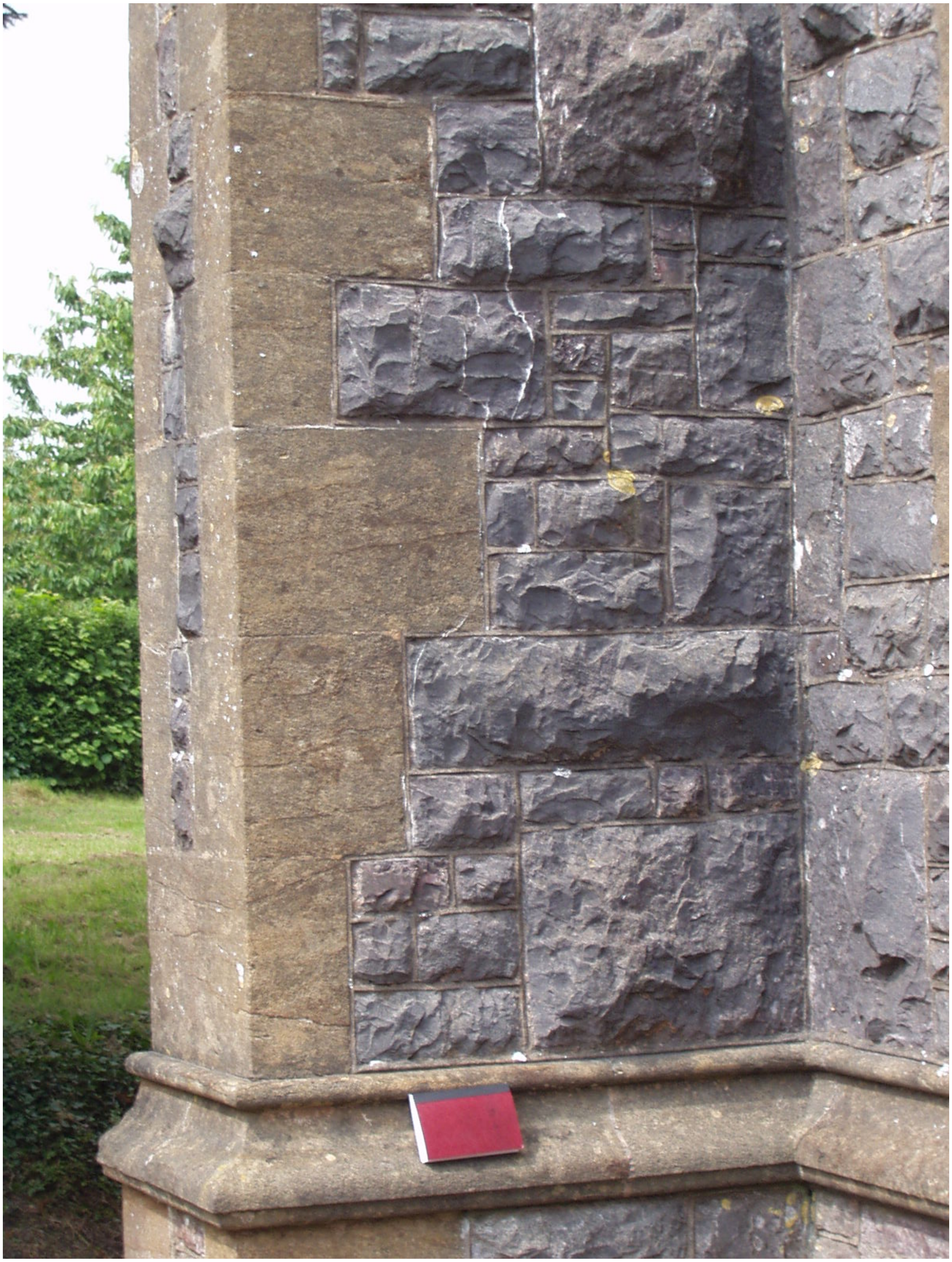

Figure 6. Tower of St John the Baptist' church, Ashbrittle. The dark grey Westleigh limestone lacks noticeable chert bands. The quoins are of Ham Hill Stone.

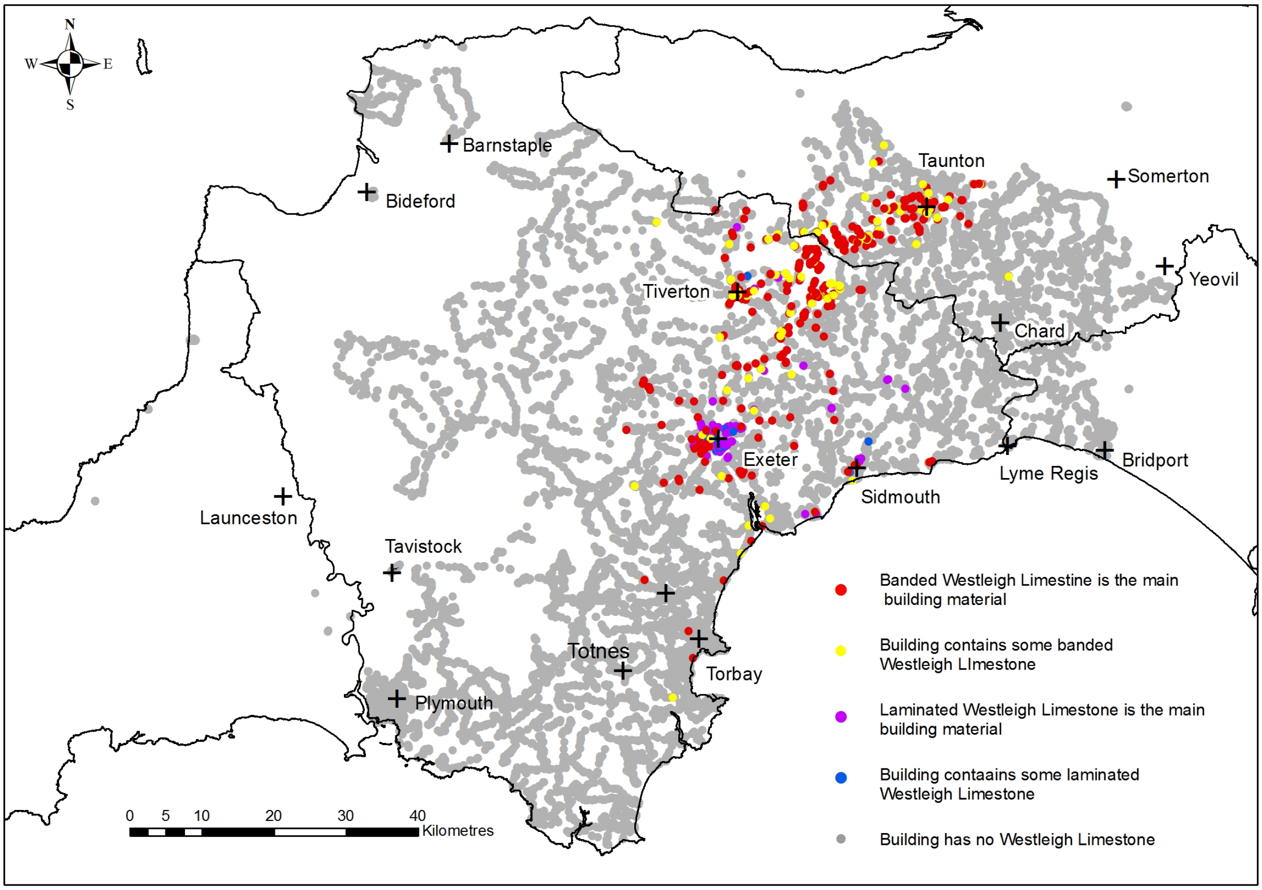

Figure 7. Distribution of Westleigh Limestone in buildings. Limestone coded 58 shown in red and yellow, that coded 139 in purple and blue.

59, Middle and Upper Devonian Slate

The code number 59 was originally applied to slate that had not been assigned to a particular horizon or formation up to December 2008. All examples have a strong slatey cleavage and many are so fine grained that individual grains cannot be resolved with the hand lens. Cleavage planes may be matt or shiny, reflecting the extent to which new sub-microscopic mica is developed. The cleavage may be penetrative or spaced with narrow layers rich in granular minerals – mainly quartz – separated by strongly cleaved zones rich in clay minerals and micas depending on whether the slate is pelitic or semi-pelitic. A few examples included under this code are less strongly cleaved and correspond more closely with mudstone. In many semi-pelitic examples the strongly cleaved parts sweep round lozenge-shaped aggregates richer in quartz defining a wavey and irregular kind of planar fabric. The majority of examples are rather homogeneous, fawn or grey-green in colour, usually with ochre-, orange- or brown-weathered cleavage partings and joints, but dark grey, black, blue-grey, reddish-weathered, turquoise and pale green examples are also included (Figures 1-8). Figure 9 is typical of many examples of the slate in buildings where the body colour is obscured by the grey surface weathering.

The quality of the stone is highly variable and slate of truly execrable quality has been used for the walls of lowly buildings (Figures 10-12); conversely, well dressed blocks about the size and shape of bricks are widely used for houses and churches (Figures 4 and 6) and coping stones of slate with large ones that extend the full depth of the parapet are a speciality of bridges in the South Hams (Figure 13).

The distribution of the stone in buildings suggests that it was won mainly from the Nordon and Tavy Formations but in truth, Code 59 is something of a sack term used for slate that cannot confidently be referred to any other group. It is a very important building stone towards the south of Devon (Figure 15) reflecting the lack of better stone on the outcrop of the Nordon, Tavy and age-equivalent slate formations. It is used alone or more commonly, associated in buildings with many other kinds of stone (Figures 10 and 14).

The original definition of the code included stone used for modern garden walls and the exterior finish of post-war houses. In these cases the stone is probably imported and may include Delabole slate although the latter is predominantly grey-blue rather than grey-green. A retrospective attempt was made in 2012 to reassign slate used for modern buildings and thought to be imported into the region to Code 191 but probably was not very successful. The intention was that Code 59 should thereafter be reserved for slate of local origin.

Slate coded 59 is a widespread constituent of older buildings and is the main building material south of a line from about Launceston to Teignmouth, excluding Dartmoor and the extreme south (Figure 15). In Teignbridge, the slate may be derived from the Kate Brook, Gurrington and equivalent slate formations. In Torbay, Dartington and Buckfastleigh slate is associated with impure grey limestone in many walls and may be derived from limestone-bearing horizons of the Nordon Formation or the Luxton Nodular Limestone Formation (Figure 10).

The main occurrences in the South Hams have been the subject of intense investigations in an attempt to derive a set of field characteristics that would permit consistent subdivision of the slates present. The criteria used and the supporting arguments are set out in the document “Coding of the slates again” attached as Appendix 1. The rules used for subdivision are as follows:

1. If not black or dark grey, and not Meadfoot or Dartmouth, code as 59, corresponding in age roughly to the Middle and Upper Devonian and parts of the Lower Carboniferous. The slate may have penetrative or spaced cleavage and is semi-pelitic to pelitic in composition.
2. If black or dark grey and associated in buildings with volcanic rocks, code as 59 as above.
3. If black and pelitic with very strong cleavage, code as 59. This criterion is based on a zone of such slate used for building through Bulkamore and along strike, the argument being that no one would go to the trouble of carting such indifferent building stone far from its source. To distinguish from the Ashton Shale (coded 171), an appeal has to be made to this argument and the relationship of the location of the building to the mapped Ashton Shale and Gurrington Slate and its correlatives.
4. Otherwise, if black or dark grey whether or not associated with sandstone, code as 177 probably corresponding to the Combe Mudstone and stratigraphically higher formations, especially if associated with banded chert.

These criteria beg the question whether it is easy or even possible to uniquely identify Meadfoot and Dartmouth slates. If the slate is associated with sandstone then it tends to be coded as Meadfoot Group (Staddon Grits). If it contains red slate, then it is coded as being derived from the Dartmouth Group.

In an area extending from Totnes through Ashprington to Cornworthy, Harberton and Harbertonford, the slate has a distinct fawn (grey-brown) hue though this may be masked by weathering (Figures 3 and 6). These slates have not been assigned a separate code but appear to be characteristic of the Ashprington Volcanic Formation and may owe their special features to admixtures of volcanic material.

Difficulty is also encountered in assigning slate building stone to the numerous formations containing slate mapped in the region northwest of Dartmoor. The principles adopted are set out in Appendix 2.

Figure 1. Wrangaton Road, Ugborough.

Figure 2. Crownhill Fort Road, Plymouth.

Figure 3. South porch of St Andrew's church, Harberton. Note the Beer Stone dressings and red sandstone (Code 144) in the wall and battlements.

Figure 4. Good quality brown slate as regular blocks. Tower of St Peter's church, Lewdon.

Figure 5. Pale grey-green slate weathered orange with some Hurdwick Stone and granite in the quoins. Callington Road, Tavistock.

Figure 6. Black-stained slate with red sandstone dressings round door, west end of St Peter’s, Cornworthy. Detail of the right buttress below shows the characteristic buff weathering.

Figure 7. Embankment outside Hazard Cottage, Tigley.

Figure 8. St Leonard’s church, Halwell. The tower is made of dark grey slate, the nave and south porch of medium grey slate, both referred to slate of Code 59.

Figure 9 a and b. General view and detail of wall made of Gurrington Slate between Woodland and Gurrington, the location of the quarry where Gurrington Slate is defined.

Figure 10. Red stained slate and medium-grey limestone, garden wall, Combe Fishacre, possibly from one of the limestone members of the Nordon Formation.

Figure 11. Grey indifferently cleaved slate, wall north side of Roborough Lane, Ashburton.

Figure 12. Wall beside the road from Berry Pomeroy village to Berry Pomeroy Castle.

Figure 13. Bickham Bridge, North Huish. The parapet is of grey slate with some slabs laid vertically extending the full depth of the parapet, not just the coping, a South Hams speciality.

Figure 14. Roadside wall with alternating courses of granite and dark slate. East side of Alma Road, Pennycomequick, Plymouth.

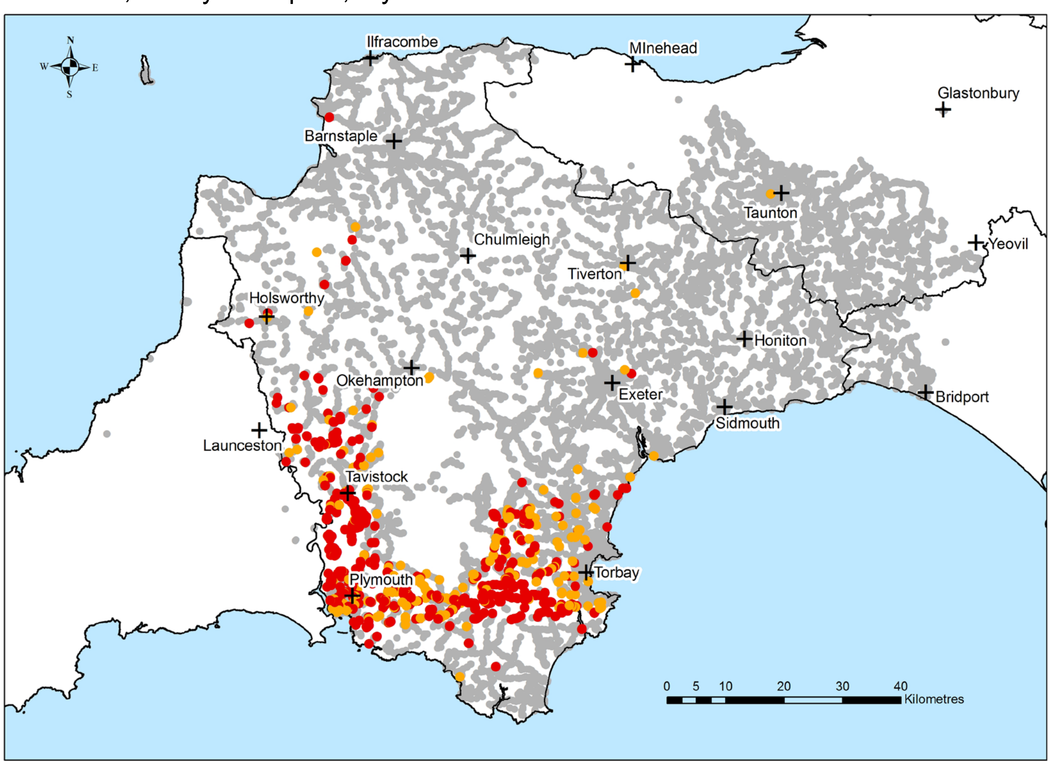

Figure 15. Distribution of Middle and Upper Devonian slate in buildings. Red symbols, the building is mainly made of this slate; orange symbols, building contains some of this slate; grey symbols, building lacks this kind of slate.

Appendix 1. Coding of the slates again

The following note describe the relationship of Material Codes to some of the slate formations of Devon.

Code 59. Middle Devonian to Lower Carboniferous (Tournaisian) slates including the Nordon, Kate Brook, Tavy, Jennycliff, Saltash, and Torpoint Slates up to the horizon where they become predominantly black or dark grey. The code includes parts of the Liddaton and South Brentor Formations. Some slates are dark grey or black but they are mixed with grey and green slates.

Code 177. Grey and black mudstone/slate including shale and slate at, above and below the Teign Chert horizon. The code includes Combe Shale, Dodddiscombe Beds, Dowhills Beds and the Lydford and Liddaton Formations.

Code 146. Teign Chert and its correlatives including splintery siliceous slate. The code includes parts of the Brendon Formation. Limestones in this unit are coded as Bampton Limestone Formation (Code 123).

Code 171. Black and grey slate from the Crackington Formation including the Ashton Shale member and parts of the Brendon Formation and Bealsmill Formation.

Code 152 Crackington and Bealsmill Formations. The code includes sandstone and slate from the St Mellion Formation since this is the facies equivalent of the Crackington though of slightly earlier age. However, I've seen the Bealsmill Formation (31-07-2015) and it doesn't look at all like the Crackington although it is dark grey and contains sandstone.

Code 161. All volcanics except hyaloclastites. The code Includes stone from the Ashprington and Milton Abbot Formations and stone of volcanic origin from the slate formations of south and west Devon.

Code 199. Hyaloclastites.

This scheme excludes the Slate with Lenticles. No stone from this formation has been identified in buildings. There is no corresponding Material Code. Sandstone and slate from the St Mellion Formation has been included with the Crackington Formation (Codes 152 and 171). It represents a flysch facies intercalated with the starved Newton-Chert- Brendon Formation sequence. It is not the exact age-equivalent of the Crackington Formation but is of the same facies and, from the limited number of occurrences seen during the survey, cannot easily be distinguished on lithological grounds.

Reference

Leveridge, B.E. and Hartley, A.J., 2006. The Variscan Orogeny: the development and deformation of Devonian/Carboniferous basins in SW England and South Wales. In *The Geology of England and Wales* 2nd Edition, (P.J.Brenchley and P.F.Rawson, Eds).

Appendix 2: North-west Dartmoor Fringes

The stratigraphy of this part of Devon is complex, caused by the conflation of complex thrusting and facies change from the Tavy Basin across the Laneast High to the Culm Basin (Isaacs *et al.* 1982, Issacs, 1983, Leveridge *et al.* 2006). The disposition of the various formations on the current BGS geological map is based to a significant extent on the work of Isaacs described in the above papers with a further important input concerning the age of the various formations based on the conodont stratigraphy (Stewart, 1981).

Table 1 sets out lithological characteristics of the formations described in Isaacs (1983) that might have been useful in identifying the unit from which a particular building stone was won. However, there are very few characteristics of value in this respect; black or dark grey slates and mudstones are common to nearly all the stratigraphic units as are intervals containing chert or cherty mudstone. Volcanic rocks are present in at least three units and carbonate rocks in four. The available descriptions in Isaacs (1983) and the BGS lexicon lack enough detail to allow confident assignment of a stone to a particular formation. The references in the lexicon are unhelpful in many cases and just refer to the BGS map sheet on which the formation was mapped, usually No. 338, Tavistock. In contrast to rock-types observed in outcrop, building stones lack the field relationships that assist the geologist in arriving at a consistent set of stratigraphic units, and so it has not been possible to identify with any certainty the source formations from which building stone was drawn in this region.

For these reasons, the threefold division of building-stone types that have served reasonably well further east is mainly retained here rather than attempting a more detailed correlation with likely source formations. The scheme largely ignores the thrust systematics in the naming of formations and plays down the influence of depositional environment, concentrating instead on lithology as follows:

Youngest – flyssh. Crackington, Bealsmill, St Mellion Formations and Meldon Shale and Quartzite (part). Building stones thought to come from these formations are coded 152 (sandstone) or 171 (slate);

Middling – black slate interval. Newton and Teign Chert, Meldon Chert, Brendon Formation, Crackington, Lyford, Liddaton and Whitelady Formations, Burraton and Yealmbridge Formations. These are coded as 171 if likely to be part of the Crackington Formation, 146 if cherty or strongly laminated, 177 if poorly cleaved and called mudstone rather than slate in the database descriptions and 128 if black slate not cherty or laminated. Brown and pale grey lustrous slates seen in Lewtrenchard on the outcrop of the Teign Chert are tentatively assigned to the Yealmbridge Formation and do not fit in this scheme; they are coded 193. This merely reflects lithological similarity with pale brown lustrous slate with this code used for building close to Start Point in the South Hams and in no way implies any stratigraphic correspondence.

Oldest. Tavy Formation and those slates mapped as Middle and Upper Devonian slates. Coded as 59.

	Slate	Sandstone	Chert	Volcanics	Carbonate	Age from BGS Lexicon
Liddaton Formation	Dark grey, phyllitic, banded grey; greenish grey slate with siltstone and sandstone laminae	<10cm. With some thicker beds, graded, load casts, ripple drift cross bedding	Black slate , siliceous nodules			Famennian
Whitelady Formation	Pale, greenish, calcareous	Thin quartzite			Dolomitic, siliceous, well bedded, nodular; anastomosing clay lamellae	Famennian
South Brentor Formation	Black, micaceous, pale greenish	Siltstone <30cm			Nodular	Famennian-Tournaisian. Passes up into the Lydford Fm.
Lydford Formation	Black	Thin siltstone and fine-grained sandstone beds	Bedded chert as lenses intercalated with volcanics	Thin tuff; pillow lavas		Tournaisian- Visean
Greystone Formation (=Brendon Fm.)	Black siliceoius slates with chert; sooty black shale	Conglomerate	Black siliceous slates with chert. No chert in BGS description	Tuff, pillow lava; manganiferous; plentiful		Tournainsian
Fire Beacon Chert Formation (= Codden Hill Chert Formation)	Thin; black slate and mudstone		Chert		Limestone beds	Brigantian (Visean)
Meldon Shale and Quartzite Formation	Black slates and mudstones	Thin, clean-washed	Chert lenses		Limestone lenses	Tournaisian-Visean. Immediately underlies Codden Hill Cherts
Lowerton Limestone Formation	Grey, calcareous. Black				Limestone turbidites	Not in BGS lexicon
Brendon Formation	Black, dark grey	Thin. Includes greywacke	Mudstone locally siliceous			Visean
Cotehele Formation (St. Mellion Fm.)	Subordinate shale	Preponderant sandstone				Not in BGS lexicon (Tournaisean-Arnsbergian
Crackington Formation	Black and bluish-grey, sandy micaceous shales	<4m but typically much thinner; sedimentary structures				Arnsbergian- Langsettian (lowermost Westphalian)
Milton Abbot Formation				Agglomerate, tuff, pillow lavas (basic)		Visean
Bealsmill Formation (age equivalent of the Ashton Shale member of the Crackington Fm.)	Dark grey mudstone	Preponderant; coarse-grained, feldspathic; some conglomerate				Namurian

Table 1. Lithology of formations from Isaac, 1983.

The difference between slate coded 59 and the overlying units here as further east, is the coming in of significant intervals of black slate. It is accepted that the difference is not all stratigraphic and there is some interdigitation of green/grey and dark grey/black slate and anyway, it is not always easy to tell the colour of stone when it is in a building. Note also that slate coded 171 falls in both middling and upper subdivisions. If a building in this region also contains sandstone, then the sandstone will be mapped as Code 152 unless there is overwhelming other evidence that it should not be.

In reality of course, further confusion is caused by stone imported from far away.

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60, Portland Stone (undifferentiated)

Portland Stone is a hard, white or cream-coloured oolitic limestone widely but sparsely used in Devon and nearby parts of surrounding counties included in the survey, for dressings and less commonly for complete buildings, usually prestigious ones. Portland Stone is also used, although sparsely, to repair the dressings of buildings where the original local stone is no longer available. Of the three imported Jurassic building stones of importance in the south-west, its dispersal is intermediate between Bath Stone, the most widely used, and Doulting Stone. Of the 199 buildings incorporating Portland Stone, 59 are churches and 72 incorporate Portland Stone only in the dressings round windows or doors.

The rock-type is distinctive under the hand lens. It is composed of ooliths of white carbonate usually less than 1mm in diameter, sutured together and without obvious cement (Figures 5 and 6). In some examples, the oolitic structure is not obvious and the rock resembles a grainstone but careful searching usually reveals some oolitic parts.

The oolitic structure is characteristic. The stone is distinguished from Bath Stone by finer grain size, paler pigmentation, the lack of cement between the ooliths so that the rocks breaks around the ooliths rather than through them, and from Beer Stone by its much harder nature and oolitic structure. Several varieties of Portland Stone are distinguished by masons and quarrymen depending on the horizon from which they are derived (Base bed, Whit bed etc.). It has so far been possible to differentiate only the Portland Roach (qv) during this study.

Like Bath and Doulting Stone, Portland Stone is widely but comparatively sparsely used throughout the area of study, mainly for the dressings of prestige buildings in the towns (Figure 10). With the eye of faith, it appears to be slightly more widely used on the south coast, perhaps because these are the areas most accessible by boat from the source quarries on the Isle of Portland. It was widely used for the rebuilding of the centres of Exeter and Plymouth after the war (Figures 2 and 8).

Figure 1. The Orangery, Bicton Park, of Portland Stone ashlar.

Figure 2. Lloyd’s Bank, High Street, Exeter. Brick with dressings of Portland Stone.

Figure 3. 74 Queen Street, Exeter. Photo © Mr Terence Harper.

Figure 4. 14-32 Berry Head Road, Brixham. Photo © Mr Dennis Coote CPAGB APAGB. Built originally for the coastguard. The listed building citation says they are of local limestone but in fact they are of Portland Stone.

Figure 5. Lloyds Bank, High Street Exeter. The small free-standing ooliths are about 0.5mm across. They are mixed with larger shell fragments.

Figure 6. Entrance to Market Hall, Fore Street, Kingsbridge. Free-standing ooliths and shell fragments with voids between. Ooliths are about 0.3mm across.

Figure 7. Trustees Savings Bank, Tavistock. The building is mainly of Hurdwick Stone but with dressings of Portland Stone for the pillars on the ground floor and of Doulting Stone (yellowish) for the dressings on the upper floors.

Figure 8. Pearl Assurance House, New George Street, Plymouth. Portland Stone cladding.

Figure 9. Saltram House, Plymouth. The south façade is finished in stucco on a footing of granite. The dressings of the portico are of Portland Stone.

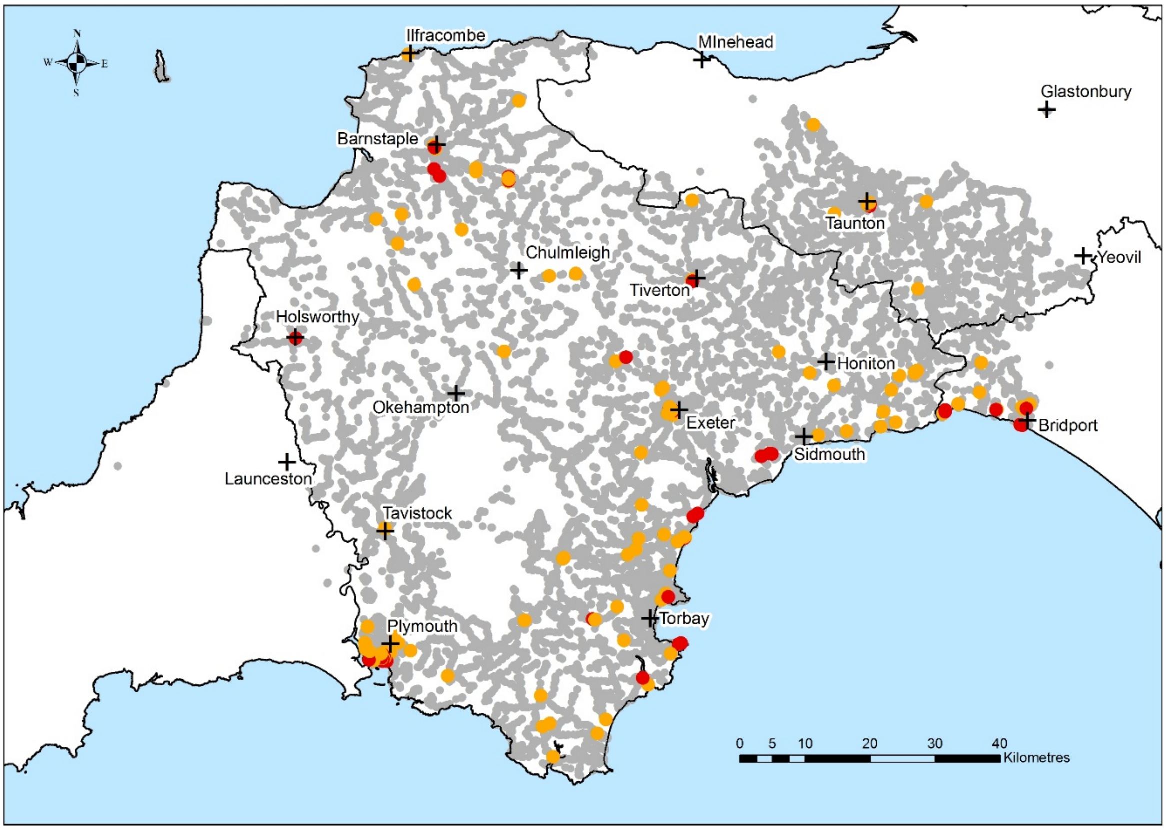

Figure 10. Distribution of buildings containing Portland Stone. Red symbols, Portland is the main building Stone; orange symbols, Portland is a subsidiary building stone; grey symbols, building lacks visible Portland Stone.

63 and 68, Lias Siltstone

Micaceous siltstone and fine-grained sandstone are incorporated in a small number of buildings in a zone extending along the coast from Charmouth to Bridport and near Ilminster and the surrounding villages of Puckington, Whitelackington, Kingstone, Alowenshay, Dinnington, Dowlish Wake and Moolham, where they are associated with Moolham Stone (Beacon Limestone Formation: Codes 22, 66 and 99 – qv – Figure 7). Most examples are believed to come from the Dyrham Formation but at least some examples from West Bay and Bridport come from doggers in the Bridport Sands. The preponderance of rounded cobbles in the buildings along the coast indicate that the stone was collected from the beach (Figures 2, 3 and 5), a practice confirmed by the recollections of older workers in the local communities.

The small number of occurrences in Charmouth are of dark grey marly or muddy siltstone, very soft and friable, associated with Blue Lias limestone and Upper Greensand chert (Figure 1). Most of the stones seen are well-rounded and there is little doubt that the walling material comes from the beach.

Yellow, fawn, brown and liver-coloured fine-grained sandstone and siltstone are associated in buildings incorporating Junction Bed limestone in the Ilminster area and with both Junction Bed and Inferior Oolite limestone in the Chideock-Symondsbury-Bridport area and in St Mary's church at Pilsdon. The liver-coloured weathered colour is very distinctive; when fresh, the rock is grey. It is poorly cemented and tends to scale in a way resembling Blue Lias limestone. In many cases it shows good bedding and may be micaceous. Very many of the examples of this rock-type used in buildings near the coast are of rounded cobbles and boulders (see Figures 2, 3 and 5). In some cases the boulders are used as is; in others they have been split across so as to provide a flat surface to lie parallel to the plane of the completed wall. In Symondsbury, the local tradition is that the boulders were collected from the beach at Eype. The distribution of the rock-type in buildings strongly suggests that it was also collected from the beach at Seatown and indeed sandstone and siltstone cobbles and boulders are common on both beaches. Somewhat similar rounded cobbles of siltstone and sandstone are used in West Bay and Bridport but here they are joined by roughly squared stone that matches exactly that exposed in the cliff between West Bay and Burton Bradstock (Figure 4) and is therefore referred to the Bridport Sand Formation.

Figure 1. Rounded cobble of grey marly siltstone (centre) along with Blue Lias limestone, and Upper Greensand chert and sandstone. Wall in Devonedge Lane, Charmouth.

Figure 2. Rounded boulders of grey siltstone associated with yellow Inferior Oolite limestone. Outbuilding adjacent to Mill House, Sea Town.

Figure 3. Outbuilding, North Chideock.

Figure 4. Wall behind the beach, West Bay. Yellow sandstone that can be matched with the sandstone forming the adjacent cliff.

Figure 5. West Bay Beer Garden. A former outbuilding now used for drinking.

Figure 6. Wall adjacent to PAWS Pet Shop, Ilminster, composed mainly of ochre limestone from the Junction Bed with a few blocks of grey Lias siltstone.

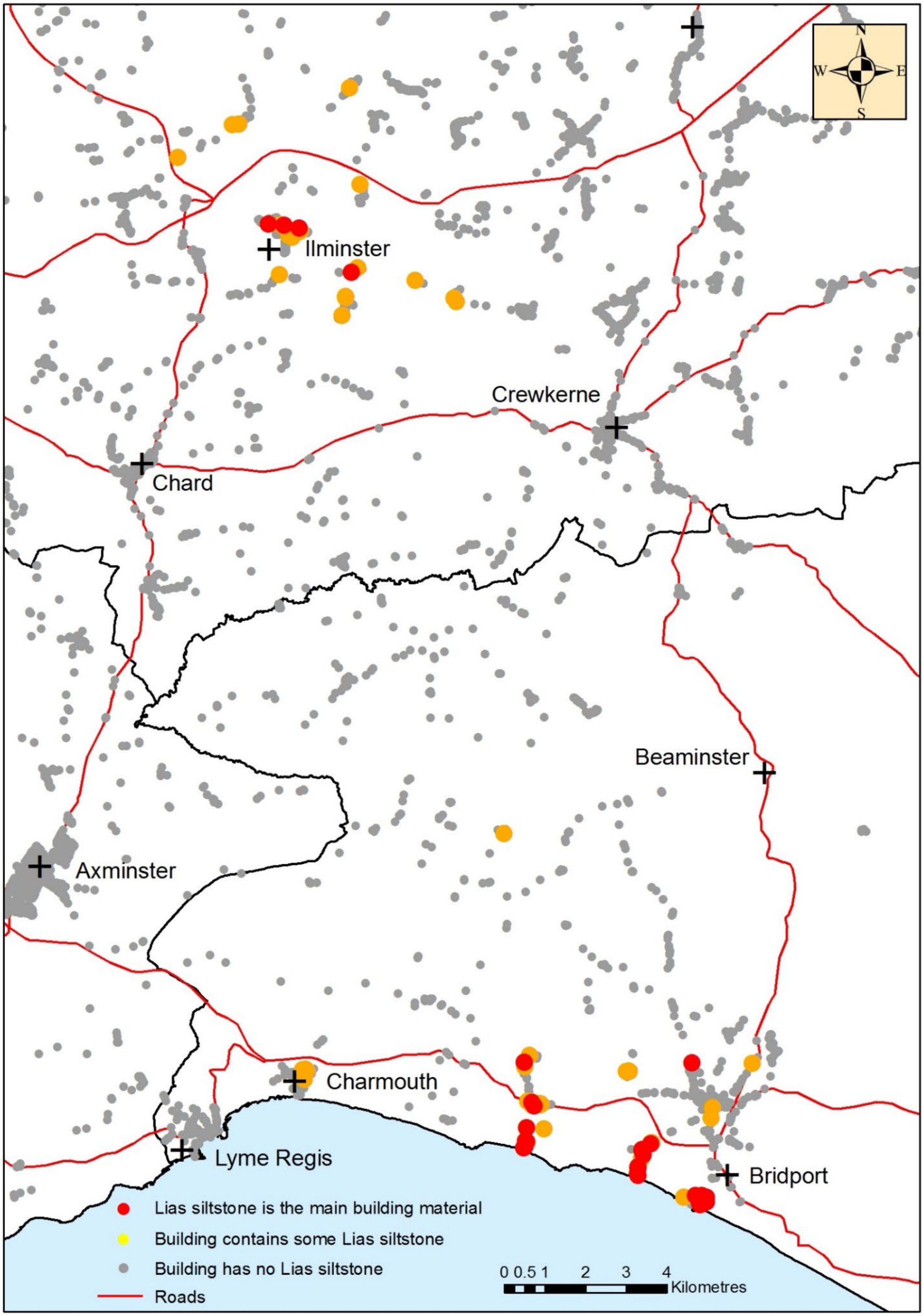

Figure 7. Distribution of Lias siltstone in South Somerset and Dorset.

Code: 64, Pale Grey Limestone (Forest Marble)

This is a tough, durable limestone with a hackly fracture evident when used as coping stone. It usually occurs as regular blocks (Figure 1), composed of fine- to medium-grained granular calcite with, in some blocks, many small bivalves lying in and defining the bedding and visible on surfaces cut across the bedding. Where bedding surfaces are laid parallel to the wall, the bedding planes can be seen to be crowded with fossil shells which are rather smooth, equidimensional and 5-10mm across. Blocks tend to be rather small and both creamy and grey stone may be incorporated in the same building (Figure 2). Some blocks are blue hearted.

The colour of the limestone is pale fawn (Figure 3), grey, pale grey or almost white but it is often obscured by weathering or traffic dirt and some blocks are darker grey (Figure 2). The stone is widely used for roadside walls but its distribution may have been underestimated because its origin was unknown until comparatively late in the survey, with a consequent reluctance to include buildings using it in the observations. Eventually rock-types intermediate with Forest Marble coded 19 were encountered and it became clear that Stone 64 was a variant of Forest Marble (Figure 4). It likely comes from the quarry of Stallbridge Quarries Ltd. at Templecombe since the stone can be matched exactly with photographs on the company's website. Many of the buildings in which it occurs are modern and it may be that this stone has filled the gap left by the closing down of more local sources of Forest Marble. One building in Bridport has its ground floor finished in the local Forest Marble stone but the first floor finished using this imported Forest Marble (Figure 5).

The stone is quite widely scattered across the eastern half of the area of study with a main concentration in Bridport and smaller concentrations in Taunton and Yeovil (Figure 6). Most of the buildings where it occurs are quite new, suggesting that its use is a relatively recent phenomenon. Roadside walls predominate over other kinds of building incorporating the stone.

Figure 1. New wall, Pymore, Bridport.

Figure 2. Toilet block behind The Salthouse, West Bay, Bridport.

Figure 3. Pale yellow stone. Roadside wall, Sea Road South, Bridport.

Figure 4. Thin blocks of limestone, some blue-hearted, providing a link with stone coded 19, Forest Marble. Wall on north side of road to Sockery, South Perrot.

Figure 5. Stevenson Court, 61 East Street, Bridport. The ground floor is finished in locally won Forest Marble, the first floor in imported stone of Code 64. The building on the right is finished in Ham Hill Stone.

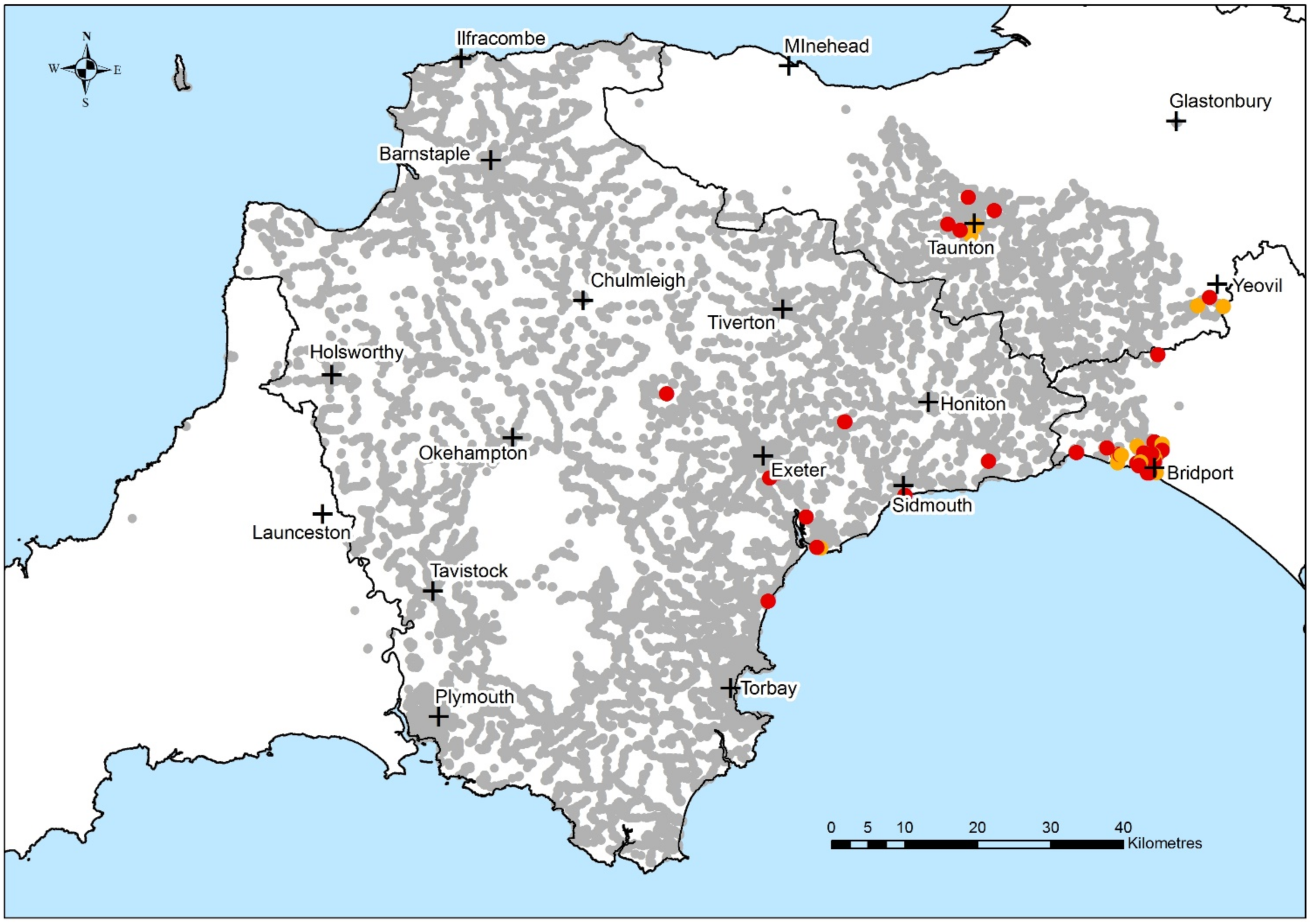

Figure 6. Distribution of Forest Marble (Code 64) in buildings. Red symbols, Forest Marble is the main building stone; orange symbols, Forest Marble is a subsidiary building stone; grey symbols, building lacks Forest Marble.

65, Whalebone

This is not a common building material in the area; indeed, only one example has been seen, used for the gateway at one entrance to Chideock Manor (Figure 1). The whalebone is reported to have been collected from Eype beach in the Nineteenth Century.

Figure 1. Whalebone gateway, Chideock Manor, Chideock.

66 and 99, Marlstone Rock Bed member of the Beacon Limestone Formation (Moolham Stone)

The lower part of the Beacon Limestone Formation, formerly called the Marlstone Rock Bed, is an inhomogeneous rubbly iron-shot limestone. It is predominantly ochre, brown, orange and yellow in colour but the cores of some blocks are grey and the exterior appearance in many cases is also grey on account of the widespread development of grey lichen on the surface of the building blocks. The rock has a well developed conglomeratic or nodular structure; the clasts or nodules are typically 2-5cm across, somewhat rounded, lacking re-entrant angles, composed of small thin shell fragments lacking any common orientation and arranged higgledy-piggledy with interstitial ochre powdery micrite and clay. Some parts, especially those that have a grey pigment are more strongly cemented by sparite. The clasts or nodules are set in a darker matrix of similar material which is in many cases partly sandy and the limestone has parts that are more properly described as calcareous sandstone. The rock is typically very rich in fossils; belemnites are particularly well represented but thick-shelled oysters and scallops are also prominent (Figure 1). The building blocks are typically rather large, up to 1m thick (Figures 4 and 6). The rock lacks an oriented fabric but the bedding is usually visible through variations in composition and texture across the bedding planes (Figures 2-4).

From about Whitelackington eastwards, the rock is oolitic and was given the Material Code 99 to distinguish it from the stone coded 66 used further west. The oolites are typically rather sparsely distributed and even within one block may be present in some parts and absent in others. The oolites tend to be ellipsoidal rather than spherical and in some cases resemble pellets. They are filled with a greenish iron mineral but on most surfaces the cores of the oolites have fallen out leaving pinhole voids in the rock.

The Marlstone Rock Bed is used for building in a well-defined zone extending from Broadway and Horton in the west to Yeovil in the east (Figure 9). it is the main building stone of Ilminster, Shepton Beauchamp and South Petherton and is widely used at Barrington Court (Figure 5), although nor for the main house. The upper part of the Beacon Limestone (Code 22 - qv) is not used here, being confined to buildings at the coast near Sea Town and Symondsbury.

The Marlstone Rock Bed is similar in many respects to the Inferior Oolite limestone and difficulty in telling the two groups of rock-types apart has been experienced in the region of Whitelackington and the Seavingtons. However, it can be distinguished from the Inferior Oolite by much more abundant large fossils, especially belemnites, fewer oolites in lithologies of comparable iron content, expressed by their colour, and by an open matrix framework composed of randomly orientated shards of small shell fragments as opposed to the more compact matrix of the Inferior Oolite limestones. The marlstone also lacks the larger single crystals of cream-coloured calcite, believed to be crinoid ossicles so typical of paler varieties of the Inferior Oolite limestone; it also usually contains some quartz sand, which is seldom observed in the Inferior Oolite. It has been confused with Ham Hill Stone, most notably by the architects responsible for the listed building citations in South Somerset, but with considerable justification (Figure 7). A common practice in older buildings in South Somerset is for the wall fronting on the main road to be of Ham Hill Stone ashlar while the less visible side walls are made of more humble material, Moolham Stone in many cases (Figure 8).

The stone is sometimes called Moolham or Petherton Stone, from the villages where it was formerly quarried and used for building (Moolham is mispelled Marlham in Howe, 2001, p202 perhaps by conflation with Marlstone).

The main zone where buildings incorporate the lower part of the Beacon Limestone extends from Chard and the villages to the north towards Yeovil. The occurrences on the coast at Sea Town and Symondsbury are of the upper part of the formation coded 22.

Reference

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Figure 1. Wall adjacent to PAWS pet shop, Ilminster.

Figure 2. Hill Farm, Shepton Beauchamp.

Figure 3. Hill View Terrace, Ilminster. This is a design of a local C19 builder. Exactly similar terrace houses using the same stone are seen in Chard.

Figure 4. Byways and Nestledown, Dowlish Wake.

Figure 5. Walled garden, Barrington Court.

Figure 6. The Grange, Broadway Road, Broadway.

Figure 7. Church of St Mary Magdalene, Cricket Malherbie. The quoins and dressings are of Ham Hill Stone and the walling of Moolham Stone but these are indistinguishable from a distance.

Figure 8. 8 Station Road, Ilminster. The front wall is of Ham Hill Stone ashlar. The side wall is of Moolham Stone rubble.

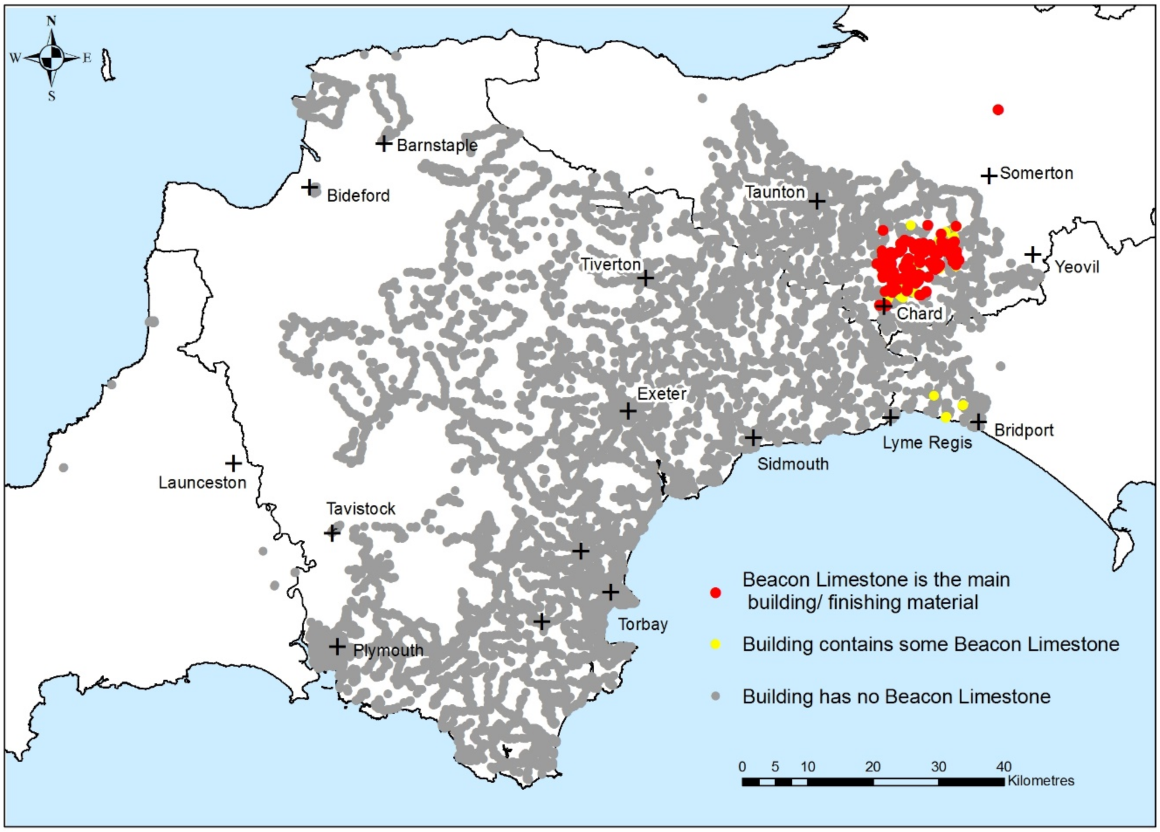

Figure 9. Distribution of the Marlstone Rock Bed (Beacon Limestone Formation) in buildings.

72, Pale Grey Limestone (Middle Devonian)

This rock-type is a pale grey, hard, crystalline limestone in some cases bedded or foliated (Figure 8), in others massive and homogeneous on the scale of the building block (Figures 1, 4 and 6). It exhibits a range of textural characteristics. Many examples are fine grained and structureless (Figure 4); these are believed to be bafflestones, formed by the capture of lime mud by bottom-living Devonian organisms including stromatoporoids. However, a proportion are medium-grained grainstones composed of close packed calcite clasts no doubt mainly of organic origin, sutured together by matrix calcite; in some cases, fossils and fossil fragments can be identified (Figure 7) but they are less easily identified here than in the medium-grey limestone (Material Code 140, qv).

The rock is mainly composed of calcite but many examples also have minor admixtures of silicate minerals and some are dolomitic (Figure 4). The rock is predominantly pale grey or pale buff and in a few cases is almost white. The blocks may be stained red, ochre, orange, purple or brown and some have pink pigmentation (Figures 5 and 9). A few blocks have inclusions of red sandstone and some also have coatings of orange-stained dripstone, indicating extraction of limestone exposed to meteoric water in the ground. Crude bedding or cleavage defined by spaced fractures is present in some examples (Figure 8) as is a tectonically induced penetrative foliation defined by the long axes of calcite crystals and deformed fossils and/or trains and lenses of impurities. Some blocks have veins and knots of recrystallised white calcite, but these are less prominent than in medium-grey limestone.

The rock-type is distinguished from other middle-Devonian limestones from Torbay and Plymouth and from undifferentiated grey limestone (Codes 28 and 31) only by its paler grey pigmentation. It has to be admitted that the distinction between pale- and medium-grey limestone is somewhat subjective, and the boundary will no doubt have been drawn at different degrees of "paleness" on different days. It is distinguished from Westleigh limestone by paler colour, lack of chert bands, less well defined and less regular bedding and stronger shearing and more extensive veining. It is distinguished from other grey limestone likely to be encountered in the south-west by induration through recrystallisation of some of the matrix calcite leading to limestone much harder and tougher than that from the Jurassic and younger eras.

Pale grey limestone from Torbay, Plymouth and adjacent areas is one of the main building stones of the Chudleigh-Torbay area and also of the coastal towns of Teignbridge and East Devon as far east as Sidmouth. It was widely used during the 19th century development of the towns in these areas and also of Exeter where however, it had to compete not only with local stone but also with Westleigh Limestone brought by rail from the Devon-Somerset border. It has not been possibly to assign the source of the rock-type to a particular quarry; it appears to have been won from several or indeed many of the quarries of the Teignbridge-Torbay-Plymouth area. Its distribution in buildings is concentrated more in the coastal areas compared to medium-grey limestone (Code 140) and it has been selected in preference to the medium-grey for export to Exeter, the Exe estuary and East Devon, suggesting that this stone comes from the coastal quarries where the cost of transport (by sea) would have been reduced. A distinctive pale grey to pale buff fine-grained limestone use in buildings in Combe Pafford suggests a local source in Lummaton Quarry. Strongly foliated pale grey limestone is characteristic of the Brixham area and no doubt was won from the Breakwater, Gasworks and Berry Head Quarries. In the Teignmouth area, rounded cobbles and boulders of the limestone, a minor constituent of some walls, are probably derived from the Teignmouth Breccia.

Figure 10 illustrates the distribution of this kind of limestone in buildings. It broadly follows the outcrop of its source formations but compared to the darker grey variety (Code 140) is concentrated near the coast and extends up the Exe estuary to Exeter. During the C19 building boom in these coastal towns, stone both for the speculative building of houses and for public works including street furniture was transported by sea from the coastal quarries of Torbay to the Exe estuary towns and Exeter itself.

Figure 1. Lloyds Bank, Exmouth. Pale grey limestone rests on a plinth of Dartmoor granite. The dressings are mainly of Bath Stone but include some granite with window jambs of Pocombe Stone.

Figure 2. Woodlands, Globefields, Topsham. Pale grey limestone with some blocks of granite and dolerite below and brick above. This is the typical appearance of pale grey mid-Devonian limestone from Torbay and Plymouth.

Figure 3. The Bike Shop, The Quay, Exeter. Pale grey limestone over Pocombe Stone footing with Pocombe Stone and red sandstone quoins and dressings.

Figure 4. Emanuel parish church, Okehampton Road, Exeter. Fine-grained pale-grey limestone composed of calcite with streaks of fawn dolomite.

Figure 5. New wall of pale grey limestone with pink cast, probably reused. Rydon Road, Kingsteignton.

Figure 6. Pale grey limestone rubble with brick dressings, junction of The Avenue and St John's Street, Newton Abbot.

Figure 7. Block of coarse-grained pale-grey limestone composed mainly of coral fragments, garden wall, Westhill Road, Torquay.

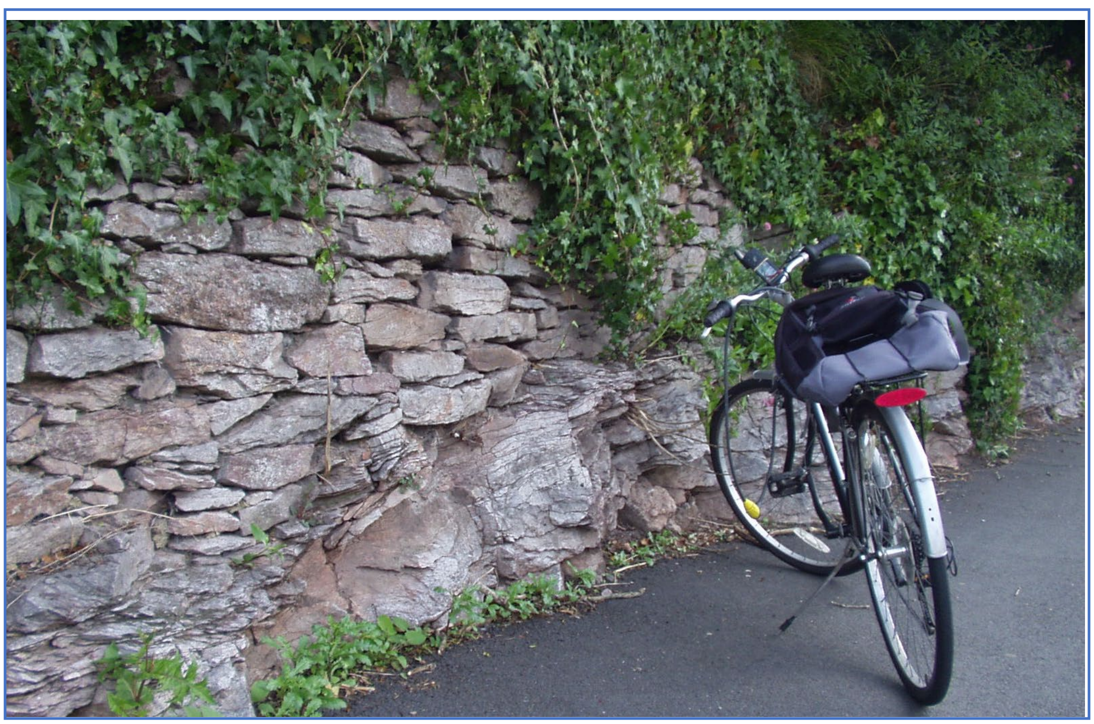

Figure 8. Babbacombe Road, Torquay. The crudely bedded limestone used in the embankment is lithologically indistinguishable from the outcrop beneath.

Figure 9. Pale grey limestone with pink cast and medium grey limestone, sea wall, Meadfoot Sea Road, Torquay.

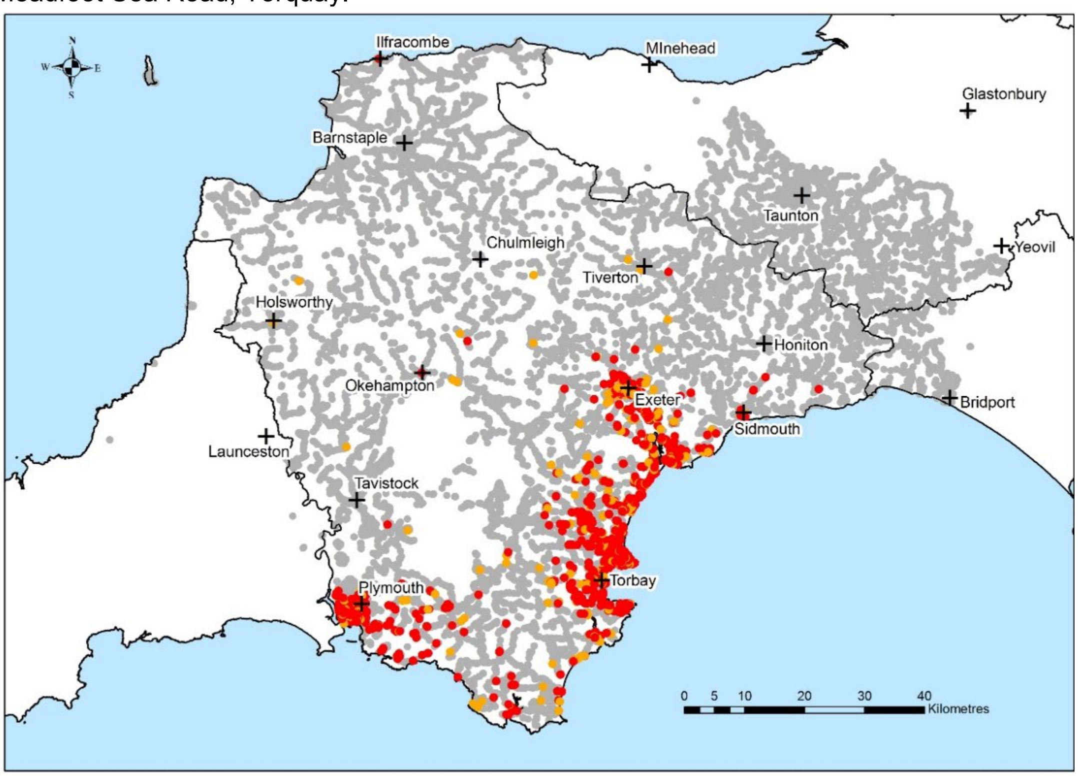

Figure 10. Distribution of pale grey middle Devonian limestone in buildings. Red symbols, the limestone is the principal building material; orange symbols, the limestone is a subsidiary building material; grey symbols, building lacks this kind of limestone.

57, Chalk

There are just two database records of chalk in the buildings of the study area. One refers to a wall beside Sea Hill in Beer – the access to the beach. The wall is made of blocks of chalk, glauconitic sandstone (Upper Greensand), Beer Stone, chert and flint probably collected on the beach. The other is in the car park in West Bay where large blocks of chalk have been placed to protect the swings in the children's playground. The chalk is nodular with black flint inclusions.

75, North Curry Sandstone

The North Curry Sandstone, a member of the Dunscombe Mudstone Formation (or Arden Sandstone Formation), is a distinctive grey-green sandstone (Figure 1) used for building on the rising ground between the Curry and West Sedge Moors of the Somerset Levels and in the western outskirts of Taunton (Figure 7). The sandstone ranges from very fine grained – really a siltstone (Figures 2 and 4) - to very coarse grained and conglomeratic (Figure 6). The clasts are composed mainly of subangular quartz but some blocks, especially the coarser grained examples have significant admixture of exotic lithic grains and plentiful pale grey to white and greenish-grey calcareous siltstone, probably caliche (Figure 6). The caliche fragments are typically about the same size as or slightly larger than the grains of hard minerals and have sharp unabraded outlines. This material gives the rock its very characteristic bright greenish-grey colour. The matrix is sparse but includes visible white carbonate material similar to the caliche fragments. Some blocks have a distinctive surface texture of small knobs believed to be caused by the weathering out of enclosing grains of coarse-grained calcite (lustre mottling – Figure 3).

Cross-bedding is characteristic of the rock-type (Figure 5). The units are typically of the order of 3-15cm thick in fine- and medium-grained sandstones and considerably thicker in coarse-grained ones. Regular planar bedding is also present in some blocks. The building blocks are of variable size, but good quality stone can form very large slabs that are thin across the bedding in comparison with their other dimensions and appear to have been much in demand in medieval times for the quoins of local churches.

North Curry Sandstone is distinguished from other sandstones of the area by its distinctive colour and very prominent small-scale cross bedding. It is one of the main building stones east of Taunton (Figure 7). Elsewhere it is mainly used for the quoins and dressings of older high-status buildings, especially churches. An exception is the Queen's College in Taunton, an important secular C19 building made of this rock-type. Outliers occur in the bridges of the Taunton to Chard railway and in the church at Aylesbeare. It is probable that the rock unit continues beneath the soil cover to the coast at Dunscombe but with the exception noted at Aylesbeare, was not used for building. A similar rock-type, more properly called a limestone is sparingly used for the quoins and dressings of churches extending north through the Vale of Taunton Deane as far as Bicknoller and Stogumber (purple symbols in Figure 7; see Code 168).

Figure 1. St Peter and St Paul's church, North Curry. Small-scale cross bedding in fine-grained sandstone. Note that the block has been laid upside-down.

Figure 2. Lych gate of the church of St Peter and St Paul, North Curry.

Figure 3. “Droplet” texture believed to be caused by enclosing grains of sparry calcite. St Mary’s church, West Buckland.

Figure 4. St Giles’ church, Bradford-on-Tone. Quoins and dressings are of North Curry Sandstone with some Portland, Ham Hill and Bath Stone while the walls are a mixture of this sandstone and Upper Greensand chert.

Figure 5. St Giles' church, Bradford-on-Tone. Cross-bedded North Curry Sandstone. Once again, the blocks have been laid upside-down.

Figure 6. Tower of All Saints church, Norton Fitzwarren. Very coarse-grained sandstone composed of quartz, hard dark exotic rock-types and intraformational clasts of pale grey calcareous siltstone.

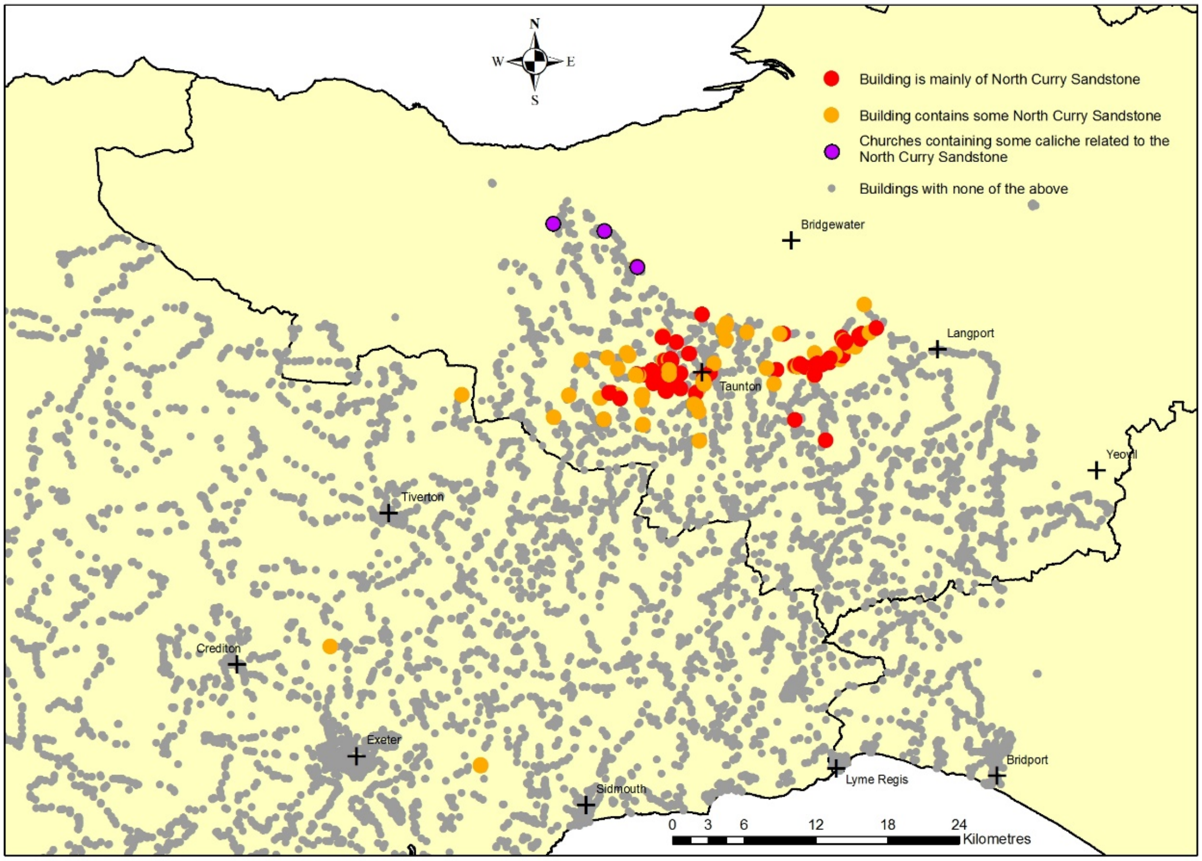

Figure 7. Distribution of buildings containing North Curry Sandstone.

76, Tile

This category is restricted to buildings where tile is used in their exterior finishing other than as a roofing material. Something less than 1% of the buildings examined contain tile used in this way with a marked concentration in Lynton-Lynmouth where finishing buildings partly with hanging tiles appears to have been a local tradition (Figure 1).

Of the 206 buildings identified that use tiles, 137 are walls (Figure 2) and of those, 76 are of cob construction where tile is used in the coping. There appears to have been a tradition, perhaps with an underlying practical justification, of capping cob walls with a tile coping and extending the protection of the cob from the weather by incorporating corrugated iron sticking out on either side of the tile, making a little waterproof roof (Figures 3 and 4).

Figure 1. Aladdin's Cave, The Esplanade, Lynmouth.

Figure 2. Tile coping of the walled garden wall at Barrington Court, Barrington. The wall is made of Moolham Stone and Blue Lias limestone laid in decorative alternating courses.

Figure 3. Roadside wall, north side of Monkton Road, Honiton.

Figure 4. Roadside wall, Ellon House, Harpford. Cob wall on a footing of painted stone rubble and with a coping of tile and corrugated iron.

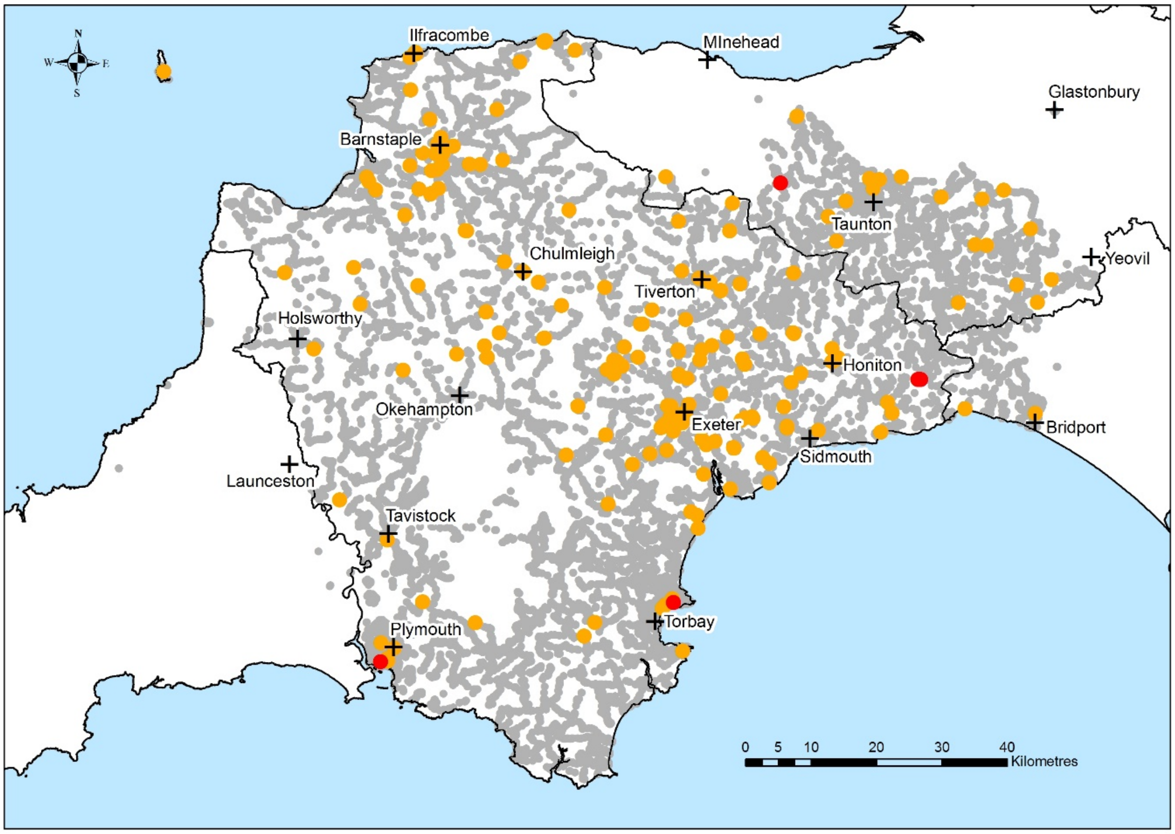

Figure 5. Distribution of wall tiles in buildings. Red symbols, tile is the main cladding material; yellow symbols, tile is a minor constituent of the building; grey symbols, building lacks tile used for the walls or coping.

Figure 5 shows the distribution of buildings that incorporate tile, other than as a roofing material. There is a particularly strong concentration of buildings in Barnstaple and Bideford, and although not obvious from the figure, in Ilfracombe also. Table 1 shows the number of buildings containing tile by building type. It shows a notable concentration of the use of tiles in roadside and garden walls. A similar analysis shows that of the 152 walls in the table, tile was the main material of the coping in 143 of them. Of course, it could be argued that the coping of walls is equivalent to the roofs of other kinds of building which would invalidate the distinction highlighted in Table 1.

Table 1. Buildings incorporating tile other than for roofing, by building type.

Building type	Survey total	Buildings with tile	
		Number	Per cent of all buildings
Church	2914	7	0.24
House	11690	44	0.38
Other	1730	3	0.17
Outbuilding	2655	3	0.11
Wall	10313	152	1.47
Total	29302	208	0.71

77, Roofing Slate

The code records the occurrence of those buildings where roofing slate is used as a building material other than as a waterproof covering of the roof. An exception is made in the case where roofing slate forms the coping of walls. These *were* included in the survey. Indeed, out of the 81 records of occurrence of roofing slate in buildings other than on the roof, 50 refer to its use as the coping of walls and of these 29 were cob walls, a significant proportion (Figures 1 and 2).

Otherwise, roofing slate is a minor component of all kinds of stone building, used either to even up the courses as a wall was built (Figure 3) or to make a repair (Figure 4). In both these cases slate seems to have been used more because it came readily to hand rather than being particularly well suited for the job. The use of slate in this way is widespread across the project area but is not particularly common (Figure 5).

Figure 1. Slate coping to wall of rendered cob on a deep stone rubble footing. Wall behind village notice board, Payhembury.

Figure 2. Painted cob on painted stone rubble footing with slate coping. Bottom of Commons Hill, close to junction with Dry Lane, Christow.

Figure 3. Single slates used fill the gaps between building stones. Vestry of St Swithin's, Woodbury. The red and white stone is sandstone from the Aylesbeare Mudstone Group.

Figure 4. North side of St Nonna's church, Bradstone. Stacks of roofing slate used to replace defective building blocks. The main building stone is hornblende-chlorite slate (metavolcanics). The window dressings are of Dartmoor granite.

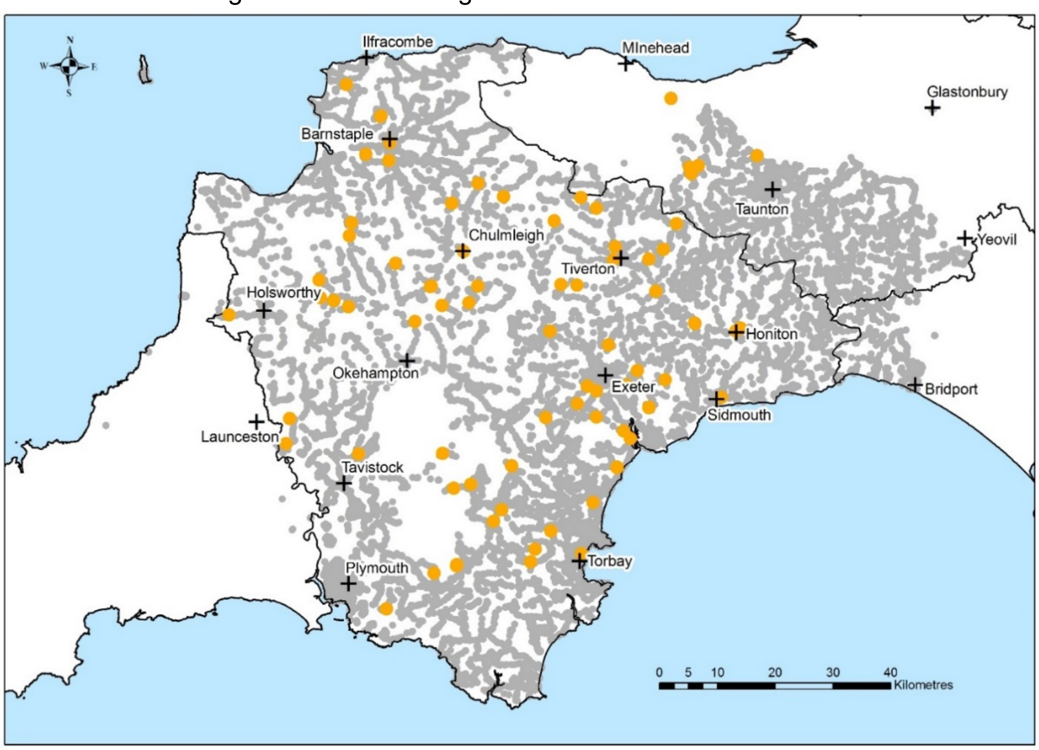

Figure 5. Distribution of roofing slate used as a building stone (not roofing material). Yellow symbols, roofing slate is a minor constituent of the walls of buildings; grey symbols, buildings lack roofing slate that is not on the roof.

78, Basic igneous rocks – gabbro and larvikite

Code 78 is reserved for dark grey coarse-grained igneous rocks originating outside Devon and mainly used either for shop fronts or for beach armour. They are predominantly dark in colour, lack oriented fabric and are composed of plagioclase and pyroxene or hornblende with or without olivine. The variety larvikite used as beach armour east of Jacob's Ladder in Sidmouth, displays iridescent feldspar caused by the fine exsolution of alkali feldspar and plagioclase and was formerly more widely used for the fasciae of Mac Fisheries shops, now sadly no more.

Figure 1. 73 Cecil Street, Plymouth. The house is clad in polished stone including black gabbro, salvaged by the owner over the years from washstands and kitchen worktops, cut up and affixed to the walls of his house both inside and out.

Figure 2. Boulder of hornblende gabbro lying beside the road, Miller Way, Plymouth. The embankment behind is made of Devonian slate.

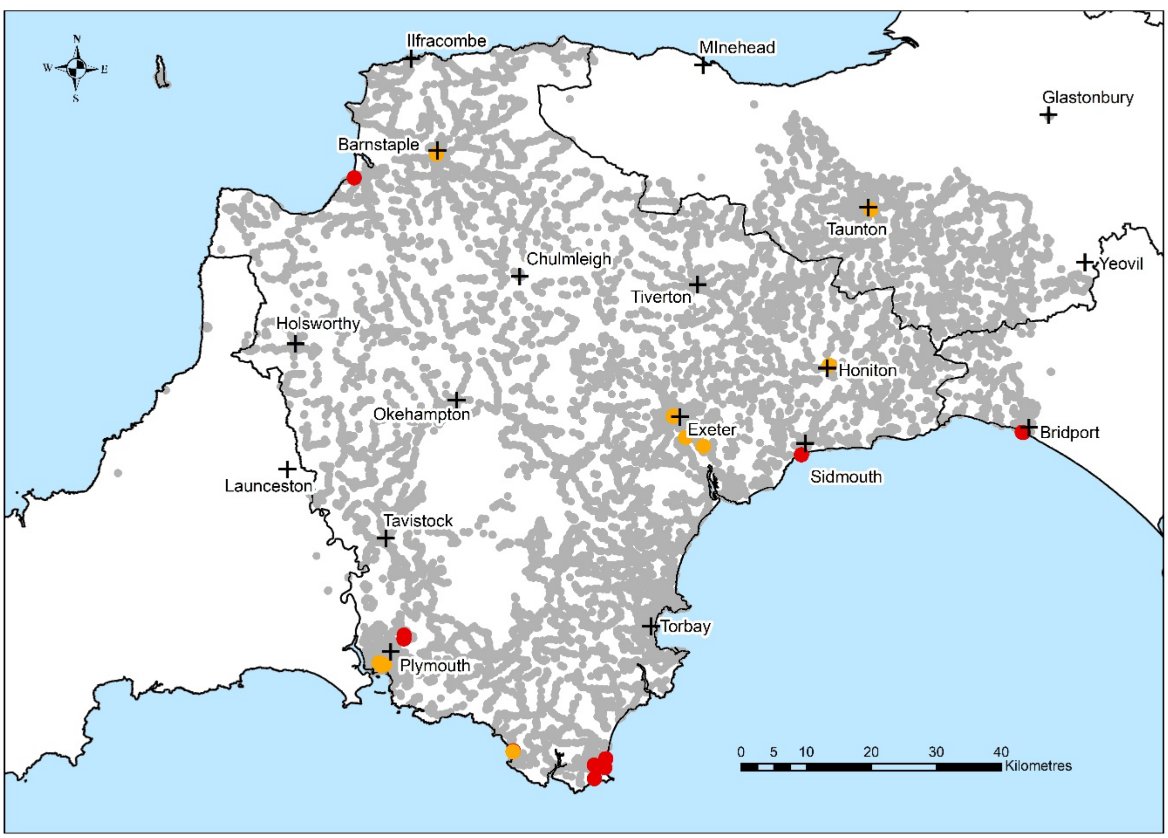

Figure 3. Distribution of gabbro in buildings. Red symbols, gabbro is the main constituent; orange symbols, building contains some gabbro; grey symbols, building lacks gabbro.

79, Exeter Volcanic Series lavas

The Exeter Volcanic Series comprises basic and intermediate predominantly volcanic rocks enriched in potash and exposed as small disjointed outcrops at or near the base of the Permian in a north-south zone to the west of Exeter. The stone is widely used for building. It is typically a purple, grey or violet fine-grained vesicular rock (Figure 1). It is holocrystalline under the hand lens - all the mineral constituents can be resolved; there is no very fine-grained irresolvable groundmass. However individual minerals cannot be confidently identified without a thin section. The groundmass is reported to include feldspar, zeolites and alteration products after pyroxene - mainly chlorite, and olivine, including a characteristic red mineral called iddingsite. The amygdales are filled with white zeolites and carbonates and/or green chlorite or brown clay minerals. In many blocks, the amygdales are empty of solids (Figure 3); it is not clear if this is a feature of the rock as it is in the subsurface or if the original filling minerals have fallen out as the amygdales are exposed at the surface.

The typical colour of the rock is purple or maroon but grey, black, violet, red, ochre, yellow and pale orange varieties also occur. However, nearly all varieties of grey lava have a purplish tinge which serves to distinguish them from other basic igneous rocks of the area (Figure 4).

The groundmass of many of the rocks is reported to enclose larger grains (phenocrysts or xenocrysts) of iddingsite after olivine, feldspar, pyroxene, quartz, biotite and apatite. These larger crystals are seldom prominent in lava used for building. Biotite phenocrysts were noticed in lavas from Killerton and iddingsite is prominent in most blocks of dolerite from Dunchideock.

The vesicles or amygdales are about 5-10mm across, in most cases roughly spherical or irregular in outline, in others ellipsoidal, smeared out in planes no doubt parallel to the edges of the volcanic body, imparting a flow fabric to the rock. In some cases, the distribution of vesicles and variations in their size defines a faint banding to the rock. However, not all examples of the lava contain obvious vesicles (Figure 2). In some cases they appear to be entirely lacking; in others they are abundant but very small - about the size of a pinhole - and so are not very obvious to a casual observer. In other respects, the rocks are rather homogeneous. They seldom show pronounced banding or foliation and veins of carbonate minerals, though present, are seldom abundant (but see Pocombe Stone, Code 115).

Building stones from the Exeter Volcanic Series are commonly named after their originating quarry so Killerton, Uton, Posbury, Thorverton and Raddon Stone are commonly encountered in the literature. The Exeter volcanics used for the walls of Exeter city, for Rougemont Castle and for many of the city churches were quarried from Rougemont itself and from Northernhayes immediately to the north in Roman and medieval times. While some success has been achieved in differentiating lava from individual quarries (see separate entries for Pocombe Stone and dolerite from Dunchideock), in most cases it has not proved possible at the level of detail of this survey to assign most examples of Exeter Group lavas in buildings to an individual quarry.

Volcanics of the Exeter Series that lack obvious vesicles can be, and indeed have been in the past, easily confused with maroon sandstone from the Bude Formation and less easily with red sandstone from the Dawlish Sandstone and even Heavitree Breccia (eg Figure 2). In all these cases, examination with a hand lens quickly reveals the crystalline igneous texture of the lava which cannot be confused with the clastic texture of the sandstones. These alkaline lavas are also easily distinguished from acid porphyrys that are a prominent constituent of the Permian breccias around Dawlish by their holocrystalline matrix which contrasts with the very fine-grained irresolvable matrix of the latter rocks.

Lavas from the Exeter Volcanic Series are a major building stone in and around the city of Exeter and extend from Ide in the southwest to Thorverton, the Clyst valley and Whimple in the north and east (Figure 5). They are a minor constituent of buildings over a much larger area extending as far east as Pitminster in the Vale of Taunton Deane in the north to Sidmouth in the south. Towards the west in central Devon, they overlap with the distribution of Hatherleigh Stone, a related hypabyssal rock much used around Hatherleigh and adjacent areas north of the Dartmoor Granite. Figure 5 shows the distribution of buildings mainly composed or finished with Exeter Group volcanic rocks, shown in red where further differentiation has not been attempted (Code 79), in purple where they are believed to have been won in Pocombe Quarry (Code 115) and in green where they were extracted from School Wood Quarry, Dunchideock (Code 164). Buildings where these volcanic rocks are subordinate to some other building material are shown in yellow regardless of the source quarry.

They have a wide distribution across central Devon, reflecting the widespread occurrence of patches of Permian volcanic rocks across this area and even extend to buildings in adjacent parts of Somerset.

Figure 1. Tower of St John's church, Plymtree. Vesicular lava is used for the relieving arch above The doorway and a few blocks occur also in the wall but most of the stone in the wall is from Bude Formation sandstone from Upton Farm quarry. The dressings round door and window are of Beer Stone.

Figure 2. South aisle, St Mary's church, Whimple. All the blocks in the photograph are of lava, mainly lacking obvious vesicles and showing a range of textures and colours.

Figure 3. North transept, St Mary's church, Poltimore. Vesicular lava is used for the quoins but lava mainly lacking vesicles is used in the wall. The block above and to the left of the 2p piece is a repair of artificial stone.

Figure 4. Exeter city wall. The red stones are of Heavitree breccia, the cream ones are of sandstone from the Exeter Group and the grey (with a touch of purple) stones are vesicular lava, probably from Rougemont or Northernhayes.

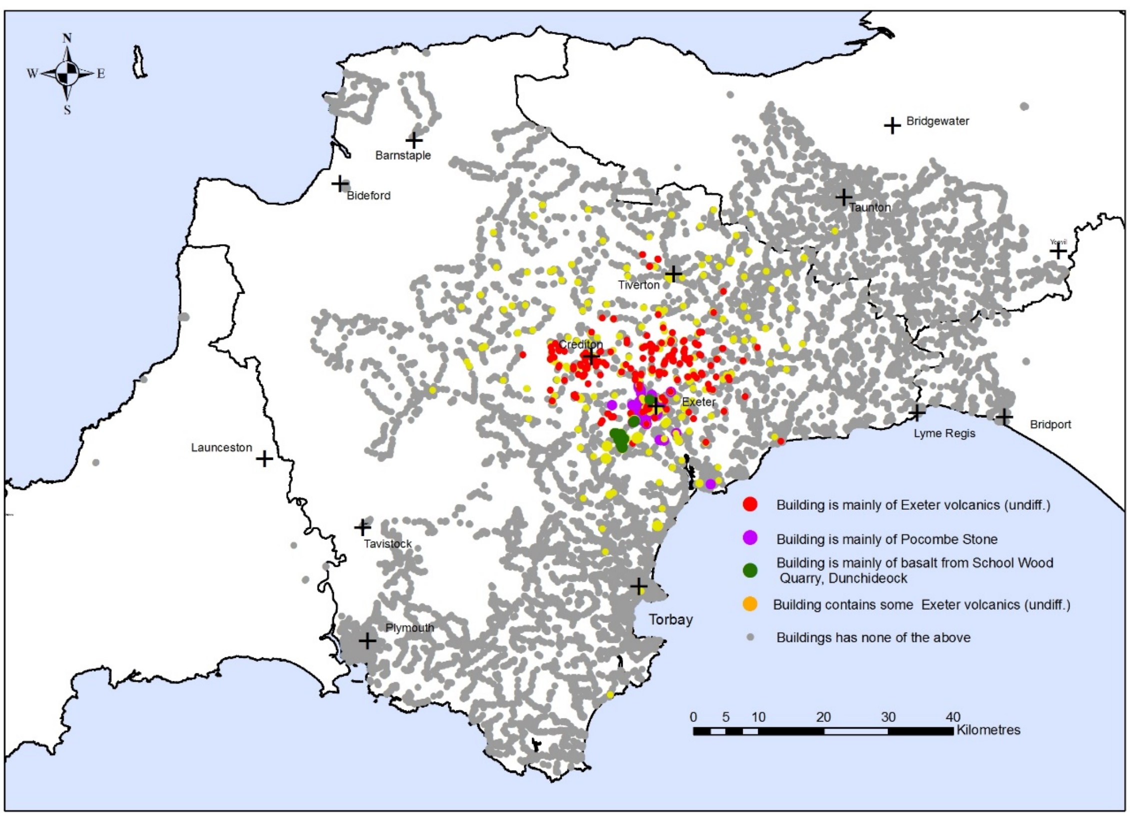

Figure 5. Distribution of Exeter Volcanics in buildings.

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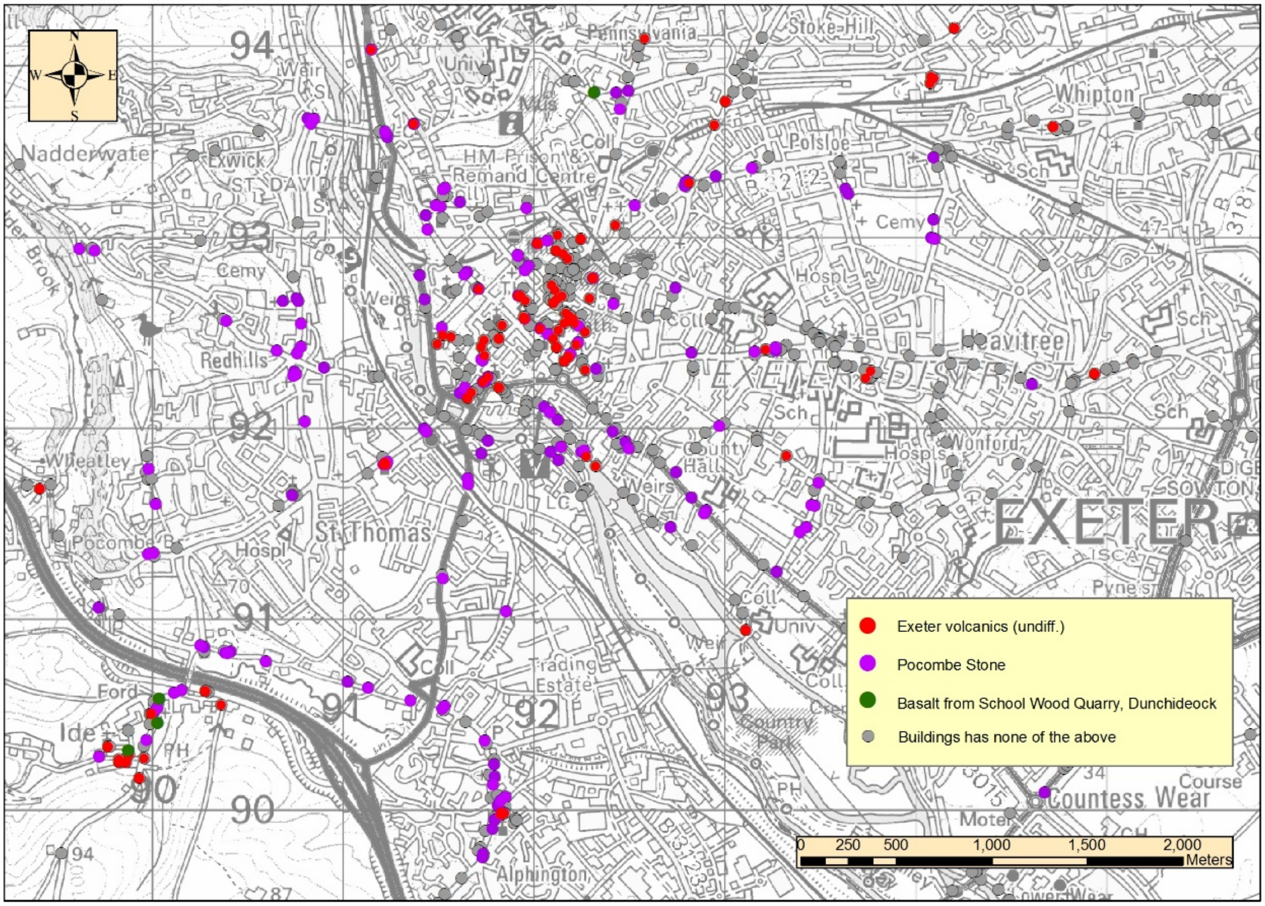

Figure 6. Distribution of Exeter Group volcanics in and around Exeter. Base map, © Crown copyright and database rights 2018 OS 93830343.

Figure 6 shows the distribution of different kinds of Exeter volcanics in and around Exeter. Pocombe Stone (Code 115, qv) predominates in the outskirts of the city, mainly built in the Nineteenth century. Volcanic rocks generally lacking the distinctive features of Pocombe Stone predominate in the city centre and in the older buildings and in the case of medieval and early modern buildings, were probably won from Rougemont.

80, Green Sandstone (Otter Sandstone Formation)

Green sandstone is sparsely distributed in buildings close to the outcrop of the Otter Sandstone Formation. The sandstone is medium- to very coarse-grained, pale green-grey in colour (Figure 1), in some cases with scattered orange-stained quartz grains. Bedding is not very well developed but is present in some examples. A significant proportion of the few examples seen show a “droplet” texture (Figures 2 and 3), believed to be caused by enclosing coarse grains of calcite that forms the cement in these example (lustre mottling). Some stone given this code contains a significant proportion of clay and some has sparse well-rounded quartz grains.

Considerable difficulty was experienced in differentiation these sandstones, referred to the Otter Sandstone Formation, from similar greenish stone with a greasy texture referred to the Upper Greensand (Code 84) and it is possible that some examples are wrongly identified in spite of visiting most of the localities at least twice. Lustre mottling appears to be common to both sources of stone. Upper Greensand sandstone usually contains some glauconite or its alteration products but this is not always prominent. Blocks that are mottled in green and red are easily distinguished from the Upper Greensand but can be mixed up with similar sandstone from the Aylesbeare Mudstone Group (Code 121) and as a general rule, mottled sandstone has been referred to that formation. It has to be admitted that more weight has been given to where the stone is used than is ideal in deciding on the source formation.

The sandstone is closely associated with the more widespread red variety (Code 81), from which it is derived through reduction (Figure 4). Its distribution in buildings roughly follows the outcrop of the Otter Sandstone (Figure 5).

Figure 1. Tower of St John’s church, Plymtree. Most of the stone in this picture is maroon sandstone from the Bude Formation but the block in the centre bottom is Beer Stone and the block to its right is pale green-grey sandstone believed to be from the Otter Sandstone.

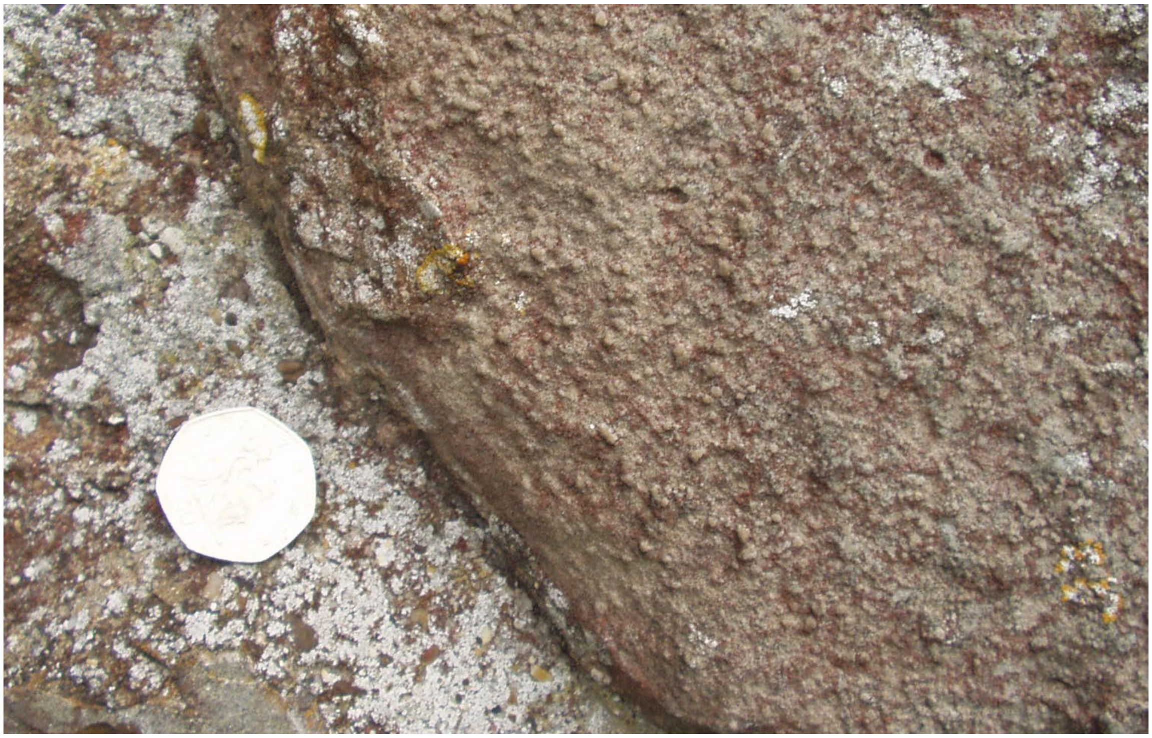

Figure 2. Church of the Holy Cross, Sampford Arundel. The "droplet", pimply texture is believed to be caused by enclosing matrix crystals of calcite.

Figure 3. Tower of St Gregory's church, Harpford. The pale sandstone block above the pencil has a pimply texture matched by some of the adjacent blocks of mud-flake conglomerate (Code 82).

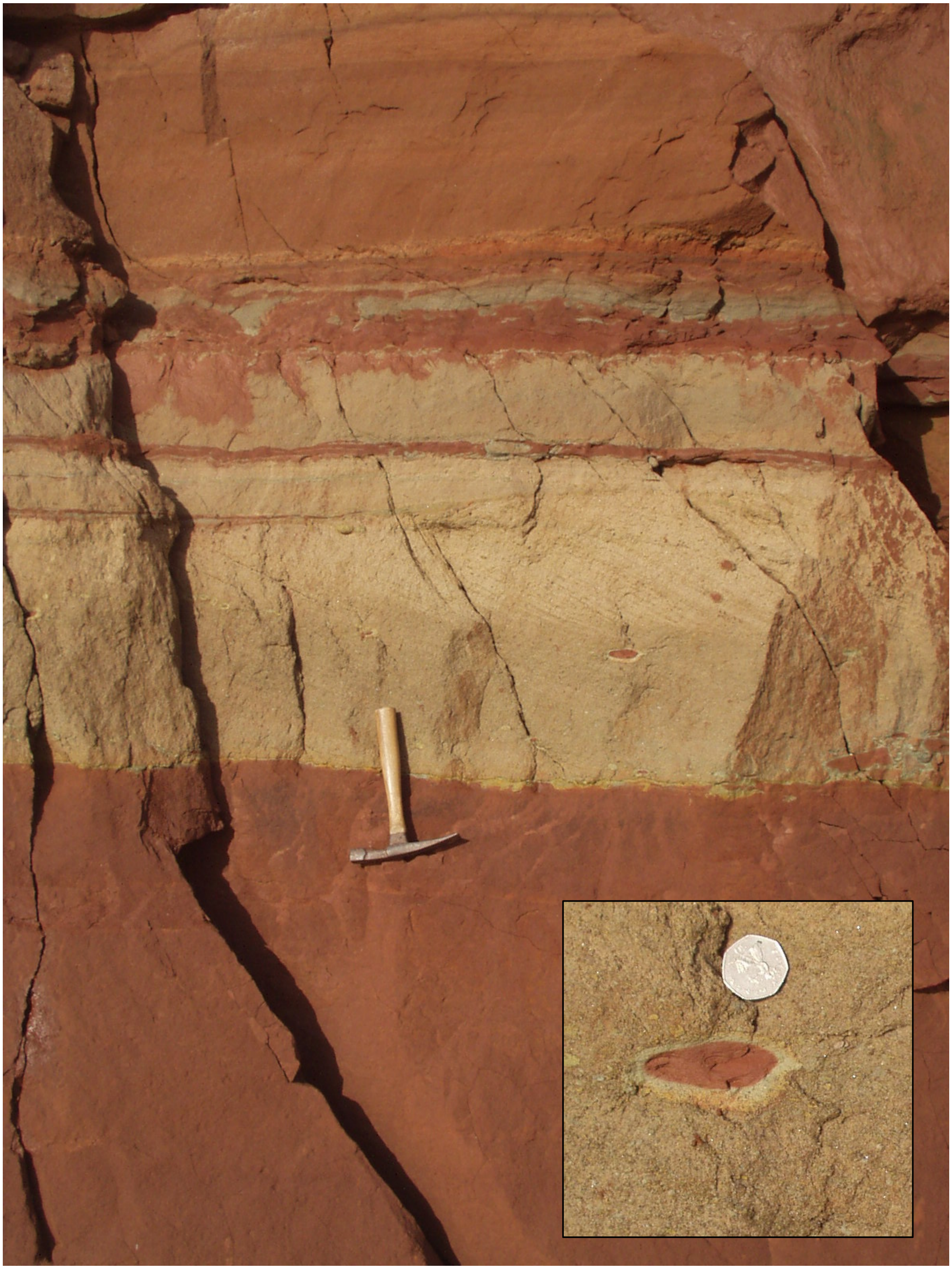

Figure 4. Pale green sandstone (cross bedded) derived by reduction and leaching of the more widespread red sandstone. Inset; detail of a clay inclusion reduced round its edge by the passage of reducing formation waters. Tortoiseshell Rocks (Otter Sandstone Formation), west of Sidmouth.

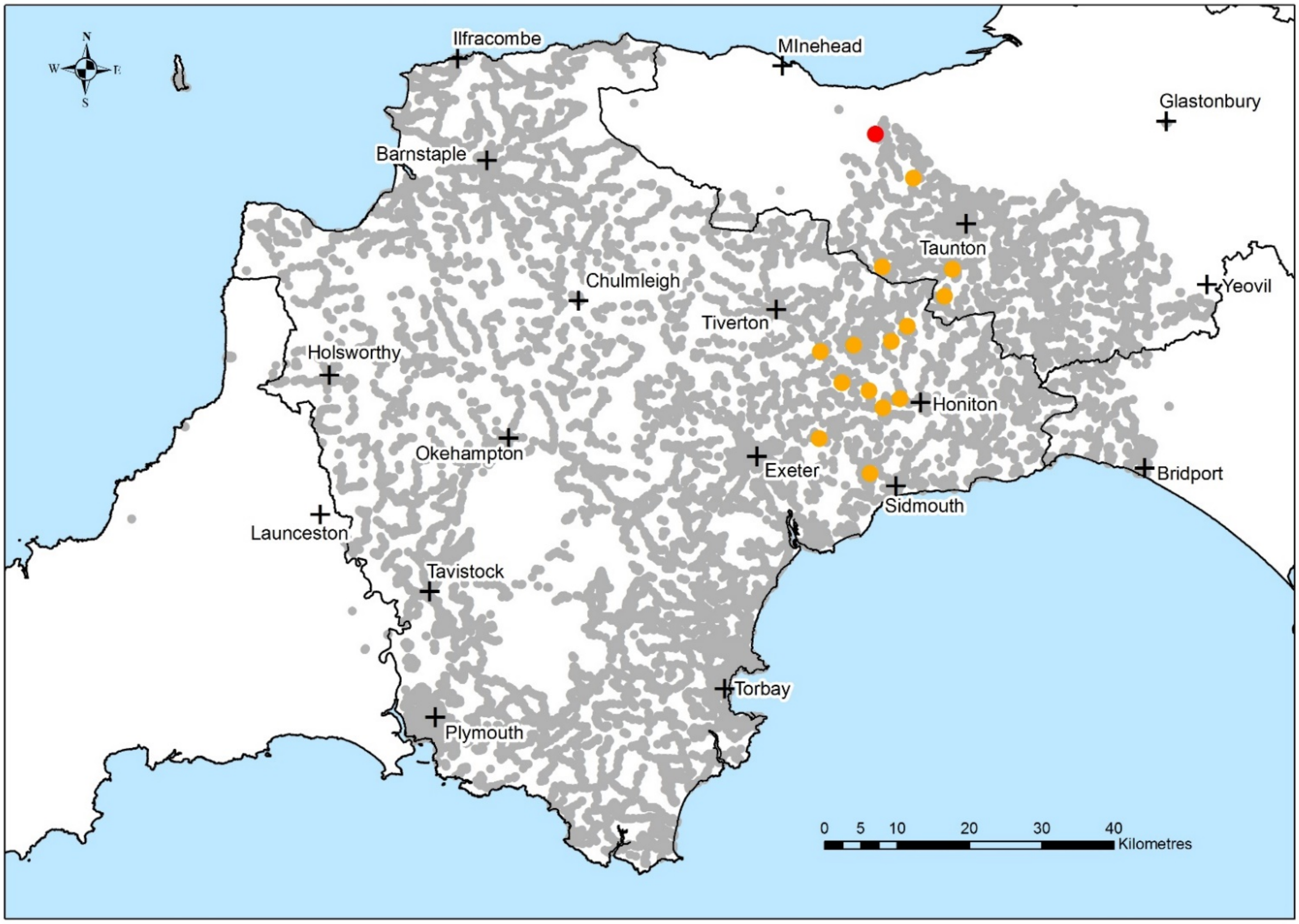

Figure 5. Distribution of green Otter Sandstone (Code 80) in buildings. Red symbol, this kind of Otter Sandstone is the main building material; orange symbols, Otter Sandstone is a subsidiary building material; grey symbols, Otter Sandstone was not observed.

81, Red sandstone (Otter Sandstone Formation)

Red sandstone is the most abundant rock-type of the Otter Sandstone Formation and is widely used for building in the lower Otter valley and the Vale of Taunton Deane. It is typically a medium-grained, even-grained sandstone composed of clasts of quartz set in sparse calcite cement. Mica is present in some examples. The quartz clasts are mainly sub-angular, but in some blocks, there is a fraction of very well-rounded grains with high sphericity characteristic of desert sand transported by the wind (so called millet seed sand). Bedding is present in many blocks, defined by grain size variation and the proportion of fines (Figure 1). Some blocks show cross-bedding (Figure 2). Nearly all examples of the sandstone are quite weakly cemented and most building blocks show rounded edges and corners caused by weathering and erosion after they were extracted (Figures 1-3).

In the Otter valley, good quality stone of the kind described above is joined by a range of inferior building stone made of even softer sandstone composed of quartz grains in a muddy or marly matrix. Paler strings, patches and small nodules which are more resistant to weathering are probably those parts of the rock richer in calcite in the cement. Some parts have more pigmented pebble-sized fragments surrounded by stringers of paler more calcareous material similar to autobreccia. In outcrop, rock of this kind can be shown to represent former soil horizons where calcareous concretions formed around the roots of vegetation.

In the Vale of Taunton Deane, the Otter Sandstone includes fawn and pale pink varieties, and red and fawn mottled varieties with variable amounts of calcite cement, in some cases so abundant that the rock has been quarried for lime burning, but more usually quite soft, forming rather rounded blocks (Figure 3). Good quality varieties are used for the quoins and dressings of many buildings especially around Bishops Lydeard. The quarry there provided especially good stone used for the building of the Victorian mental hospital now called Cotford St Luke (Figure 4). Lower quality stone is used as rubble for the walls of these buildings. Much of the sandstone is poorly sorted and has small pebbles and lenses rich in granule-sized grains. There appears to be a continuum of rock-types between this kind of sandstone and similar sandstone referred to the Budleigh Salterton Pebble Beds. Where there is an association of sandstone with pebbly sandstone that contains either scattered rounded pebbles, or pebbly beds where the maximum size is greater than small pebbles, then the sandstone is referred to Code 127, ie, a cut-off point between Otter Sandstone and Budleigh Salterton Pebble Beds is made, lacking other evidence, where the size of the pebbles in the building stone is greater than small pebbles. This may seem an arbitrary distinction, but it is less hard to make than would at first appear.

The range of sandstone types present in the Otter Sandstone is quite large and it is difficult to differentiate between them and similar sandstones from the Exeter Group and indeed, from red sandstone imported from other parts of the country, on the grounds of lithology. The association with mud pebble conglomerate (Rock-type 82) is characteristic. Otherwise, red sandstone used in buildings close to the outcrop of the Otter Sandstone Formation has been referred to that formation rather than any other.

Figure 1. Cotmaton Road, Sidmouth. Otter Sandstone and conglomerate with glauconitic sandstone (Upper Greensand) in the footing.


Figure 2. South aisle, St Mary's church, Bishops Lydeard.


Figure 3. Tithe Barn, Fitzhead.

Figure 4. Former hospital block in course of renovation, Cotford St Luke. Red Otter Sandstone from Bishop's Lydeard quarry. Dressings of Ham Hill Stone.

Figure 5. Stogumber station booking office.

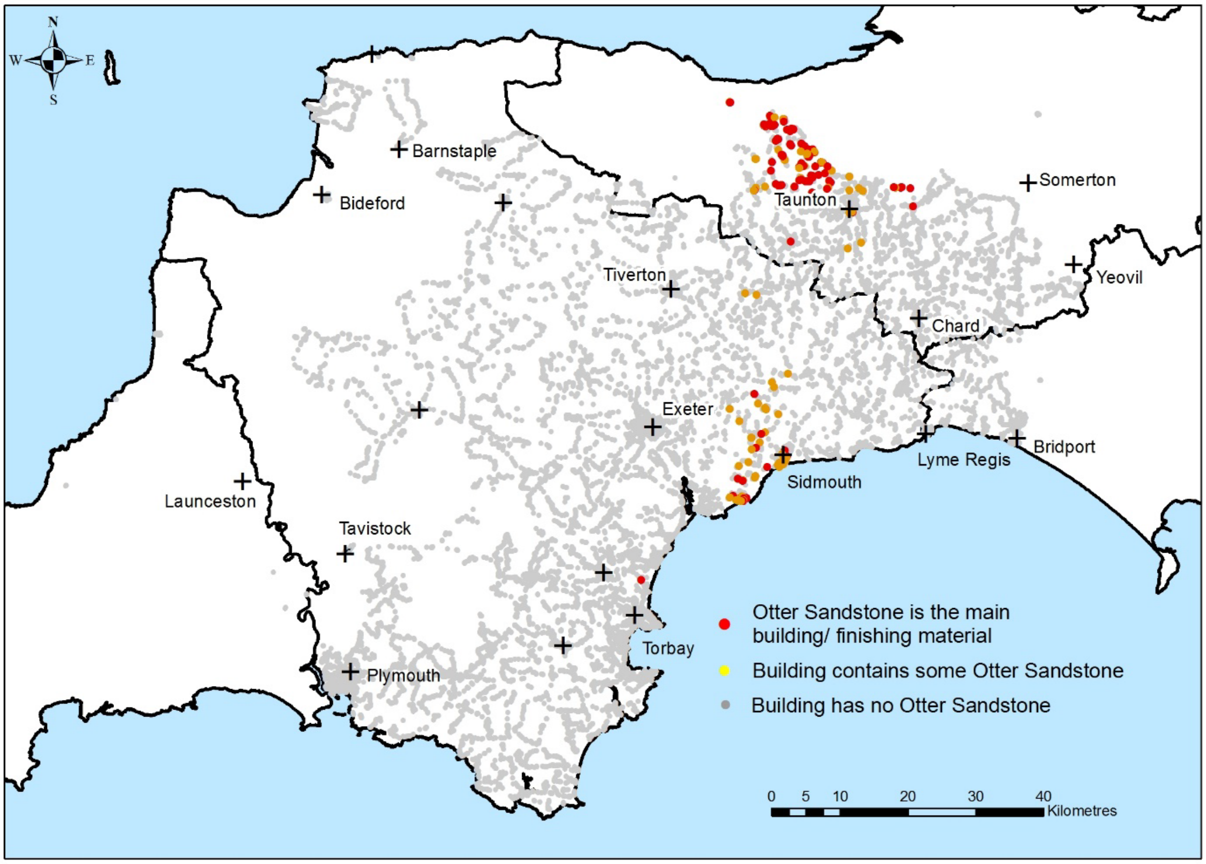

Figure 6. Distribution of Otter Sandstone (Code 81) in buildings.

Figure 6 shows the distribution of this building stone. It is used in the Otter Valley extending north from Sidmouth and Budleigh Salterton, though sparsley because of the poor quality of the stone, and much more extensively in the Vale of Taunton Deane, extending towards Williton, where the sandstone is better cemented.

82, Mud Pebble Conglomerate and Associated Sandstone (Otter Sandstone Formation)

Dark red, in places almost black, conglomerate composed of rounded muddy sandstone fragments up to 3cm across set in a medium-grained calcareous sandstone matrix composed predominantly of subangular quartz grains in a sparse muddy or calcareous cement is given Material Code 82. In most examples, the muddy sandstone clasts are darker and finer grained than the matrix sandstone (Figure 1). They represent overbank deposits of finer-grained sandstone subsequently eroded and redeposited by incorporation into coarser-grained sandstone of the stream channels. However, examples of paler, less muddy, more calcareous sandstone included in darker red sandstone matrix also occur. These probably represent calcareous palaeosoils that have suffered the same fate of erosion and reincorporation in penecontemporaneous sandy deposits.

Many examples of the rock used in buildings also enclose angular fragments, also up to pebble-sized, of harder sandstone, greywacké and hornfels derived from the Devonian and Carboniferous (Figures 2 and 3). Some hard pebbles can be scratched with a penknife – they may include some limestone. However, intraformational clasts derived from penecontemporaneous erosion preponderate over those derived from outside the basin of deposition. The rock typically has a pronounced bedding fabric mainly defined by the long axes of included fragments which, being softer than the matrix, weather out giving the rock a carious weathered appearance.

The associated sandstone is coarse grained, red or coloured in shades of cream, yellowish, pale grey or blackish, composed of angular grains of quartz and some pebble-sized rock fragments set in a calcareous cement or in many cases, poorly cemented. Cementation is in some blocks quite variable giving the rock a somewhat nodular appearance with harder parts interspersed with softer more powdery parts.

The sandstone associated with the mud pebble conglomerate is indistinguishable from other sandstone lithologies of the Otter Sandstone Formation (Rock-type 81) but where it is subordinate to mud pebble conglomerate in the same building has been assigned Code 82. The conglomerate is easily distinguished from the Budleigh Salterton Pebble Beds in Devon; the latter is too poorly cemented to be used as is, and as a rule, only the individual pebbles are incorporated into buildings. In Somerset there are gradations between conglomerate with exotic clasts, pebbly sandstone with exotic clasts, mud pebble conglomerate and sandstone with scattered mud flakes. Rock-types where intraformational pebbles predominate over exotic ones and are plentiful enough to merit description as a conglomerate have been assigned Code 82. However, it must be admitted that the distinction between sandstone (Otter Sandstone), conglomerate (Otter Sandstone) and Budleigh Salterton Pebble Beds is here somewhat subjective.

Mud pebble conglomerate is subordinate to red sandstone in exposures of the Otter Sandstone Formation in the coastal cliffs between the mouth of the Otter and Sidmouth (Figure 4). In contrast, the conglomerate is more widely used in buildings in Devon than the red sandstone. It seems that the mud pebble conglomerate was preferred over the sandstone for building perhaps because it is more porous and therefore better cemented with calcite.

In common with other rock types from the Otter Sandstone, mud pebble conglomerate is used for building in the lower Otter valley as far north as Ottery St Mary and Feniton, and in the Vale of Taunton Deane (Figure 5). It has not been observed in buildings in the intervening area even although the Otter Sandstone is exposed continuously between these areas. It is more widely used than the corresponding sandstone (Code 81) in the Otter valley because it is more durable; for example, it is the main construction material of St Mary's church in Ottery St Mary. It is about as common in buildings in the Vale of Taunton Deane as the associated sandstone although the buildings where it occurs tend to fall on the map a little to the south.

Figure 1. North aisle of St Mary's church, Bishops Lydeard.

Figure 2. Salting Hill, Budleigh Salterton. The top of the wall is of red pebble conglomerate from the Otter Sandstone. The lower part is finished in carefully matched cobbles from the Budleigh Salterton Pebble Beds.

Figure 3. Red and blackish mud pebble conglomerate, tower of St Gregory's, Harpford.

Figure 4. Interbedded red sandstone and mud flake conglomerate, cliffs east of the mouth of the Otter river.

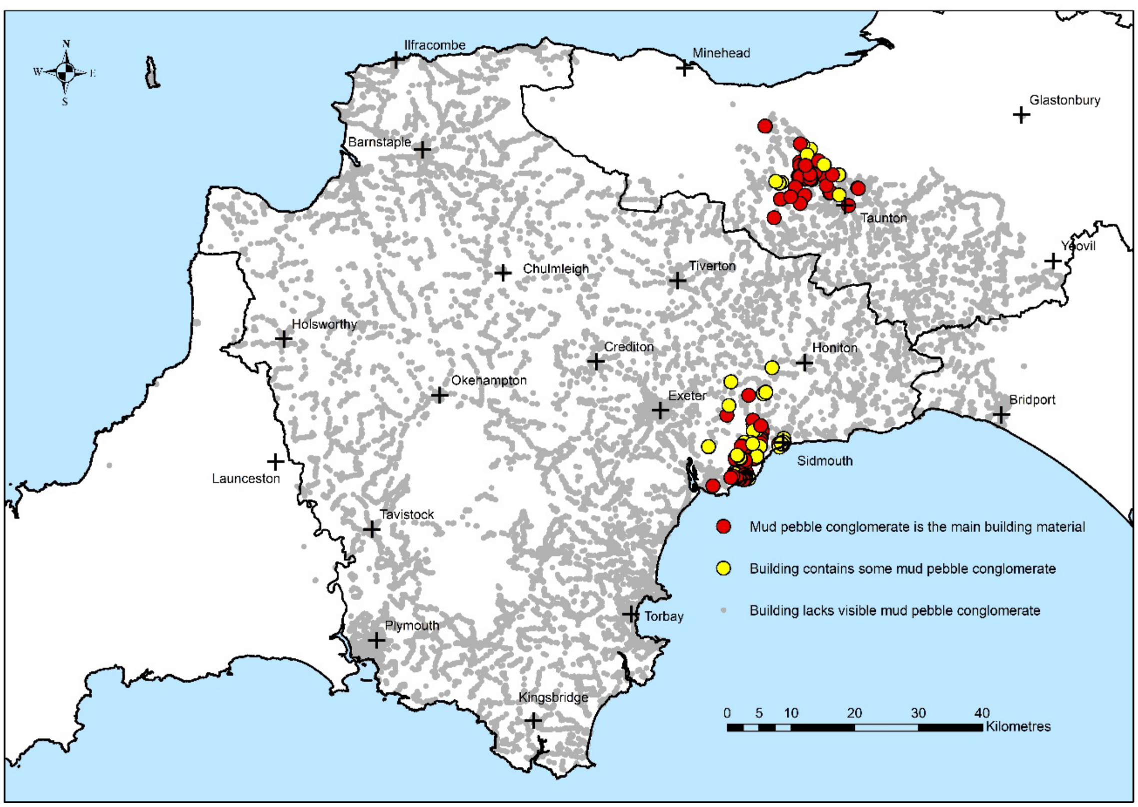

Figure 5. Distribution of mud pebble conglomerate (Otter Sandstone) in buildings.

83 and 118, Chert Breccia and Silcrete

The chert breccia of East Devon consists of angular fragments of chert or flint plus in some cases other rock types, typically pebble-sized but ranging up to small cobbles, set in a hard chalcedonic or opaline matrix with some crystalline quartz, especially as small glassy chips. In a minority of examples, the clasts are well rounded and the rock-type resembles Hertfordshire Puddingstone. The rock is typically yellow or toffee-coloured, resembling the flint of the Sidmouth area in this respect. According to Isaac, (1979), the rock originates in both the Peak Hill and Mutters Moor gravels of the Sidmouth area. Similar silcretes are widespread in the residual deposits above the chalk elsewhere in the south-west. However, the use of this rock for building in Devon appears to be restricted to the area of Budleigh Salterton-Newton Poppleford-Sidmouth with outlying occurrences at Branscombe and Kerswell (Figure 5).

Chert breccia of a somewhat different aspect occurs on the Haldon Hills and is used for building in the surrounding villages. It consists of angular chips of chert ultimately derived from the underlying Upper Greensand or possibly from the chalk now stripped away, set in a dull pink chalcedonic matrix (Figure 4). Similar chalcedonic building stone with a yellow outer crust and porous texture is used sparingly in the churches of Farringdon and Exminster. Red cherty stone is used for walling in the village of Charles in North Devon (Figure 5) and according to a passer-by, is also used in his garden wall and in the north wall of the church.

Reference:

Isaac, K.P., 1979. Tertiary silcretes of the Sidmouth area, East Devon. *Proceedings of the Ussher Society*, **4**, 341-354.

Figure 1. Block of chert breccia in the footing of St Gregory's church, Harpford. The yellow or toffee colour of the chert fragments is characteristic.

Figure 2. Block of chert breccia in the rubble wall of St Luke's church, Newton Poppleford. The wall is made of a mixture of materials including also Otter Sandstone and rounded cobbles of quartzite from the Budleigh Salterton Pebble Beds Formation.

Figure 3. Rockery and wall of the Fish House, Bicton Park, Bicton. A note inside the Fish House records that the chert breccia was hauled from the top of the cliff between Sidmouth and Beer.

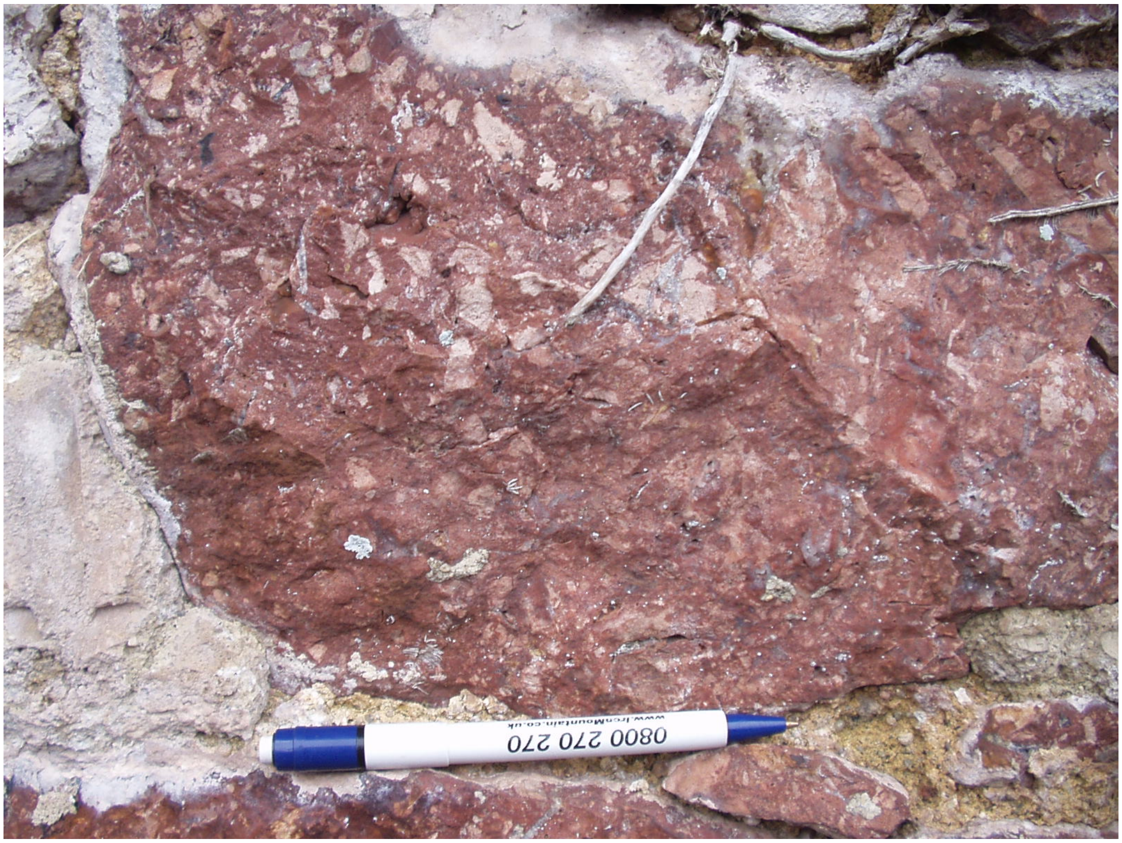

Figure 4. Roadside wall, Butts Lane, Ideford.

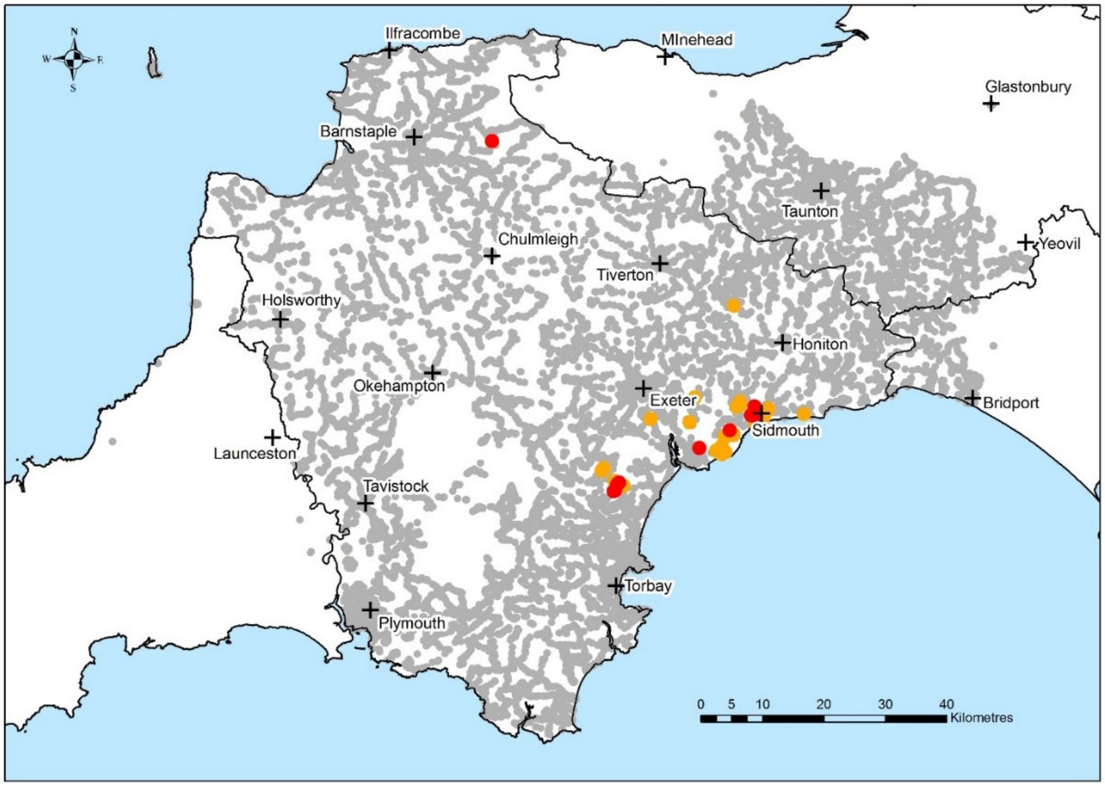

Figure 5. Distribution of chert breccia in buildings. Red symbols, chert breccia is the main component; orange symbols, chert breccia is a subsidiary component; grey symbols, building lacks chert breccia.

84, Glauconitic Sandstone (Upper Greensand)

Green, grey and fawn (grey with a hint of brown) medium-grained soft or rough-weathered sandstone (Figures 1 and 3) is assigned Material Code 84. The clasts are mainly of angular quartz with in most examples disseminated rounded grains of green glauconite or its black, ochre or dark-red weathering products. The sandstone which is used mainly in the south in Sidmouth and Charmouth has a fine-grained matrix and is soft and easily abraded.

In both places, a large proportion of the stone occurs as rounded boulders, believed to be collected from the beach in former times (Figure 2). Elsewhere, the clasts are set in an open framework of chalcedony mainly as outgrowths on the quartz grains but also filling the interstices between grains. However, in the most typical examples, the matrix is highly porous with many voids. The combination of angular quartz grains and irregular infilling chalcedony network gives the rock a very rough-weathered appearance. Some blocks are also rich in acicular sponge spicules and some contain scattered orange-stained millet seed (well rounded) quartz grains.

Blocks are generally small - about the same size as a standard brick, irregular, lacking obvious bedding with in some cases, flat surfaces believed to record the cleaving of the rock when it was first extracted and before it became hard (Figure 5). However, large slabs of this sandstone have been used for the dressings and especially the quoins of medieval churches (Figure 1) and the rock-type was clearly prized for its ability to form large, relatively thin slabs without breaking in a region generally lacking decent building stone. In these cases, the rock usually has a crude but well-defined bedding fabric (Figure 1).

Because of the plentiful dark minerals and open texture, lichen and moss tend to thrive on this rock-type. Although this obscures the nature of the underlying rock, it is itself one of its secondary identifying characteristics.

A significant minority of examples of the green sandstone lack visible glauconite or have only very sparsely disseminated grains. In these cases, the surface of the rock tends to have a compact, greasy appearance in which it is hard to discern individual clastic grains. Some surfaces are characterised by a pimply appearance, as if drops of rain had solidified on the surface of the rock (Figure 4). This texture has been noted also in reduced parts of the Otter Sandstone where it is caused by large single crystals of calcite that enclose the smaller clastic grains. Weathering and wasting of the surface takes place preferentially along the boundaries of the calcite grains, resulting in the drop-like texture of exposed surfaces. It is probable that "raindrop" surface textures in the green sandstone have the same origin.

Code 84 rock is in a few cases interbedded with other rock-types of the Upper Greensand including calcareous sandstone (Code 13) and Salcombe Stone (Code 14). A few examples of glauconitic sandstone enclosing chert nodules have also been seen and a small but significant proportion of blocks contain the burrows of the serpulid worm *Rotavia* spp (Figure 6). Through an increase in hardness and the completeness of infilling by chalcedony cement, the rock grades into Rock-type 29. Indeed, in the Sidmouth area, very similar rocks have been mapped variously as Rock-type 29 and Rock-type 84. Where the sandstone lacks visible glauconite or its weathering products, it is difficult to distinguish from green sandstone of the Otter Sandstone Formation.

Glauconitic sandstone (Code 84) has a well-defined distribution on the western slopes of the Blackdown Hills extending from Blackborough as far south as Whimple and Combe Raleigh as well as in the lower Sid valley as noted above (Figure 7). It is much less used on the top of the Blackdowns. This distribution closely matches the localities where Devon Batts (whetstone) were formerly mined. Moreover, there is a strong lithological similarity between the whetstone country rock and this building stone. Edwards (in Stanes and Edwards, 1993) notes that stone unsuitable for the manufacture of Devon Batts was sold by the miners as building stone. It is concluded that this sandstone at least in its distribution as far south as Whimple, Awliscombe and Combe Raleigh, was produced as a by-product of the whetstone mining industry which extended along the western escarpment of the Blackdown Hills from Blackborough, the main centre of mining, as far south as Hembury Hill.

References

Barr, M.W.C., 2007. Building stone at the western edge of the Blackdown Hills. *Geoscience in south-west England,* **11**, 348-354

Stanes, R.G.F., and Edwards, R.A. 1993. Devonshire batts. The whetstone mining industry and community of Blackborough, in the Blackdown Hills. *Report and Transactions of the. Devonshire Association for the Advancement of Science, Literature, and the Arts* **125**, 71 - 112

Figure 1. Tower of St Andrew's church, Feniton. Large slabs of grey-green sandstone with a greasy texture but lacking obvious dark minerals. It has a crude but quite well-defined bedding fabric.

Figure 2. Rounded boulders of glauconitic sandstone probably collected from Sidmouth beach. Boundary wall of Sid Abbey estate, Sid Road (West), north of Sidmouth. The coping is of flint cobbles.

Figure 3. United Reformed Church, Plymtree. Grey-green glauconitic sandstone as regular small blocks laid as coursed rubble. The dressings round the window are of Bath Stone.

Figure 4. Tower of St Nicholas' church, Combe Raleigh. "droplet" texture developed on the surface of a block of green sandstone with sparse disseminated glauconite.

Figure 5. Ruined outbuilding near Kentisbeare. Fawn glauconitic sandstone showing characteristic rough-weathered porous surface texture and flat facets believed to record the original cleaving of the rock when first extracted in a soft state.

Figure 6. The upper block is of glauconitic sandstone enclosing tubes of the serpulid worm *Rotavia* spp. The lower blocks is of Blue Lias limestone. Jurassic Coast Heritage Centre, Charmouth.

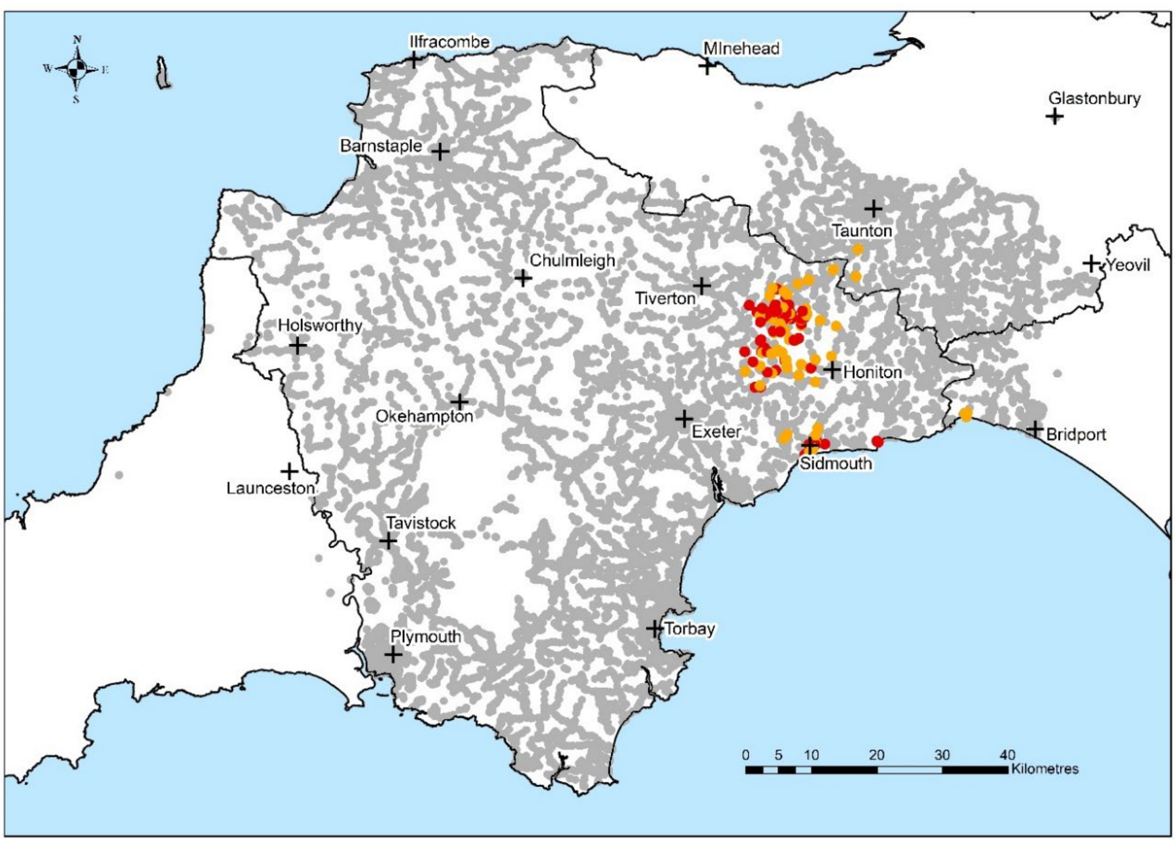

Figure 7. Distribution of glauconitic sandstone in buildings. Red symbols, glauconitic sandstone is the main building material; yellow symbols, glauconitic sandstone is a subsidiary building material; grey symbols, glauconitic sandstone was not recognised.

85 and 125, Heavitree Breccia and Equivalents

The Heavitree Breccia consists of angular clasts of a range of rock-types mainly derived from the subjacent formations enclosed by a matrix of coarse-grained red sandstone (Figure 1). The clasts are up to small cobbles in size and are mainly of very low grade metamorphic lithologies including red, maroon, brown and black fine-grained sandstones, greywackés, slates and hornfels with in many examples, a significant component of fine- and medium-grained igneous rocks including granite, quartz and feldspar porphyry and cleavage fragments of alkali feldspar, the so called merchisonite (Figures 1 and 2). In some examples, clasts of softer poorly cemented red sandstone are present, believed to be derived from penecontemporaneous sandstone layers in the Permian succession. The clasts are angular and poorly sorted. At the scale of the building block, they show very little preferred orientation and typically do not define bedding planes.

The matrix is composed of medium- and coarse-grained somewhat porous and poorly sorted pebbly sandstone. The rock may be either clast- or matrix-supporting, in the latter case reflecting very rapid deposition by flash floods heavily laden with unsorted rock debris. The rock has a variable degree of cementation but the best quality stone, generally that with porous sandstone matrix, is well cemented by white calcite. Building blocks may be large but because of the coarse nature of the stone, tend to be hard to dress accurately and may have somewhat rounded outlines. A common practice when using this stone is to pack out the voids left between the rounded blocks with smaller pieces of other stone (Figure 2).

Building stone assigned Code 85 is widely used in Exeter and adjacent parts of East Devon and extends southwards about as far as Dawlish (Figures 3-10). Important quarries from which production of stone is recorded from the second half of the fourteenth century onwards are in Exeter. The stone is variously called Heavitree, Wonford and Whipton Stone there; in Exminster, it is sometimes called Peamore Stone (Dove 1994), but similar stone must have been extracted from a wide distribution of smaller local quarries.

The rock-type is distinguished from other breccias of the area by characteristics of both the lithology of the clasts and general appearance. It is distinguished from the breccia of the Torbay area (Code 141, qv) by a lack of limestone clasts. The breccia occurring around Ken, the Shillingfords and Alphington (Code 125, qv) is closely similar but somewhat finer grained and tends to contain more sandstone bands and lenses. It is possible, given its distribution, that it might be from the Alphington Breccia rather that the Heavitree. However, it is generally accepted that the stone used for the church at Kenn was quarried nearby. Moreover, the authors of the BGS Exeter memoir (Edwards and Scrivener, 1999) expressed the view that the Alphington Breccia was too poorly cemented to be used for building. Breccia used for building from Dawlish southwards usually has prominent grey limestone clasts derived from the underlying Devonian (Code 141, qv). Breccia from lower in the Permian succession, identified in buildings in Sampford Peverell, is finer grained, has a muddy matrix and tends to be visibly bedded on the scale of the building block (Code 120, Halberton Breccia Formation, qv). An unusual kind of breccia entirely lacking in limestone or igneous rock clasts (Code 151) occurs in a few places, notably the parish church at Dunchideock. However, note that details of the rock-type are not well displayed in all buildings. In those cases where only a general identification as red breccia has been possible, the rock has been assigned lithology code 85. This applies to breccia used at the western end of the Crediton Trough, which is very likely from the Bow Breccia and stone probably derived from small outliers of breccia widespread in various parts of Devon.

References:

Edwards R.A. and Scrivener, R.C., 1999. Geology of the country around Exeter. *Memoir of the British Geological Survey, Sheet 325 (England and Wales).* HMSO.

Dove, J., 1994. *Exeter in Stone: a city walk; Exeter in Stone; an urban geology*. Thematic Trails, Oxford. 44pp

Figure 1. Block of matrix-supported red breccia, south porch of St. Swithin's church, Woodbury.

Figure 2. Red breccia, St Michael's church, Clyst Honiton. Note the use of thin sandstone blocks to compensate for the rather rounded outlines of the breccia blocks.

Figure 3. St Margaret's Topsham. The tower is medieval, composed of red breccia from Heavitree or Exminster, mottled sandstone from the Exmouth Sandstone and Mudstone Formation and minor Exeter volcanics.

Figure 4. Methodist church, Exminster. The walls are of pale grey limestone from Torbay, with decorative string courses and outer relieving arch of red Heavitree Breccia. The dressings of the window and a few additional strategically placed blocks are of Bath Stone.

Figure 5. North aisle of All Saints church, Kenton. The wall is of mixed Heavitree Breccia, mottled fawn and red sandstone, probably from the Dawlish Sandstone, and minor calcareous sandstone from the Upper Greensand, probably from Salcombe Regis. The superb window arcade is dressed with Beer Stone.

Figure 6. Junction of Topsham Rd. and St. Leonards Rd., Exeter. Cob with tile coping over Heavitree Breccia rubble.

Figure 7. Junction of riverside walk with Larkbeare Road at Port Royal public house, Exeter. Heavitree Breccia and pale grey limestone from Torbay.

Figure 8. 6 Cathedral Close, Exeter. The Georgian front wall including the dressings is a mixture of red Heavitree Breccia, purple Exeter volcanics and brown Salcombe Stone.

Figure 9. Exeter city wall 175m northeast of the South Gate. The near part is composed of a mixture of Heavitree Breccia (red), Exeter volcanics (violet), probably from Rougemont or Northernhayes and fawn sandstone (Exeter Group,Otter Sandstone or Salcombe Stone). The far part is composed entirely of Heavitree Breccia. It contains a stone dated 1743 just visible on the extreme left of the photograph.

Figure 10. Embankment, Ferry Road, Topsham. Note two large fragments of purple volcanic rock in the breccia towards the lower left corner of the photo.

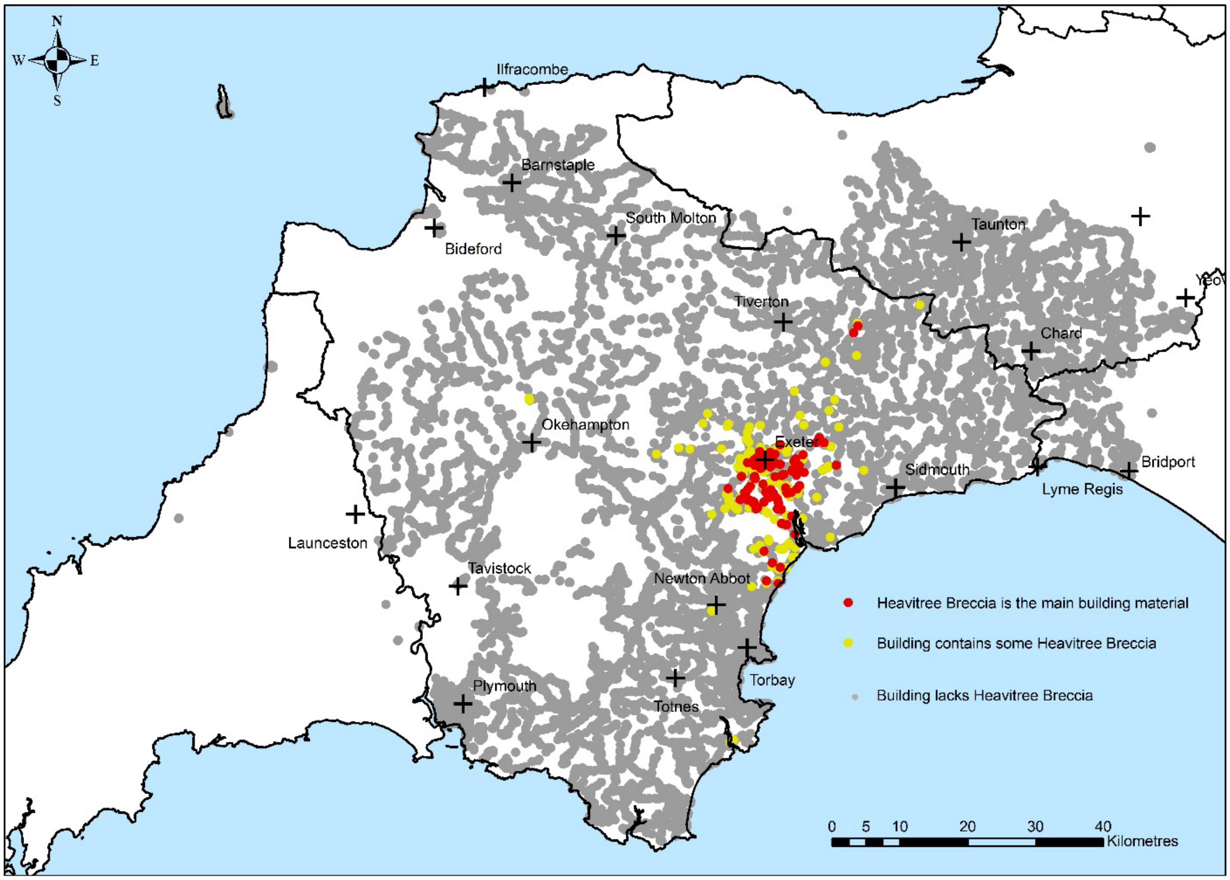

Figure 11. Distribution of Heavitree Breccia in buildings.

89, Fawn-weathered Sandstone

Fawn- or cream-weathered medium- to coarse-grained sandstone composed of subangular to subrounded close-packed grains of translucent quartz and orange/yellow more chalky feldspar or stained quartz with, typically, some lithic fragments some of which are green, in sparse cement, is given this material code. Some blocks are homogeneous and lack a bedding fabric; some are finely laminated by colour, composition and resistance to weathering. The rock has an open texture where the individual clastic grains are separate and distinct and the matrix is very sparse or absent, making the rock both porous and permeable. However, some examples have a matrix of coarse-grained sparite single crystals which may enclose the clastic grains.

Bedding is present in most blocks and some are cross-bedded. In some cases, the bedding is oblique to the tops and bottoms of the blocks and these are interpreted as foresets of a generally cross-bedded rock–type.

It is not clear in hand specimen whether the orange grains are stained quartz or feldspar and both may be present in different examples of this rock-type. However, the association of a scattering of orange grains distributed among translucent ones which are clearly of quartz is very characteristic of this rock-type and, combined with its marked lack of matrix, is quite distinctive.

Sandstone assigned Code 89 is indistinguishable from the fawn-coloured parts of red-and fawn mottled sandstones from each of the Otter Sandstone, sandstone bands within the Exmouth Mudstone and Sandstone Formation, and the Dawlish Sandstone. Fawn sandstone is very frequently associated with these mottled rocks or with red sandstone that can more confidently be assigned to one or other of these formations. The building stone may therefore come from any of these formations or indeed from sandstone bands within the breccias of the Exeter Group. There is no doubt, in these cases, that the rock-type is derived by reduction of the ferric iron of the pigment of the red sandstones by the passage of reducing formation waters. There is very clear evidence of this exposed in the cliffs of Otter Sandstone west of Sidmouth (Figures 1 & 2). It is remarkable that the characteristics of the rock-type should be so specific with regard to the composition and appearance of the clastic grains given that it appears to have such diverse origins. Alternatively, the stone may be drawn from just one of these formations of which the Otter Sandstone is the most likely. Where used in association with red sandstone of whatever stratigraphic interval, fawn sandstone tends to be of better quality and in some cases to be used exclusively for the quoins or dressings where red sandstone is used for the rubble walling.

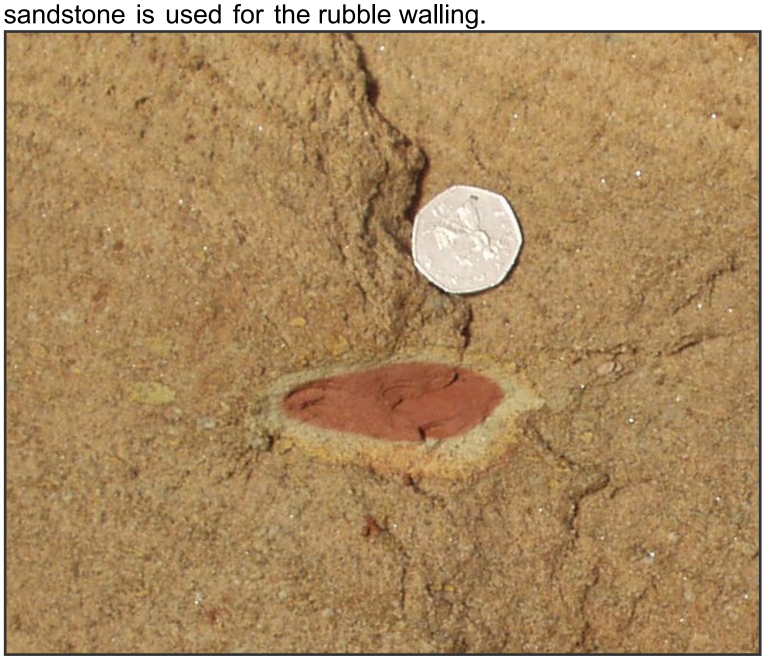

Figure 1. Fawn sandstone band of Figure 2 with red mudstone inclusion. The leaching out of the ferric iron pigment round the edge of the inclusion demonstrates that the fawn sandstone is derived from red sandstone by reduction of ferric to ferrous iron and its removal in solution by the passage of formation waters.

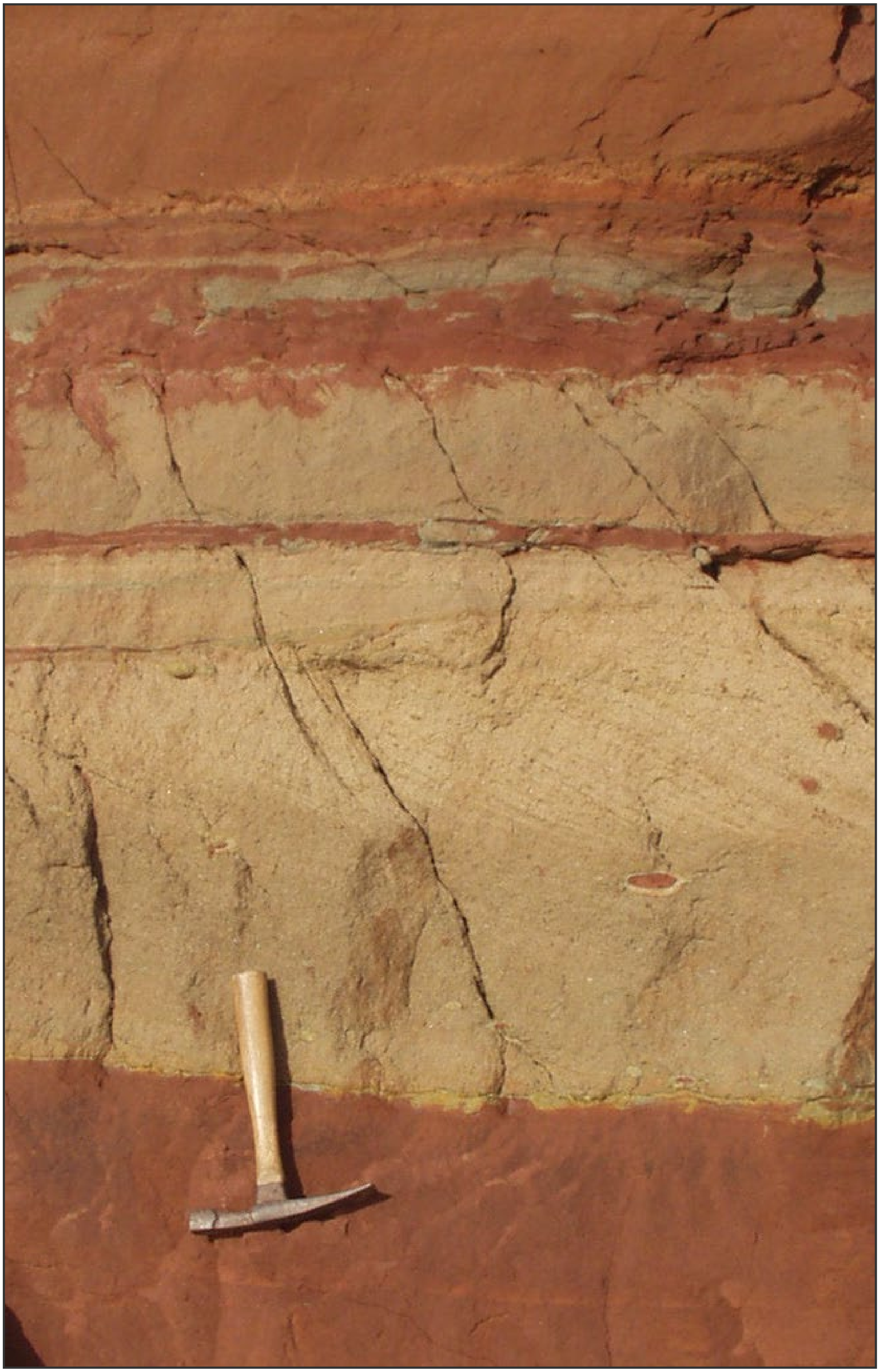

Figure 2. Cross-bedded band of fawn sandstone enclosed by finer-grained less permeable red sandstone. Cliff exposure, west of Sidmouth. Note the red mudstone inclusion to the right and above the hammer.

Figure 3. Wall outside the church gate, Woodbury. Stepped construction of fawn sandstone at the base followed by brick, then “Budleigh Buns” with a slate coping (according to the listed building citation but not visible in the photograph).

Figure 4. St Lawrence' church, Lydeard St Lawrence, north porch and north aisle. Fawn, slightly pink sandstone.

Figure 5. City wall, Exeter. The nearer part is composed of a mixture of Heavitree Breccia (red), Exeter volcanics (purplish grey) and fawn sandstone. In this case, it may be that the sandstone is Salcombe Stone (Code 14) rather than being won from older formations.

Figure 6. Roadside wall, Dawlish Warren. The closer part of the wall is made of easily eroded fawn sandstone. The further part is of limestone from Torbay.

Figure 7. Coarse-grained sandstone, east end of St Michael's church. Creech St Michael.

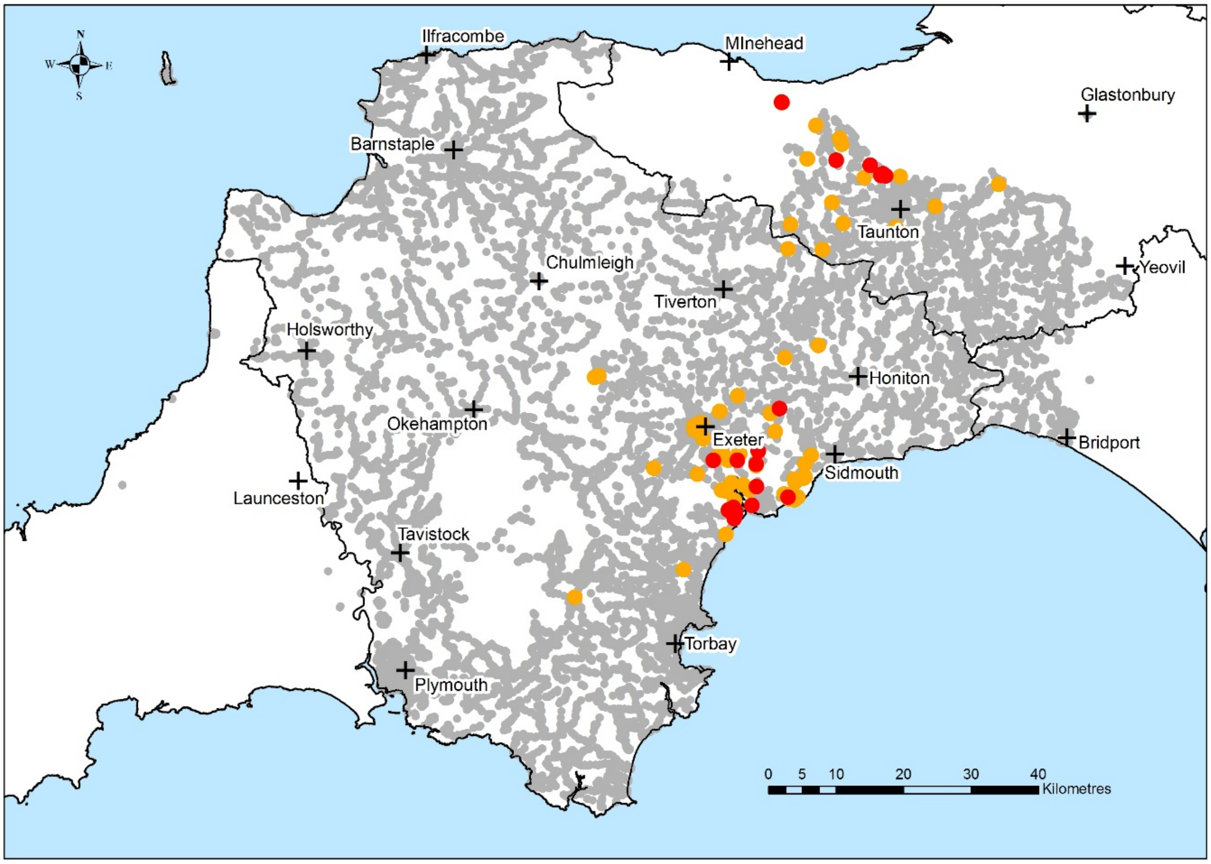

Figure 8. Distribution of fawn sandstone in buildings. Red symbols, fawn sandstone is the main building material; orange symbols, building contains some fawn sandstone; grey symbols, building lacks fawn sandstone.

Figure 8 shows the distribution of this kind of building stone. With few exceptions, this is entirely consistent with a source in the Exeter Group or Otter Sandstone. However, it has to be said that the rock-type is not very distinctive and various sources have been suggested by masons met along the way, including Carboniferous stone from the north of England.

90, Thatch

The convention followed in the database is that the coping of walls is entered in the Dressings1 and Dressings2 fields of the table that contains descriptions of buildings. This is the reason why thatch appears as one of the building materials of walls and embankments. There are just 9 of these occurrences in the database, widely scattered across the county. Figures 1-3 show some examples. For other kinds of building, thatch is entered exclusively in the "Roofs" field.

Figure 1. Place Court, Colaton Raleigh. The wall is of cob full of the burrows of solitary bees, on a footing of "Budleigh Buns".

Figure 2. Street scene, Dunsford (Britton Street Lane).   The wall on the left-hand side of the road in the distance is likely of rendered cob with a thatch coping.

Figure 3. Boundary wall of Pollards, Yeoford. Rendered cob on a tall footing of Exeter volcanics.

91, Amphibolite (altered basic igneous rock)

Lithology Code 91 is applied to building stone composed predominantly of hornblende and plagioclase that lacks obvious inhomogeneities and is believed to originate as a basic intrusive rock. The stone is typically dark green, locally bluish green, composed of medium-grained hornblende and plagioclase with or without chlorite. Some examples are epidotic and at least one example is composed exclusively of chlorite and appears to be ultrabasic in composition. In some examples, the proportion of plagioclase exceeds 60 per cent and invites comparison with dolerite of Trusham type (Code 165, qv).

Most of the examples in East Devon are described in the field notes as diorite, composed of medium-grained aggregates of dark green hornblende with, in a few cases, biotite also, set in lighter green plagioclase (Figures 1 - 3). Stone of this kind does not occur elsewhere and it may be that this diorite was imported to Topsham from a distant source, for example, the Lizard, as ballast on the wool ships.

Elsewhere, the stone is accurately described as amphibolite as it is commonly described in the legends of the BGS maps of the area of study. It is generally a dark grey, blue-grey or greenish blue rock, mostly unfoliated or poorly foliated in which it is hard to resolve individual mineral grains. Some examples contain relict phenocrysts (Figures 4-6) but these are usually absent. Some coarse-grained examples are speckled with parts rich in plagioclase or hornblende. Building blocks tend to be irregular in shape and of moderate size. The stone is usually subordinate to other rock types reflecting perhaps its lowly qualities as building material (but see reference to the valley of the R. Tavy below).

There are obvious opportunities for confusion with dolerite of Trusham type (Code 165) and Devonian volcanic rocks forming part of the succession of the South Hams (Code 161). Rocks coded 91 are distinguished from Trusham-type dolerite through having hornblende rather than pyroxene as the main dark mineral, and from chlorite and hornblende slate assigned code 161 through being less well cleaved, much more homogeneous and entirely lacking in textures suggesting an extrusive origin such as amygdales, compositional banding or fragments of devitrified glass.

It is likely that much of the amphibolite is derived from dolerite of Trusham type through recrystallization during deformation and it may be that some represents homogeneous parts of basic lava with an origin that links it to other volcanic rocks of the South Hams coded 161. Large bodies of altered gabbro coded 91 composed of coarse aggregates of plagioclase and hornblende are the source of the main building stone of the valley of the River Tavy and of both Mary Tavy and Peter Tavy, including the parish churches of both villages (Figures 8 and 9). These and similar rocks coded 91 here, are described in the legends of the BGS mapping as “metamicrogabbro”. The occurrence on Lundy is likely to be derived from a Tertiary dyke many of which cut the Lundy Granite.

It is also difficult to distinguish some of these rocks from schorl, hornfels and Crackington Formation sandstone, all of which may be dark, with unresolvable mineral grains in hand specimen. This group of basic igneous rocks is not a common constituent of buildings but it is widespread south of a line joining Exeter to Lifton.

Figure 1. Garden wall, Woodlands, Globefields, Topsham. Grey and dark green-grey blocks of basic igneous rock in a wall mainly of pale grey limestone imported from Torbay.

Figure 2. Roadside wall, Monmouth Hill, Topsham. Hornblende gabbro (dark blue) with subordinate biotite gneiss (pale grey).


Figure 3. Roadside wall, Exe Street, Topsham.

Figure 4. Embankment on north side of Exeter Rd, Ivybridge, adjacent to Marshalsfield. Fine-grained amphibolite with lenses of plagioclase, perhaps representing deformed and recrystallised phenocrysts.

Figure 5. Dark grey amphibolite with acicular phenocrysts of plagioclase, St John’s church, Ivybridge.

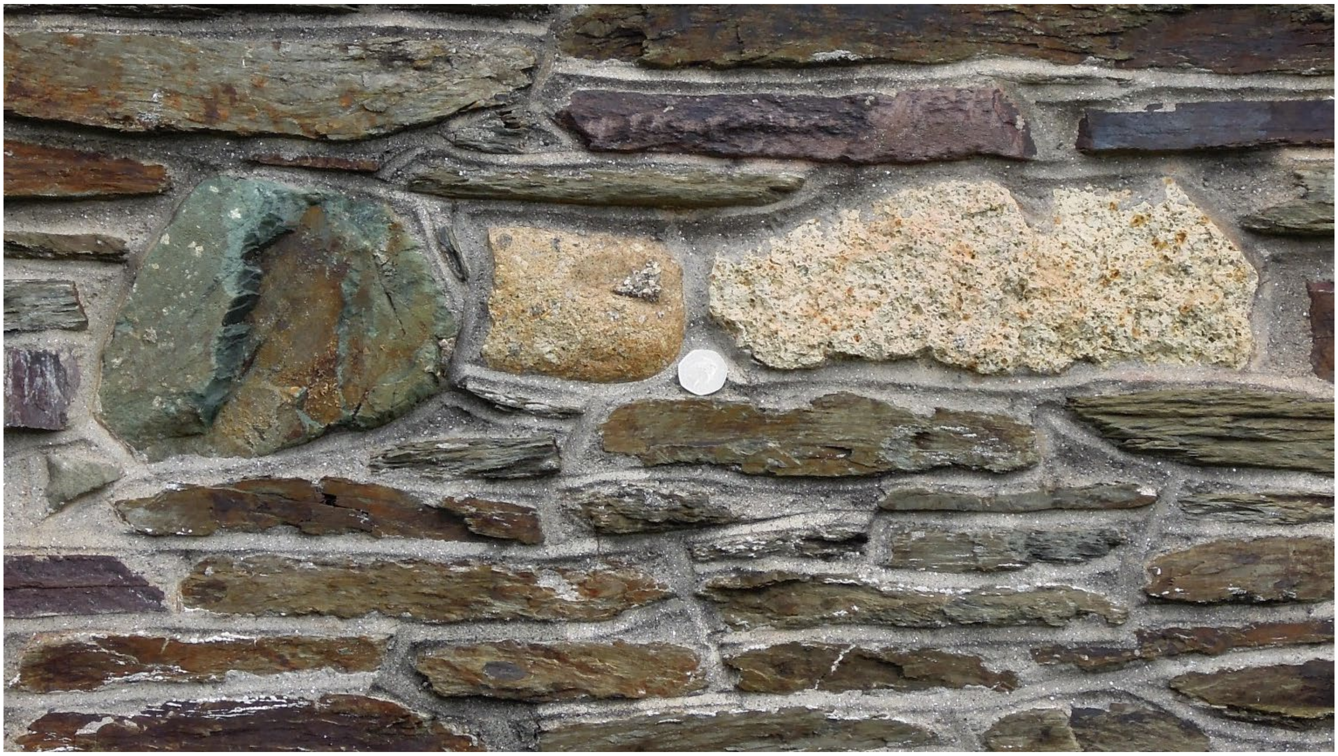
Figure 6. Green-blue block of amphibolite with visible white plagioclase phenocrysts (centre left), pale yellow quartz porphyry and dark hued slate, south transept of St Peter and St Paul’s church, Ermington.


Figure 7. Amphibolite with adhering patches of pale plaster. Outbuilding, Roman Way, Plymouth.


Figure 8. Chancel of St Peter's, Peter Tavy. The walling is of altered gabbro coded 91. The window dressings are of granite and Roborough Stone and the quoins of granite.


Figure 9. Parapet of the bridge over the Mill Leat in the centre of Peter Tavy. The coping is of Dartmoor granite.

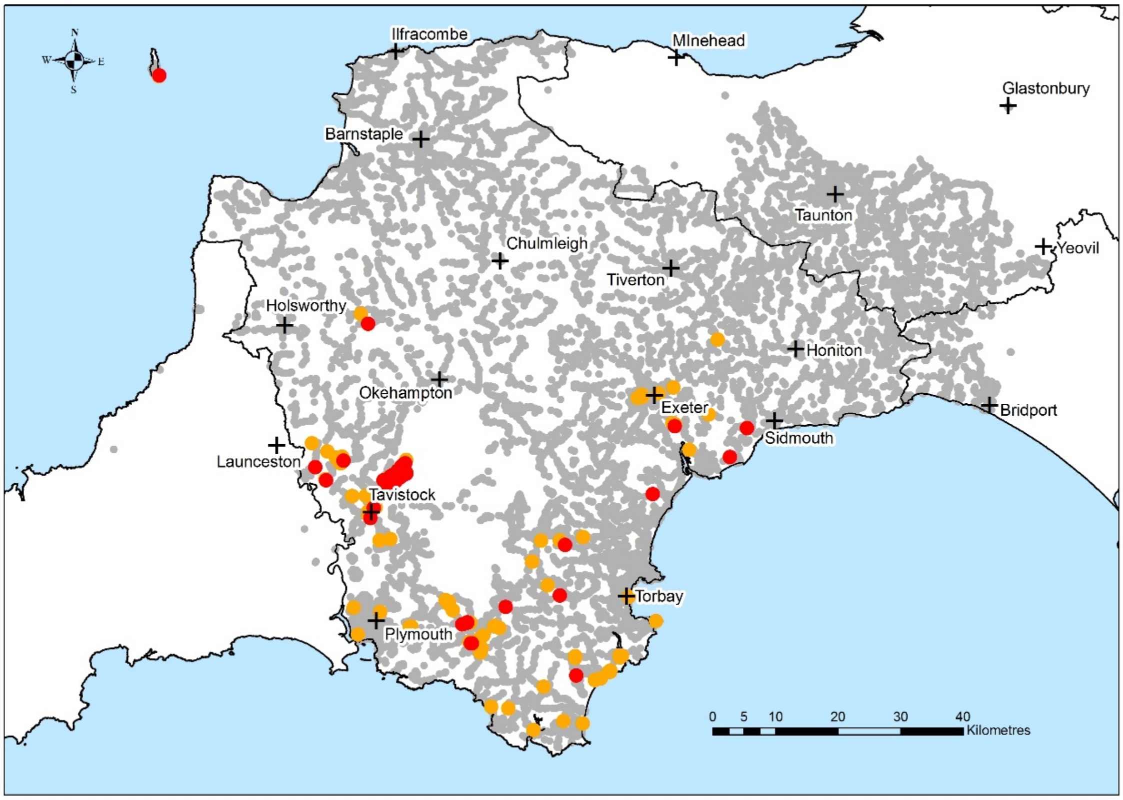

Figure 10. Distribution of altered gabbro and amphibolite in buildings. Red symbols, amphibolite is the main building material; orange symbols, building contains some amphibolite; grey symbols, building lacks amphibolite.

92, Dark Red Sandstone

This building-stone type is defined by a small group of just 4 observations. The stone is described as very dark red or blackish homogeneous sandstone composed of medium-grained subangular quartz grains, well sorted, with some orange grains, set in sparse cement. The occurrence at Obs. 6190 looks like gossan or sandstone contaminated by slag (Figure 1) and is perhaps derived from an Iron Age bloomery nearby. The occurrence in the chancel wall of the church of St John in the Wilderness in Exmouth is more likely to be a variant of the Exmouth Sandstone and Mudstone Formation sandstone of which the church is mainly made. The occurrence near Mary Tavy (Obs. 29743) may be a gossan associated with mineralisation peripheral to the Dartmoor Granite. Further work is required but for the time being the code has been left to stand.

Figure 1. Roadside wall at Fulwood, Somerset. The stones of the coping at the right and left of the photograph are of dark red gossanous sandstone.

93, Slate from the Morte Slate Formation

The predominant rock-type used for building in the north-east of the area of study (Figure 8) is a cleaved siltstone or sandy shale/slate (Code 93 – Figure 1). The rock has a strong cleavage (Figure 2) but is not so strongly recrystallised that new minerals e.g. muscovite can be identified. The body colour is drab olive green to blue-grey with a hint of turquoise but weathered partings and joints are reddish brown to dark brown, ochreous or purplish. The composition is mainly of quartz - the rock has a psammitic composition - with subordinate clay minerals and micas. Fine banding and lamination preceding the cleavage are visible in some blocks, especially where the cleavage is oblique to them in which case they form prominent colour banding on the cleavage surfaces. Sandstone bands up to 2cm thick are present in many building blocks. In other blocks a phacoidal structure, of lozenge-shaped more competent parts formed by the intersection with and disruption of the bedding by the cleavage is present, set in a matrix of the more shaley material, developed by the break up of interlayered more competent sandy and less competent shaley layers (Figure 1). In still other examples, the bedding is the main planar fabric even where the cleavage, developed in the more micaceous layers, is oblique to it. Some of these blocks form large slabs up to one metre in long dimension.

Small-scale cross bedding has been observed in many examples of the less strongly cleaved slate. Cross-beds are typically 1-3cm thick. In other examples, bedding surfaces show undulations that closely resemble ripples; however, it is not clear in every case that this is their origin and similar structures caused by the trace of the cleavage on the bedding surfaces have also been observed.

The Morte Slate used for building around and to the north of Wiveliscombe generally lacks sandstone bands, is pelitic in composition, has regular planar cleavage and seldom shows evidence of cleavage oblique to the bedding planes. It is very probable that this variety of slate comes from Oakhampton Quarry where much of the production was used for roofing slate. Further north in the Brendan Hills, the rock-type of the Morte Slate becomes more similar to the material won from the Quantocks.

Reviewing the photos of Morte Slate and the associated sandstone adjacent to the Quantocks one is struck by the predominant red pigmentation of the stone (eg Figure 1). This has been largely explained by weathering at the surface. It is thought not to be an intrinsic property.

Experience based on examining buildings in north Devon around Ilfracombe requires some amplification and modification of this description. In north Devon, the Morte Slate and its associated sandstone is weathered grey not red (eg Figure 5). The fresh body colour is predominantly grey-green in most examples where it can be observed but weathered material, which is in the overwhelming majority in the walls of buildings is grey (eg Figures 2, 3, 5, 7). Exceptionally, slate showing buff, ochre, purple, pink, orange, red, yellow or variegated colours has been observed. It is clear that the colour of the stone in buildings is a poor guide to its source formation. Fine banding or lamination has been observed in a few places.

The slate in these western occurrences tends to be better cleaved and more pelitic that that used further east. The slate is described predominantly as pelitic or semi-pelitic. Cleavage planes are lustrous or silvery and the stone in some buildings is described as phyllite.

An association with sandstone, coded 96, is extremely common and the two rock-types occur together in many walls. The association of this sandstone with Morte Slate is one of its defining features. Vein quartz is also common. Because of its strong cleavage, embankments may be made of this stone laid on edge or in a herring bone pattern (Figures 4, 6 and 7).

Morte slate is distinguished from slates of the Ilfracombe Formation by a somewhat more psammitic or semi-pelitic rather than pelitic composition, darker grey weathered surfaces and absence of calcareous slates which give the latter in places a dusty appearance. However, it has to be admitted that there are many opportunities for confusion between these groups because of lithological similarity.

Figure 1. Typical Morte Slate, St John's church, Durston.

Figure 2. Lytch gate and coffin rest of St Mary's, Cheddon Fitzpaine. The roof covering is of thin bedded Ham Hill Stone.


Figure 3. St Mary's, Cheddon Fitzpaine. The red and yellow building blocks are of Otter Sandstone and Ham Hill Stone respectively. The balance are of Morte slate, some laid with cleavage parallel to the plane of the wall.


Figure 4. Roadside wall, Langley Marsh. Strongly and regularly cleaved slate from Oakhampton Quarry.

Figure 5. Packhorse bridge, Challacombe. The parapet is made of poorly cleaved slate weathered dark grey.

Figure 6. Wall of Morte Slate laid in a herring-bone pattern. Roadside wall, Arlington village.

Figure 7. Boundary wall, Yarde Farm, near Mortehoe

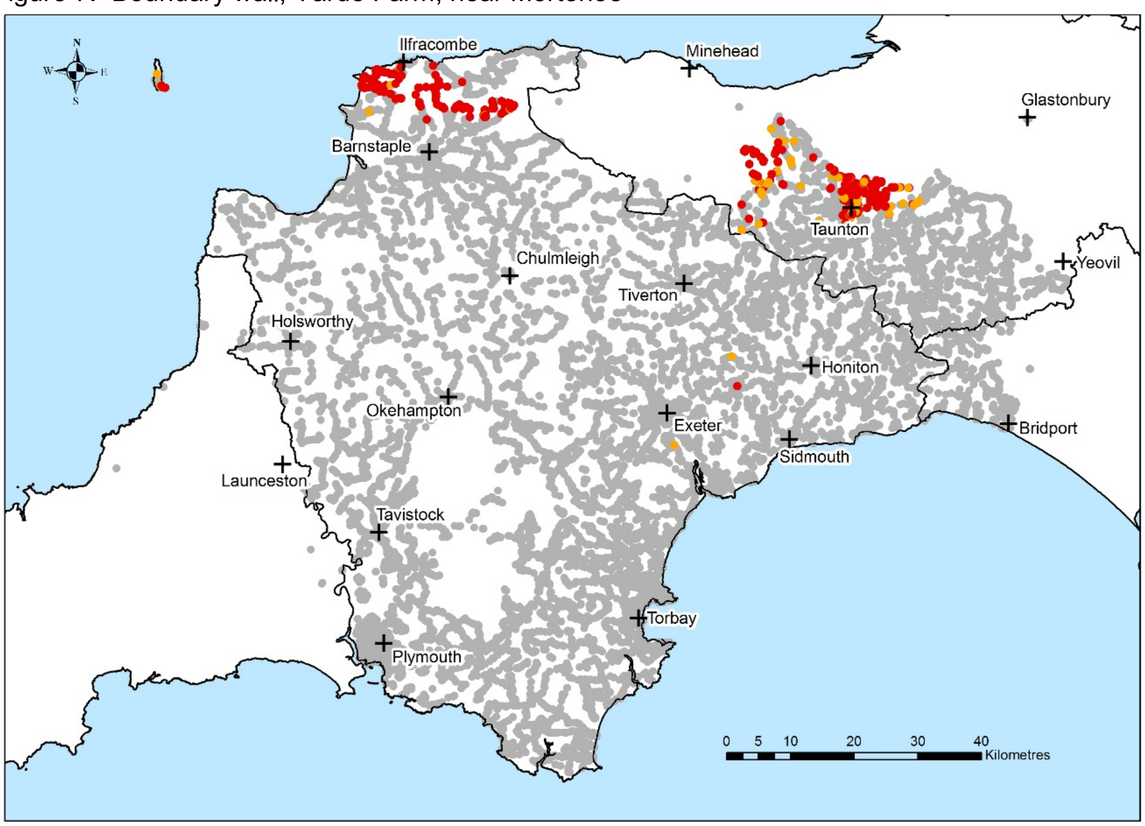

Figure 8. Distribution of Morte Slate in buildings. Red symbols, the slate is the main building material; orange symbols, building contains some Morte Slate; grey symbols, building lacks Morte Slate.

94, Vein Quartz

Crystalline quartz from veins in the Devonian and Carboniferous rocks of the area is used sparingly as a building material, subordinate to other kinds of stone (Figure 1) and in a few cases has been used as a decorative finish for the coping of garden walls (Figures 2, 3 and 5). The quartz is generally white in colour and coarsely crystalline. It can be distinguished from calcite by its hardness which is greater than that of steel so that the mineral is not scratched by a knife. Vein quartz is unlikely to have been quarried specifically for use as a building stone. In some cases it has been incorporated in walls along with the enclosing country rock; in others, it has probably been collected as cobbles and boulders from the land surface or stream beds; this applies particularly in cases where it originates as clasts in the breccias and conglomerates of the Permo-Triassic succession.

Its distribution is not uniform across Devon but is concentrated in the north, west and south, reflecting the frequency of veins of quartz in the country rocks (Figure 7).

Figure 1. Abraded cobble of white vein quartz in a roadside wall mainly composed of purple porphyry and pale grey limestone, Dawlish Warren.

Figure 2. Boundary wall, the Old House, Compton. The wall is of medium-grey limestone. The coping is of vein quartz.

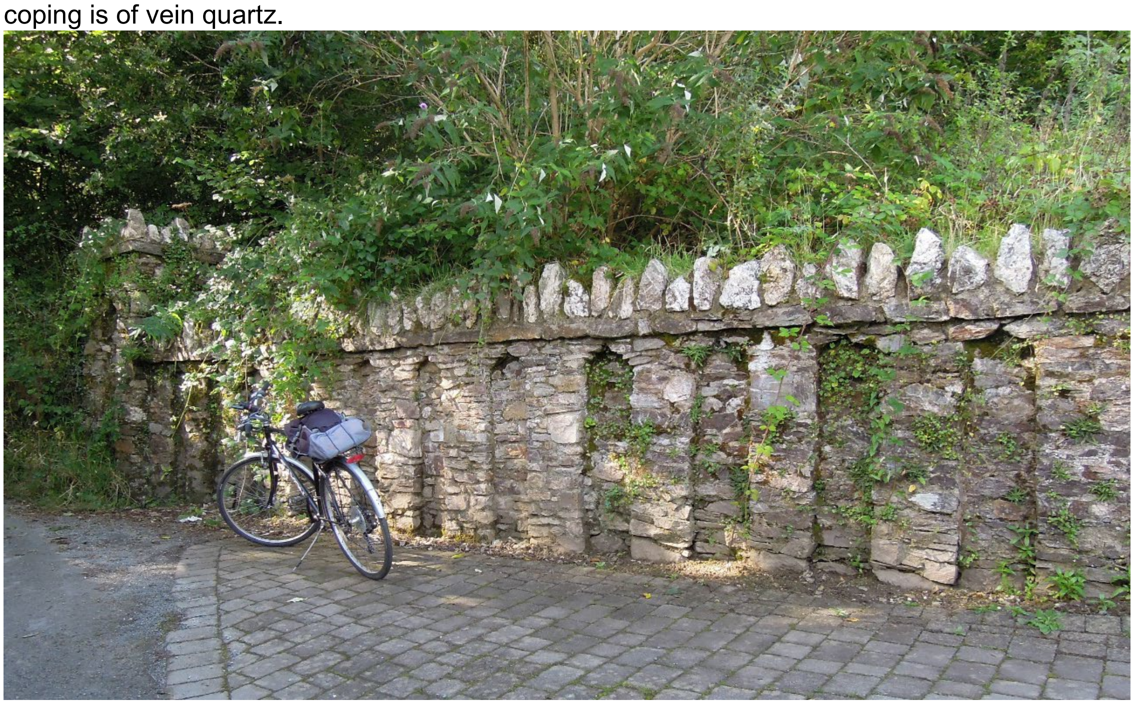

Figure 3. Entrance wall to Hazelwood Farm, near Brownston, South Hams, composed of slate from the Meadfoot Group with decorative vein quartz coping.


Figure 4. No 11 Malborough Road, Ilfracombe. Vein quartz used as a decorative band above the first floor of the house and as edging to the front border.

Figure 5. Vein quartz coping of the wall in front of Rosebank, Bannawell Street, Tavistock.

Figure 6. Vein quartz boulders used as signposts, B3362 between Milton Abbot and Dunterton.

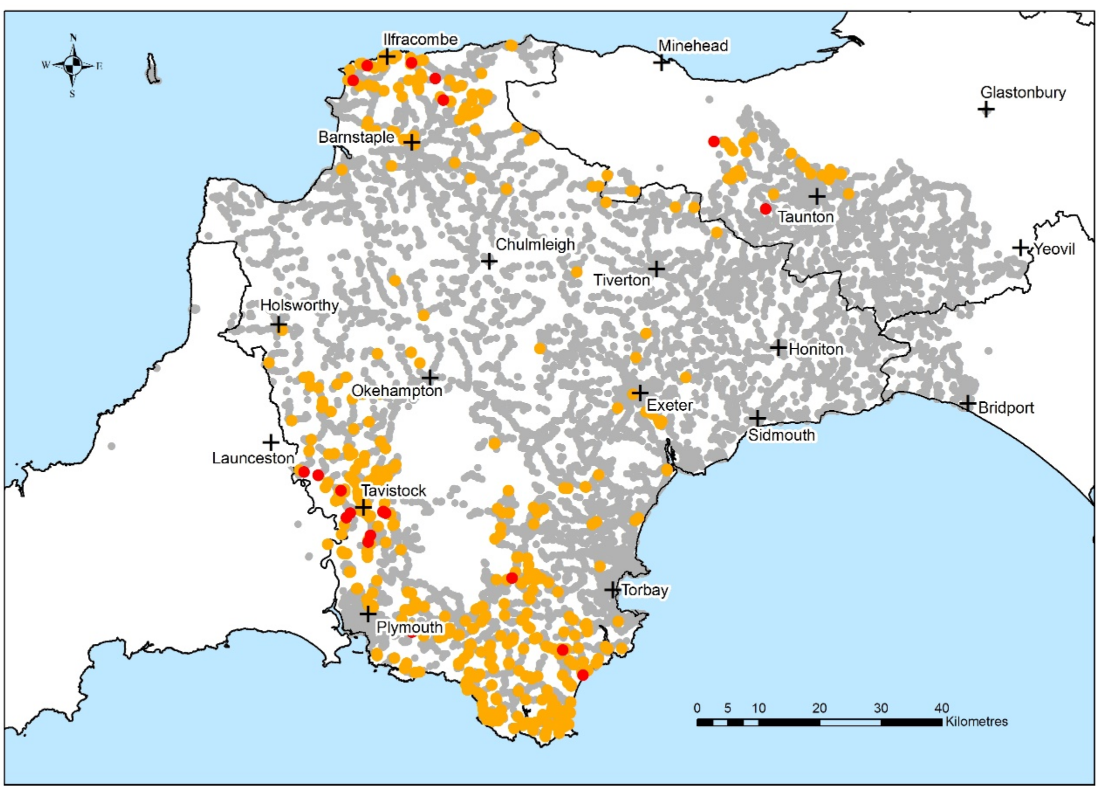

Figure 7. Distribution of vein quartz in buildings. Red symbols, quartz is the main building material; orange symbols, building contains some quartz; grey symbols, building lacks vein quartz.

96, Sandstone from the Morte Slates and Ilfracombe Formation

Considerable difficulty was encountered in deciding on the source formations of the sandstone used for building in the extreme north-west of Devon, north of Woolacombe and west of Combe Martin. The area is underlain by the Morte Slate and the Ifracombe Formation. The former contains a small proportion of sandstone especially towards the base (Edmonds *et al*., 1985) while the latter has sandstones of different aspects in all of its constituents. This diversity is expressed in the building sandstone of the area which shows considerable variation. It therefore has not been possible so far to distinguish between sandstone used for building taken from the Morte Slate and that from the Ilfracombe Formation and both have been assigned Code 96. The situation north of Taunton and in the Vale of Taunton Dean, where both formations also occur, is simpler because the Ilfracombe Formation does not appear to have contributed any sandstone to the local buildings.

Around the Quantock Hills, in a large proportion of the walls in which Morte Slate occurs, it is accompanied by blocks composed of grey, and greenish grey sandstone weathered brown on exposed surfaces. In some cases, the sandstone is micaceous and may be cleaved but in many cases it lacks platy minerals, is homogeneous, without orientated fabric and has a conchoidal fracture, with concentric undulations surrounding the point of the impact which broke the rock apart. These sandstones lack any very distinctive features that might permit their assignment to a specific stratigraphic interval; grey sandstones, more or less micaceous are present in several different parts of both the Devonian and Carboniferous successions. Where such sandstone occurs in association with the Morte Slate, it has been assigned Code 96. It is taken to represent sandstone bands within the predominantly slate succession and can be matched with such bands visible in quarries in the Morte Slate of the Quantock Hills. However, it has to be said that sandstone bands are not commonly described in the BGS memoirs covering the Morte Slate and were seldom observed in outcrop during the course of the study.

The building sandstone of northwest Devon shows a wide variation in lithology. Grey and dark grey sandstone with brown-weathered surfaces forming medium-sized more or less equidimensional blocks (described as 'blocky' in the field notes) is prominent west of Ilfracombe towards Mortehoe (Figures 1 and 2). Buff and grey, medium-grained sandstone forming relatively large equidimensional blocks and in some cases micaceous, is widely used in and around Ilfracombe (Figures 3 and 4). Green, pale grey and brown medium-grained sandstone occurs in Combe Martin and may show bedding or colour lamination (Figure 2). It is perhaps from the same localities as Combe Martin Stone (Code 213,qv). However, the sandstones coded 96 show a wide range of characteristics and it is something of a coding of convenience for a range of different kinds of sandstone used for building in Ilfracombe and Combe Martin. Moreover, much of the stone given this code is medium grained, broadly grey in appearance and lacks distinguishing features other than those that permit differentiation from the Hangman Grits. In those cases where it is associated in a building with slate from the Morte Slate or Ilfracombe Formation, a significant proportion of occurrences, the attribution of Code 96 is perhaps more firmly founded.

The various sandstones used for building in this part of Devon have been differentiated as follows:

- Code 169. Very coarse-grained sandstone from the Hangman Grits. The sandstone in and to the west of Parracombe is given this code.
- Code 96. This is extended to cover grey sandstone in the Ilfracombe Formation (except Combe Martin Stone) as well as that in the Morte Slate. Sandstone associated with Morte slate or slate from the Ilfracombe Formation is given this code.
- Code 133. This continues to be restricted to the Hangman Grits but the distinction between the Hangman and the sandstone coded 96 in buildings is not very well founded.
- Code 213 (Combe Martin Stone). This is sandstone from the Ilfracombe Formation that has original red pigmentation and can be relatively easily distinguished from other sandstone from that formation.

Figure 1. Grey sandstone (Code 96) probably from the Ilfracombe Formation. The coping is of slate, likely from the same source. South side of Portland Street, Ilfracombe.

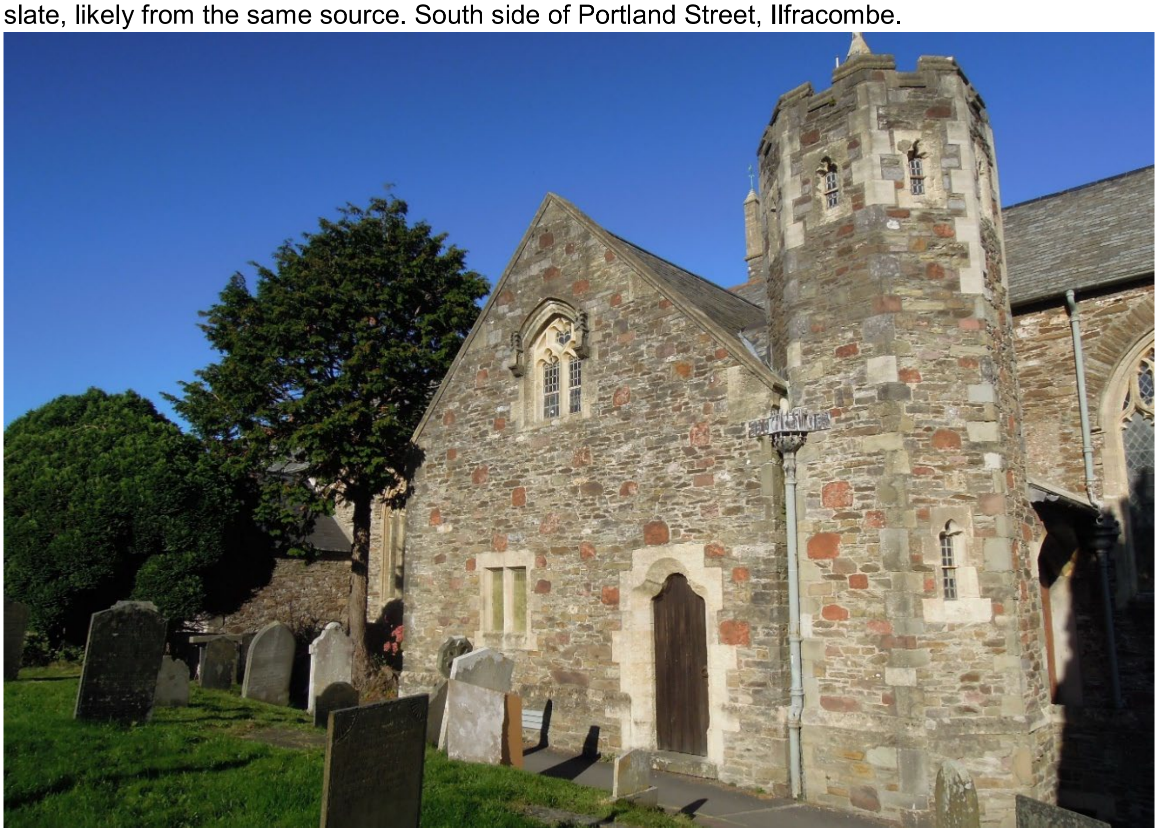

Figure 2. South side of Holy Trinity Church, Ilfracombe. Larger decorative blocks of red sandstone (Code 213) set in a mixture of grey-buff sandstone (Code 96) and slate (Code 93).

Figure 3. St Phillip and St James' church, Ilfracombe. The buff colour and large size of the sandstone blocks are typical of some stone from the Ilfracombe Formation.

Figure 4. The porch of Christ Church, Parracombe. Grey and buff sandstone similar to that in Figure 3.

Figure 5. Embankment, south side of North Morte Road, Mortehoe. Compare with Figure 3.

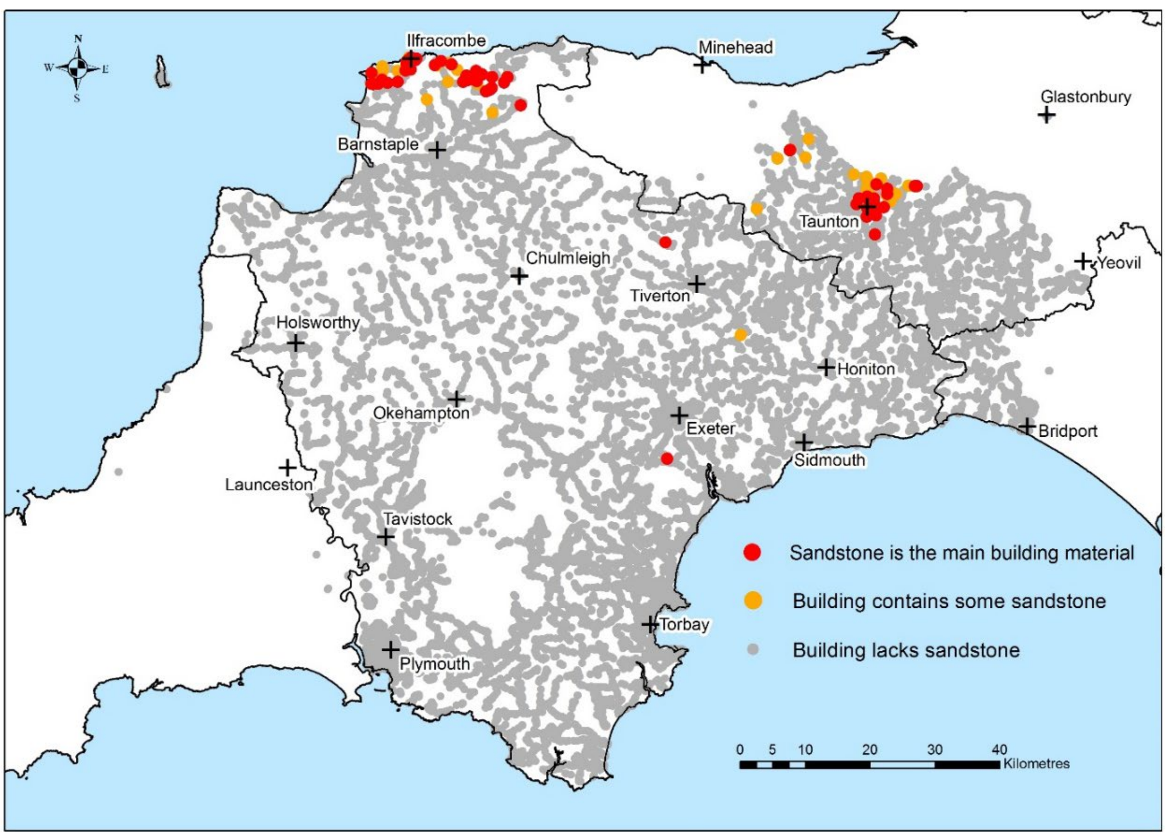

Figure 6. Distribution in buildings of sandstone from the Morte Slate.

98, Pickwell Down Sandstones Formation

This sandstone has been observed in three contrasting varieties, 1) as used on the edge of the Brendan Hills north from Ashbrittle to, and especially around, Wiveliscombe, 2) the main zone along the outcrop from Dulverton to Woolacombe and 3), used for the quoins and dressings of high status buildings, especially parish churches in central north Devon as far south as Lapford (Figure 12).

Ashbrittle to Wiveliscombe. Building stone from the formation is distinguished by rather dark colours, especially red, purple, brown and grey but with red predominating. Blocks may be approximately equant with irregular outline and irregular to hackly fracture (never conchoidal) or slabby with or without accompanying banding or lamination. The pigment is the colour of the unweathered rock and this serves to distinguish the Pickwell Down sandstone from other Devonian and Carboniferous sandstones at the Permian unconformity which may also be mainly red, but where this is a Permian staining or weathering effect and tends not to affect the full thickness of unfractured rock.

The sandstone is typically medium-grained; many blocks are cleaved and some parts are described as psammitic slate. The bedding and lamination is less well marked than further west. The code has been used also for hard sandstone probably with a siliceous cement characterised by small voids elongated in the bedding.

Main outcrop zone. The sandstone is characterised by variegated colours and strong bedding and lamination (Figures 1 and 2). The colours include dark grey, greenish grey, red, pink, maroon and fawn. Very characteristic is a dark grey pigmentation with a tinge of ***violet*** and where this can be seen the identification is well based (Figures 3 and 4). The strong bedding varies between 30cm and millimetre scale and is defined by colour and grain size. Some intervals up to 10cm thick have ripple-drift cross bedding (Figures 5 and 6). However, the expression of bedding is quite variable depending on the nature of the exposure and some blocks appear homogeneous and lacking in banding (Figure 7).

The sandstone is medium- to coarse-grained and is micaceous in many blocks. Where mica and other unidentified platy minerals are plentiful, the sandstone grades into psammite and both sandstone and psammite are interbedded with subordinate slate. The bedding fabric is usually preserved but in some cases, especially where the cleavage is oblique to the bedding and platy minerals are more abundant, it is disrupted, forming lozenge-shaped aggregates richer in quartz surrounded by more micaceous envelopes. In any case, even quite pure sandstone bands are somewhat micaceous and tend to be foliated throughout their thickness.

Blocks tend to be of medium to quite large size and to be slabby, that is thin across the bedding or cleavage compared to the other dimensions (Figure 8). This tendency has led to walling made of thin slabs of sandstone laid on edge, a method of building mainly reserved for slate in Devon (Figure 3).

Pickwell Down Sandstone is distinguished from Crackington and Bude sandstones by stronger bedding, variegated colours and penetrative foliation that extends through the thickness of the rock. It can be confused with sandstone lower in the Devonian sequence but these tend to be uniformly grey and/or have much thicker bedding. It may be difficult to differentiate from rock from other formations especially sandstone and even mudstone from the Pilton Mudstone Formation where the colour is obscured by surface weathering, dirt or lichen.

North central Devon. Very large slabs of Pickwell Down sandstone are used for the quoins and dressings of medieval churches outside the zone where it is used more generally, especially on the outcrop of the Crackington and Bude Formations where the local stone is of poor quality and more decorative and stronger stone has been sought for these important parts of the buildings. The stone resembles Pickwell Down Sandstone from the main outcrop but individual stones tend to be very large (Figure 9) and in many cases are set on edge with bedding vertical so as to take advantage of their slabby nature (Figure 10). In nearly all the examples seen, the sandstone is well foliated. It displays the same range of colours as the stone in the main outcrop zone with greenish and purple varieties standing out particularly strongly against the background of grey Bude and Crackington sandstone used for the ordinary rubble walling. The parish churches of Rackenford, Lapford, Rose Ash, Mariansleigh, Knowstone, the Ansteys, Chulmleigh, North and South Molton and Chittlehampton make use of the stone.

As well as being used for many of the parish churches in North Devon, Pickwell Down sandstone is also the stone used for the main part of Arlington Court (Figure 11) built in the nineteenth Century and now owned by the National Trust.

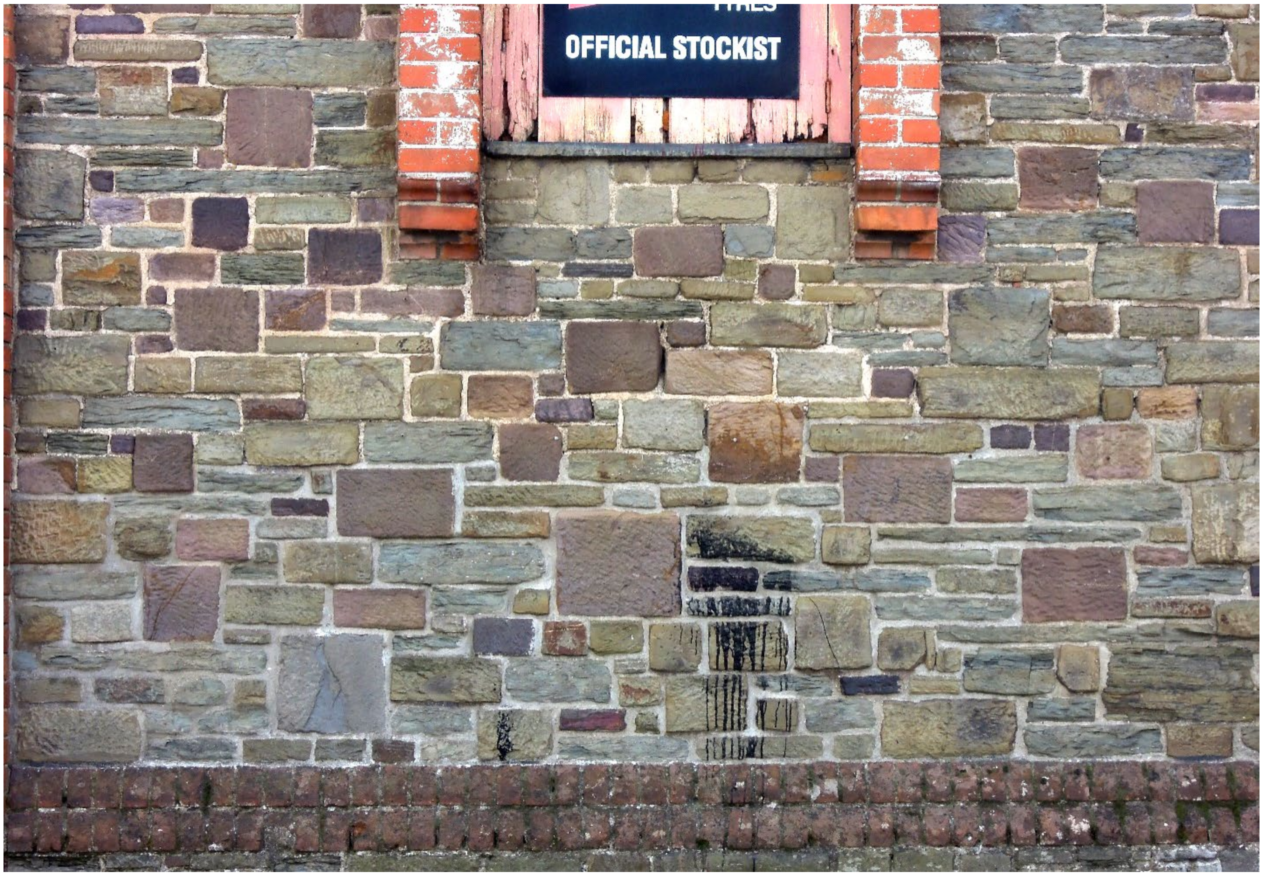

Figure 1. Part of Teapes Tyres, adjacent to Yeo Valley Primary School, Derby Road, Barnstaple showing the wonderful range of colours in this sandstone.

Figure 2. Variegated sandstone, house adjacent to lych gate, Bank Square, Dulverton

Figure 3. Cleaved sandstone with violet pigmentation, laid on edge; embankment to Northmoor Road, Near Dulverton.

Figure 4. Springfield Lodge, Marwell, External walls composed entirely of dark purple sandstone.

Figure 5. Pink and green fine-grained sandstone showing ripple-drift cross bedding. St Peter's church, Twitchen.

Figure 6. Ripple drift cross-bedded sandstone, chancel of St Hieritha's church, Chittlehampton. The stone has been laid upside-down. Width of view, 30cm.

Figure 7. Red, pink and purple sandstone, St Sabinus' church, Woolacombe.


Figure 8. Variegated sandstone, garden wall of Myrtle Cottage, 1.5km south of Fremington.

Figure 9. Large blocks of Pickwell Down sandstone lining the niche for a statue, Tower of St Thomas of Canterbury's church, Lapford. The rest of the wall is made of sandstone from the Bude Formation.

Figure 10. South porch of All Saints, North Molton. The door jambs are made of single slabs of purple cross-bedded sandstone set on edge, a very common usage of the stone in the dressings of medieval churches.

Figure 11. Arlington Court. This wing is composed of purple and green Pickwell Down Sandstone ashlar.

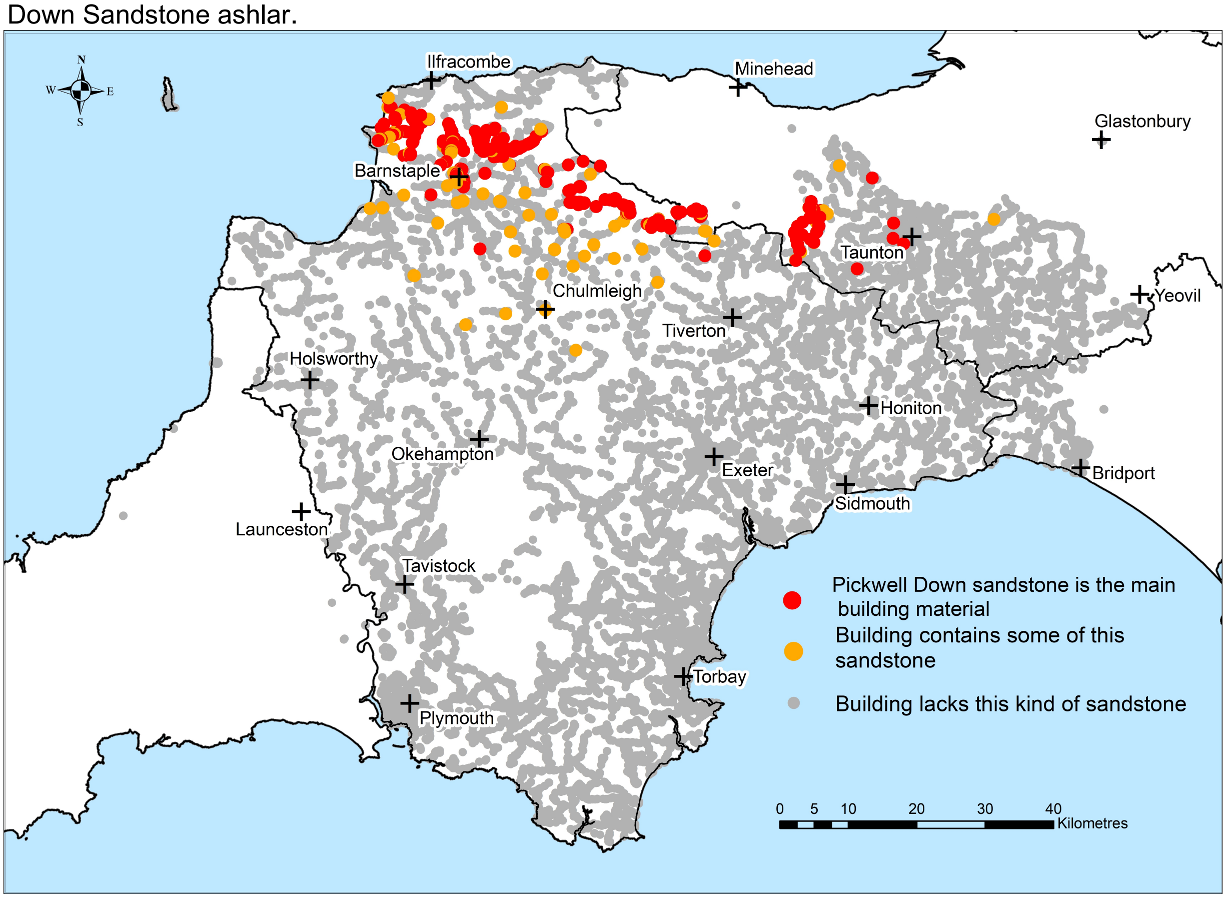

Figure 12. Distribution of Pickwell Down sandstone in buildings.

Figure 2. Stratigraphic distribution of Material Codes

	A	B	C	D	E	F	G	H	I	J
1		**Stages**	**Epochs, Series**	**West**	**South**		**Central &Teign Valley**	**North**	**East**	**Distant sources**
2	CAINOZOIC		Recent	Cob (10) and rendered cob (42); tile (76)	Cob (10) and rendered cob (42); tile (76)		Cob (10) and rendered cob (42); tile (76)	Cob (10) and rendered cob (42); tile tile (76)	Cob (10) and rendered cob (42); cemented river gravel (105); slag (126); tile (76)	Italian travertine (143)
3			Pleistocene					Beach rock - Saunton Stone (204)	Alluvium and colluvium (1, 2)	
4			Pliocene							
5			Miocene							
6			Oligocene							
7			Eocene						Clay-with-flints (1, 2); chert breccia (83)	
8			Paleocene					Lundy Granite (32)		
9	CRETACEOUS	Maastrichtian								
10		Campanian								
11		Santonian								
12		Coniacian							Beer Head Limestone Fm. and Chalk (2) incl. Beer Stone (3)	
13		Turonian								
14		Cenomanian								
16		Albian							Upper Greensand incl. sandstone various (29, 52, 84), Salcombe Stone (13), calcareous grit (14), Eggardon Grit (16) and chert (1)	
17		Aptian								
18		Barremian								
19		Valanginian								
20		Berriasian								Purbeck Marble (Durlston Fm, 102)
21	JURASS IC	Tithonian	Upper Jurassic							Portland Stone (60) and Portland Roach (37)
22										
23		Kimmeridgian								
24										
25		Oxfordian								
26									Oxford Clay	
27		Callovian	Middle Jurassic						Kellaways Formation	
28									Cornbrash	
29										
30		Bathonian							Forest Marble (19, 64 and 166)	
31									Fuller's Earth Formation	Bath Stone (20) and Caen Stone (214)
32									Inferior Oolite Group (15 and 18)	Doulting Stone (49)
33		Bajocian								
34										
35		Aalenian								
36										
37		Toarcian	Lower Jurassic	Ham Hill Stone (4)	Ham Hill Stone (4)		Ham Hill Stone (4)	Ham Hill Stone (4)	Bridport Sand Fm. (63, 68 & 107) incl. Ham Hill Stone (4 & 100).	
38										
39		Pliensbachian							Beacon Limestone Fm. Incl. Eype Mouth Limestone member (22) above and Marlstone member (66 & 99) below; assoc. siltstone (63 and 68)	
40									Dyrham Formation; shale and marl (6) and siltstone (63 and 68)	
41									Charmouth Mudstone Fm (6)	
42		Sinemurian								
43										
44		Hettangian							Blue Lias Formatiom (5,6, 34, 35, 74 and others)	
45										

Figure 2. Stratigraphic distribution of Material Codes

	A	B: Stages	C: Epochs, Series	D: West	E–F: South	G: Central &Teign Valley	H: North	I: East	J: Distant sources
46	TRIASSIC	Rhaetian	Upper Triassic						
47								White Lias Formation (27)	
48									
49								Mercia Mudstone Group incl. North Curry Sandstone (75) and limestone breccia (168)	
50								Sidmouth Mudstone Formatiom	
51			Middle Triassic					Otter Sandstone Formation - 80, 81, 82 & 89 (Helsby Sandstone Formation)	
52									
53			Lower Triassic			Sandstone from Capton Quarry (167)		Budleigh Salterton Pebble Beds (Chester Formation) - 36 &127; sandstone from Capton Quarry (167)	
54								Exmouth Mudstone and Sandstone Formation; sandstone (121)	
55	PERMIAN		Lopingian						
60			Guadalupian						
61									
63									
64			Cisuralian						
65									
66				Tough sandstone from the Exeter Group (144); Hatherleigh and Halwill Stone (154 &205)	Exeter Group including sandstone (144), breccia (85, 141, 151) and alkaline volcanic and hypabyssal rocks (Exeter Volcanics 79)	Exeter Group including sandstone (144), breccia (85, 141, 151) and alkaline volcanic and hypabyssal rocks (Exeter Volcanics 79); Hatherleigh and Halwill Stone (154 &205)	Exeter Group including sandstone, breccia (85) and alkaline volcanic and hypabyssal rocks (Exeter Volcanics 79 & 115); Hatherleigh and Halwill Stone (154 &205)	Exeter Group including sandstone (106 & 110), breccia (85, 120, 125), alkaline volcanic and hypabyssal rocks (Exeter Volcanics) 79 & 115; and associated tufa (111); porphyry (155); School Wood basalt (164)	
67				Dartmoor Granite (32), hornfels (148), schorl (156), microgranite (162), Roborough Stone (190), Pentewan-type elvan (208), Polyphant Stone (197)	Dartmoor Granite (32), hornfels (148), schorl (156), microgranite (162), Roborough Stone (190)	Dartmoor Granite (32), hornfels (148), schorl (156), microgranite (162), Roborough Stone (190), Bovey Tracey slate (164)	Dartmoor Granite (32)	Dartmoor Granite (32)	
68	CARBONIFEROUS	Gzhelian and Kasimovian	Upper Pennsylvanian						
69									
70				Amphibolite and metagabbro (91)	Amphibolite (91)	Amphibolite (91) and metagabbro (164); basalt (147)	Amphibolite (91)		
71									
72		Moscovian	Middle Pennsylvanian			Bude Formation; sandstone (172) and slate (171)	Bude Formation; sandstone (172) and slate (171)	Bude Formation: maroon sandstone (119)	
73									
74							Bideford Formation; sandstone and slate (215) incl. Cornborough Sandstone (206), buff friable sandstone (207)		
75									
76		Bashkirian	Lower Pennsylvanian						
77									
78									
79									