

## ROBOROUGH STONE

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Vesicular quartz porphyry called Roborough Stone is widely used in the west and south of Devon for the dressings and less commonly the quoins of medieval churches. The distribution of the stone in buildings is described and discussed and LiDAR elevation data is used to identify many of the quarries from which the stone was formerly won.

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## INTRODUCTION

During the course of a study of the building stones of Devon and nearby parts of adjacent counties (Barr, 2016), it became apparent that an unusual quartzo-feldspathic rock-type was widely though sparingly used throughout the South Hams and in western parts of Devon. Comparison with published descriptions of Devon's building stones (Moore, 1829; Prideaux, 1830; Coppard, 1831; De La Bêche, 1839; Henwood, 1843; Worth, 1875; Ussher, 1906, 1912; Hoskins, 1954; Perkins, 1971; Worth, 1979; Clifton-Taylor, 1989; Brown, 1995; Tavistock Community Page, 2009 and English Heritage and British Geological Survey, 2015) demonstrated that this kind of building stone was well known, especially in the past, and was called Roborough Stone after the location, Roborough Down, north of Plymouth, from which it was won.

The location of the Roborough Stone quarries is, with few exceptions, rather poorly located in the cited references, near or on Roborough Down. However, Moore (1829, p. 307) locates the quarries: "...extending from a point nearly opposite Hoo Meavey to Bickham, is a bed of a singular porphyry, without defined dip; bowlders of which are strewn about the Down so extensively as to have acquired for it the name of "Roborough-Down stone". Henwood (1843, p.138) notes that the stone was won from a locality "not far from the water-course that crosses Roborough Down"; Prideaux (1830, p. 30) identifies the quarry locality in words so exactly matching those of Moore that it is hard to credit that they were arrived at independently.

Perhaps the most reliable evidence as to the location of the quarries, is Ussher's memoir (1912) covering the Ivybridge area and the accompanying geological map, Sheet 349 (Ivybridge), which is still used as part of the country-wide digital geological cover at 1:50,000 scale provided free of charge by the British Geological Survey through a web mapping service. The section of this memoir dealing with economic minerals and building stone is vague as to details of the quarry localities, but hidden in the text (Ussher, 1912, p. 67) is a description of a north-south section which intersects a microgranite dyke and identifies it as the locus of the Roborough Stone quarries. Reference back to the topographic map reveals an east-west line of anomalous ponds extending across the Down coincident with this microgranite dyke shown on Ussher's map.

In order to confirm and if possible extend this insight, LiDAR elevation data (Ferraccioli *et al.*, 2014) was acquired for the area of Roborough Down and processed to highlight surface irregularities as described later in this paper, followed by a field investigation.

## LITHOLOGY

Roborough Stone is a distinctive and striking rock-type used mainly for the dressings of medieval churches in the South Hams and west Devon (Figs 1, 2). The rock is typically pale fawn or grey and is strongly vesicular, almost pumice-like in texture, composed of a fine-grained granular matrix of quartz and feldspar with few dark minerals, enclosing rounded limpid phenocrysts of quartz up to 5 mm in diameter. The matrix encloses vesicles typically up to 10 mm across representing original gas bubbles in the solidifying rock and showing varying amounts of departure from the spherical presumably caused by deformation and flow during solidification. Prideaux (1930) was of the opinion that these voids have an approximately cubic shape but this was not confirmed by the present study.

The rock-type is markedly homogeneous where used as a building stone (freestone) and has been successfully shaped for decorative use. As mentioned above, its use is largely for the dressings and quoins of buildings and it is seldom used for ordinary walling, perhaps reflecting not only the value placed on it by medieval masons but also its scarcity, especially as large blocks.

Float of this rock-type, identical with that used for building, is widespread lying on the surface around the quarry locations. Here it is joined by more normal microgranite consisting almost exclusively of a fine-grained homogeneous mosaic of quartz and feldspar lacking any discernible oriented fabric or dark minerals. Some of these blocks are composite, consisting partly of this fine-grained microgranite, typically adjacent to joints and fractures, and partly of the more typical vesicular Roborough Stone (Figure 3). It is likely that in order to win good quality stone, some material marred by joints and fractures with accompanying loss of the characteristic texture, had to be discarded. However, there is very little waste now visible at the quarry sites.



**Figure 1.** Window dressings on the south side of the nave of the church of St James the Less, Kingston.



**Figure 2** Archway into the crossing of the former abbey church at Buckland Abbey. The dressings here and throughout the former church are of Roborough Stone.

It is evident from this description and from the dyke-like shape of the source that Roborough Stone is one of the microgranites or *elvans* that form minor intrusions, mainly dykes, cutting the granites and country rocks of Devon and Cornwall. The elvans of Cornwall form an important class of building stone in that county and include Pentewan-type Stone, and Newham, Tremore and Warleggan Stone (Bristow, 2013, 2014; English Heritage and British Geological Survey, 2017). Elvans are typically fine-grained pale-coloured rocks of broadly granitic composition (Goode, 1973). Some varieties are porphyritic, some take a polish and several, with a combination of attractive colours and textures, make handsome decorative stone.

Elvan well suited to building is much less well represented in Devon (Barr, 2016). Besides Roborough Stone, Pentewan-type Stone, won from several different minor intrusions in Cornwall is the main building stone of Lifton and Bere Ferrers, both villages close to the River Tamar. Meldon aplite is used for the dressings of Okehampton Castle (Higham *et al.*, 1982) and elsewhere. Finally, rocks described as aplite, microgranite, elvan or felsite in the literature are widely distributed in outcrop, in buildings and in the river gravels on and near the Dartmoor granite outcrop. On the south side of Dartmoor they may be called “alvin”, clearly a corruption of “elvan”, or “river stone”, a reference to the abundance of these rock-types in the gravels of the rivers draining the moor. These rocks, of broadly granitic composition, are distinguished from the main Dartmoor granite by one or more of finer grain size, compact, non-porphyritic texture and paucity of dark minerals. Other than those named above, they are of poor quality and their use is restricted to rough walling on and adjacent to the Dartmoor Granite.



**Figure 3.** Loose boulder on Roborough Down, partly of Roborough Stone and partly of normal dark brown microgranite (right hand side).

### DISTRIBUTION IN BUILDINGS

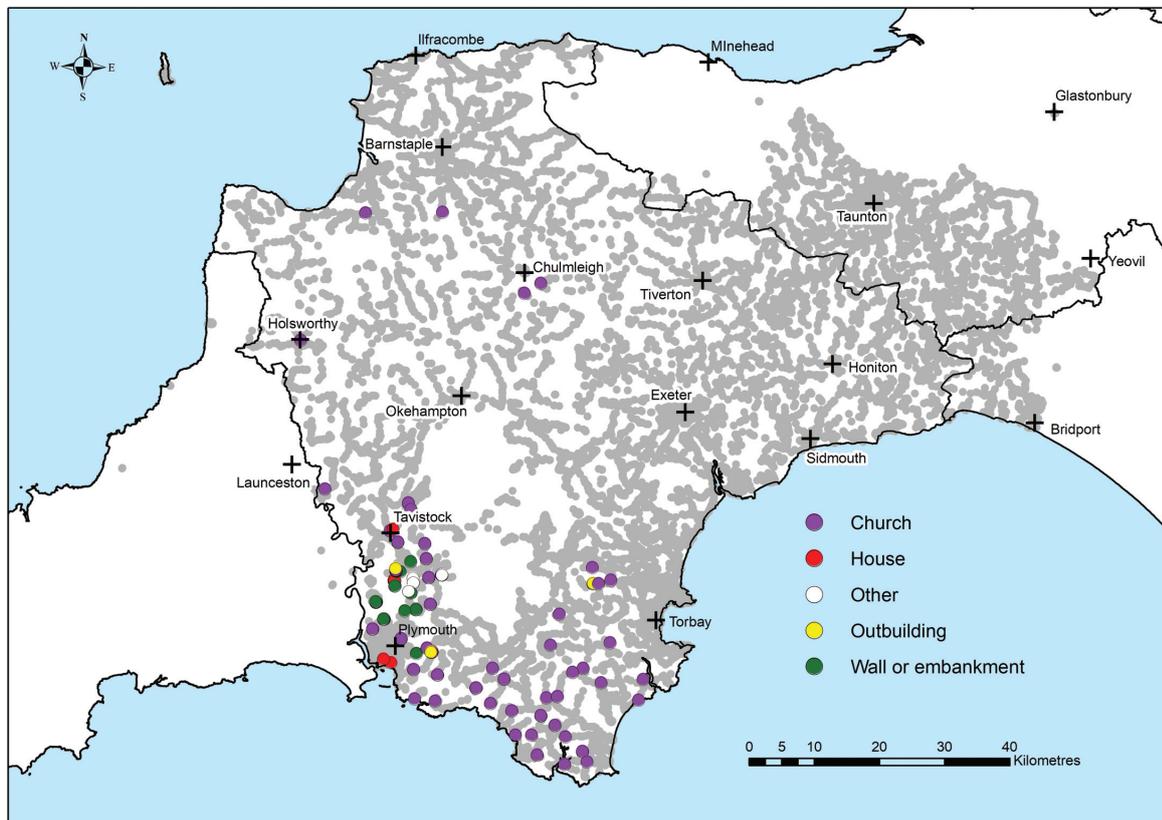
Figure 4 shows the distribution of Roborough Stone in the exterior of Devon buildings, distinguished by building type. It is used almost exclusively for churches except near the source quarries where it figures in a greater range of building types. Table 1 compares the frequency of its use in different kinds of building in tabular form and Table 2 lists the churches where the stone has been found externally. The great majority of building types containing the stone are churches, or in the case of Buckland Abbey, former monastery buildings including the church. Use of the stone is concentrated in the south and west of the county but, considering the medieval age of most of the buildings, when land transport of heavy stone was mostly by packhorse or sledge - means primitive in the extreme - use of the stone is widespread and extends far from the source quarries, reflecting the high regard in which it was held by

masons and church patrons. This is reinforced by the preponderance of churches in the mix of building types where the stone was used (Table 1) although it should be borne in mind when reading this table, that each church typically requires more than one record to reflect the variation in the building materials used and the different dates of construction of different parts of most churches with a medieval origin.

Table 2 shows that Roborough Stone was a relatively precious commodity mainly being used externally for the dressings round doors and windows, for the quoins or much less commonly, being incorporated as a minor component of the stonework of the walls. It was also used internally (see, for example, Chends (2009) for St Leonard's, Sheepstor; Cresswell (1921) for St Bridget's, Bridestowe; Hamilton-Leggett (2017) for St Mary the Virgin, Walkhampton; Tavistock Community Page (2009) for St Eustace; and Worth (1875) for the ruined Carmelite Friary in Plymouth). The interiors of churches were not systematically examined during this study.

Type of building	Records in database	
	Number	Per cent
Church	137	76%
House	11	6%
Other	8	4%
Outbuilding	5	3%
Wall or embankment	19	11%
<b>Total</b>	<b>180</b>	<b>100%</b>

**Table 1.** Distribution of Roborough Stone in buildings by building type.



**Figure 4.** Distribution of Roborough Stone in Devon buildings by building type.

<b>Dedication and settlement</b>	<b>Location of Roborough Stone (external)</b>
St David, Ashprington	Minor component of the dressings round the west window of the tower
St Andrew, Bere Ferrers	Dressings of west door, south elevation windows and east window
St Mary, Bickleigh	Quoins and dressings of tower, south aisle and porch; dressings of the chancel and a minor component of the wall of the south chapel
St Lawrence, Bigbury	Component of south porch and south transept quoins; minor component of the walls, quoins and dressings of the spire
St Michael, Blackawton	Dressings of the north aisle
St Nonna, Bradstone	Minor component of the dressings on the south side of the nave
St Mary, Brixton (near Plymouth)	Dressings of tower and minor component of south porch and south aisle walls
St Peter and St Paul, Broadhempstone	Dressings of the west door
St Andrew, Buckland Monachorum	Main component of quoins and dressings throughout the church
Buckland Abbey, Buckland Monachorum	A component of the dressings and quoins of many of the abbey buildings including internal dressings of the abbey church, now the main house
St James, Chawleigh	Quoins of the chancel and minor constituent of chancel wall
St Sylvester, Chivelstone	West window tracery and drip stone
Churchstowe (no dedication)	Subordinate dressings of south aisle and tower; minor component of chancel and south chapel walls
St Clement, Dartmouth	Dressings of west window in the tower
St Mary, Diptford	Minor component of chancel wall
St Winaloe, East Portlemouth	Dressings of north porch and chancel
All Saints, Eggesford	Minor component of north porch door dressings
St Peter and St Paul, Ermington	Minor constituent of south transept walls and north chapel dressings
St Leonard, Halwell	Dressings of south side of nave and chancel
All Saints, Holbeton	Dressings of the tower and north aisle and minor constituent of south transept and north aisle walls
St Peter and St Paul, Holsworthy	A few pieces in the west end of the south aisle
St Edmund, Kingsbridge	Minor constituent of the dressings on south side
St James the Less, Kingston	Minor constituent of the dressings of the tower, the south transept and on the south side of nave
St Swithun, Littleham (south of Bideford)	Minor component of south aisle; high up - not well identified
St Michael and All Angels, Loddiswell	Dressings of west window; not well identified
All Saints, Malborough	Minor constituent of dressings of south aisle
St Mary, Mary Tavy	Main component of the dressings of the south porch, south aisle and

**Table 2.** Devon churches that contain Roborough Stone in the external stonework.

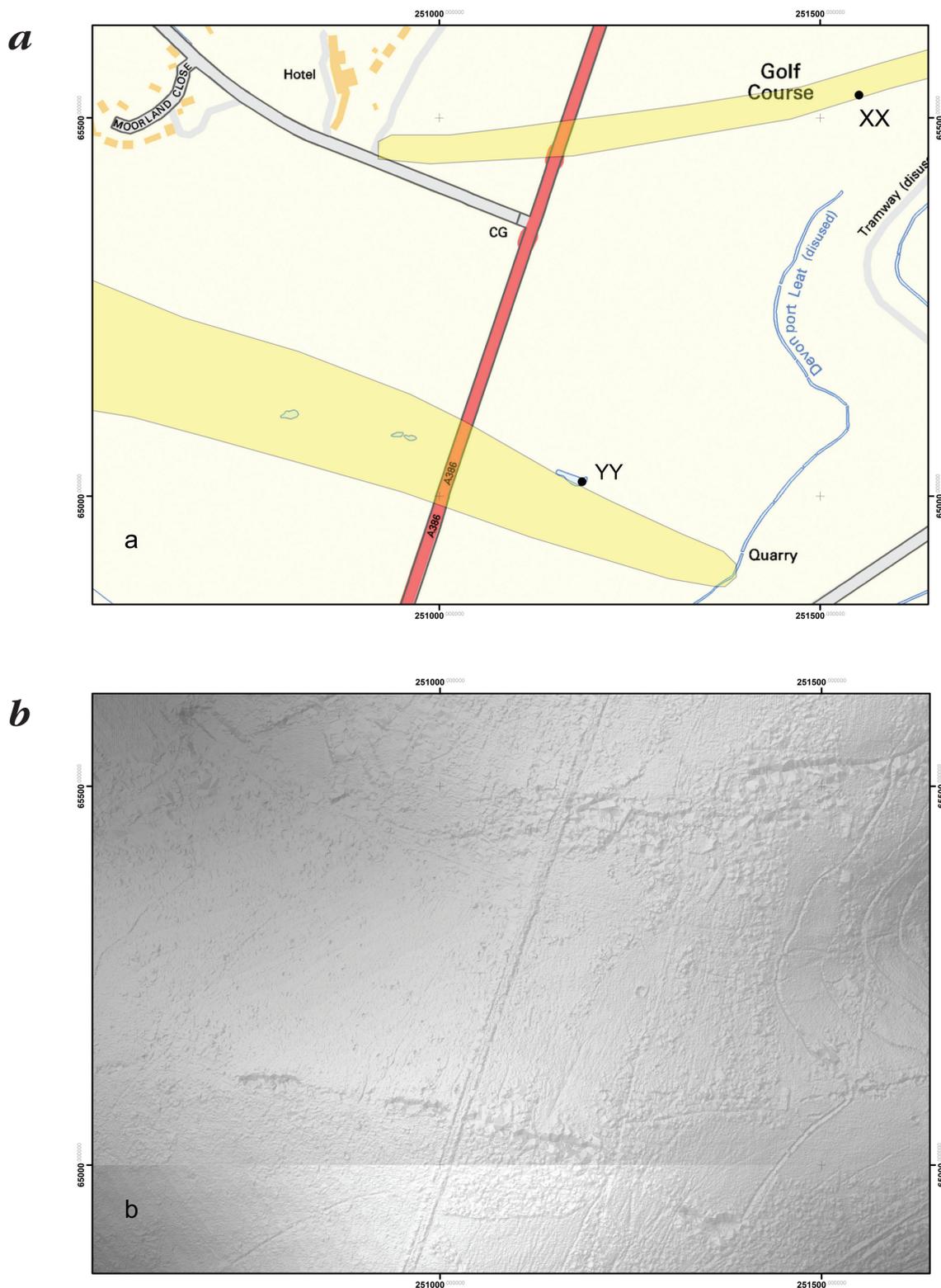
<b>Dedication and settlement</b>	<b>Location of Roborough Stone (external)</b>
	chancel
St Peter, Meavy	Main component of exterior dressings throughout the church
Holy Spirit, Milton Combe	West end window dressings
St George, Modbury	Minor component of the south aisle west of porch and main component of south transept dressings
All Saints, Moreleigh	South transept and chancel dressings
Holy Cross, Newton Ferrers	Minor constituent of chancel dressings
St Peter, Peter Tavy	Main component of chancel and tower dressings
St Edward, Plymouth	Footings of tower walls and main component of tower quoins and dressings; minor component of north aisle quoins
St Budeaux, Plymouth	Dressings of chancel and chapels on the east end and of south porch and tower
St Mary, Plymouth	Quoins and dressings of east end and south aisle; quoins of the south aisle and minor constituent of east wall
St John, Plymstock	Major constituent of dressings and quoins of tower and subordinate component of chancel dressings
St Mary Blessed Virgin, Plympton	Tracery of door on south side and upper parts of jambs and mullions of east window; dressings on north side of church
St Maurice, Plympton	Dripstone of north aisle and north chapel windows; quoins of chancel (east end) and south aisle
St Mary, Rattery	Subordinate component of window mullions and tracery
St Mary, Sampford Spiney	Minor component of the south porch and chancel stonework, tower window and quoins and dressings of the north side of the nave
St Edward, Shaugh Prior	In dressings of the south aisle, chancel and tower windows
All Saints, South Milton	Dressings of north aisle, chancel and south transept
St Nicholas and St Cyriacus, South Poole	Dressings of chancel and tower windows
St Peter, Stoke Fleming	Minor component of the dressings
St Eustacius, Tavistock	Main component of south porch dressings
St Andrew, Tavistock	Main dressings of south porch, aisle and transept
All Saints, Thurlestone	Dressings on the north side of the nave and of the vestry
Holy Trinity, Torbryan	Dressings of chancel side door
St Mary The Virgin, Walkhampton	Dressings of the south porch, tower, vestry and north aisle; quoins of the chancel
St Werburgh, Wembury	Window tracery
St Mary, West Charleton	Dressings of bell opening
St John, Woodland	Dressings
St Mary, Woodleigh	Minor dressings of chancel and on south side of nave
St Andrew, Yarnscombe	Subordinate dressings of east window

*Table 2 continued. Devon churches that contain Roborough Stone in the external stonework.*

## SOURCE QUARRIES

Figure 5a shows a part of Roborough Down, including some of the characteristic ponds, underlain by the geological map showing, in yellow, the outcrop of two of the Roborough Stone microgranite dykes copied from the Geological Survey map (British Geological Survey web mapping service, 2017, bedrock only). Figure 5b shows laser ground elevation data of the same

area as if illuminated from the north, processed to highlight areas of rough topography. The data processing was carried out using the Spatial Analysis add-on of the ArcView geographic information system. The algorithm is not described in the software documentation but is likely to be a convolution filter designed to emphasise east-west trending edges in the elevation data as if illuminated from the north.



**Figure 5.** (a) Topography and geology. Roads and water bodies from Ordnance Survey Street View mapping, Crown copyright 2017. All rights reserved. Ordnance Survey Licence Number 100042128; microgranite dykes (yellow), from British Geological Survey, 2017, bedrock layer only. (b) LiDAR ground surface digital elevation model (Ferraccioli et al., 2014) of the same area as (a) as if illuminated from the north.



**Figure 6.** Linear depression caused by past quarrying crossing Yelverton Golf Course. Locality xx in Figure 5a looking west.



**Figure 7.** Linear depression filled by a pond created by past quarrying at Locality YY in Figure 5a looking west.

The coincidence of rough ground caused by narrow depressions from which the stone was extracted with the microgranite dykes shown on the geological map is obvious. The dyke locations are marked by taller and denser scrub compared to the open down with here and there, more substantial trees, but this contrast is not obvious on the air photographs or indeed on the ground. Figures 6 and 7 show parts of these zones, in the first case crossing Yelverton Golf Course (the view from XX in Fig. 5a) and in the second filled with one of the ponds (the view from YY in Fig. 5a).

The conclusion that these depressions mark the location of the former Roborough Stone quarries is reinforced by the presence of blocks of the stone on the down near the depressions (e.g., Figure 3). However, spoil is not abundant either in the depressions or on the surrounding down and towards the east none was found, all of the sparse float seen on the surface of the down being slate referred to the Tavy Formation. The lack of spoil is something of a puzzle. The date on which the quarries were finally worked out and quarrying ceased is not known but if, as seems likely, it was during the 19th Century then one would have expected there to be more to see; Prideaux (1830) states that spoil around the quarries was formerly plentiful. One possible partial explanation is that the diggings identified in the LiDAR imagery are not all former quarries; some of them, especially the rough ground between the more substantial hollows, may represent prospecting pits dug by the quarrymen seeking continuations of good quality stone and were quickly abandoned when none came to light.

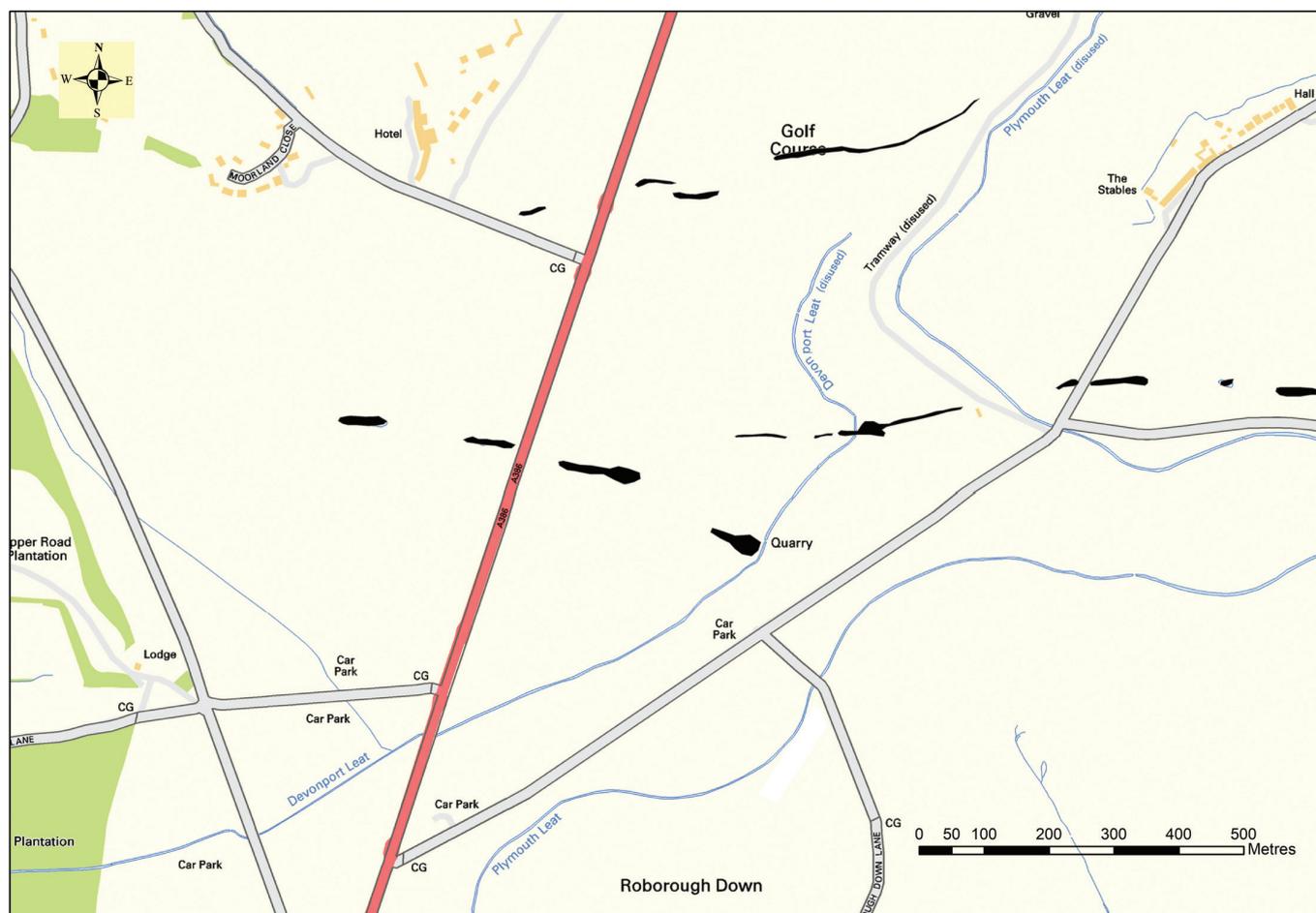
## DISCUSSION AND CONCLUSIONS

Prideaux (1830, p. 30) writes that the dyke from which the stone was won continues across the Tamar and was formerly

quarried at a place called “Harewood”. There are Cornish localities with similar names in an eastward loop of the Tamar east of Calstock including “Hare Wood” on the south bank on the north side of the loop and “Harewood Consols” in the centre of the loop. The comprehensive description of building stone quarries of Bristow (2013) and the compilation of such quarries by English Heritage and the British Geological Survey (2017) make no mention of quarries of any kind close to these localities. Roborough Stone is not mentioned as a building stone used in Cornwall by Bristow (2013). One is drawn to the conclusion that the stone was used very rarely, if at all, west of the Tamar.

Conversely, consideration perhaps should be given to the possibility that the stone is derived from parts of Devon other than Roborough Down. This might be an alternative explanation for its widespread use. Against this may be set the observation that the stone is used only in churches in this dispersed area and almost exclusively, only for quoins and dressings (Fig. 4 and Table 2); its use for other less prestigious kinds of buildings and other parts of buildings is restricted to the vicinity of Roborough Down (Fig. 4).

In conclusion, laser elevation data of Roborough Down has helped to locate the former source quarries of this building stone, widely used for the dressings and quoins of medieval churches in the west and south of Devon (Fig. 8). The microgranite dykes from which the stone was won are known to extend to the west towards the River Tamar and were formerly quarried between Milton and Maristow (De La Bêche, 1839, p. 495). These quarries have not been relocated although the widespread use of the stone for building in Buckland Abbey and St Andrew’s church, Buckland Monachorum perhaps points to a source closer than Roborough Down.



**Figure 8.** Location of Roborough Stone quarries on Roborough Down. Black, pits representing the main quarries; background, Street View topographical mapping. Crown copyright 2017. All rights reserved. Ordnance Survey Licence Number 100042128.

## ACKNOWLEDGEMENTS

The idea of using LiDAR elevation data to locate former quarries is based on a demonstration of the approach by Dr Charlie Moon who used it to map lamprophyre dykes quarried for building stone around Hatherleigh and Halwill in a presentation to a meeting of the Ussher Society in January 2015. This source and inspiration is gratefully acknowledged as is constructive criticism of a draft of the paper.

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