Building and roofing stone

British Geological Survey

Mineral Planning Factsheet

This factsheet provides an overview of natural **building and roofing stone**, including **slate**, production in the UK. It forms part of a series on economically important minerals that are extracted in the UK and is primarily intended to inform the land-use planning process.

June 2024

Natural stone is the traditional building material of Britain and Northern Ireland, and the built environment is perhaps the most visible aspect of our cultural heritage. Stone has been used for building and roofing purposes in the UK for over two thousand years and the diverse geology of the country has provided a variety of stone types that is probably unmatched anywhere else in the world. Production and usage of these stones has seen a decline since the industry's acme in the late 19th century, however, largely because of competition from cheaper manufactured alternatives such as brick, concrete, glass and steel and, more recently, the import of stone from overseas. As a result, many indigenous building stones are no longer available. This has created significant challenges for the conservation sector and also hampers attempts at maintaining a 'sense of place' with 'new-build' developments.

Building and **roofing** stones, including **slate**, are naturally-occurring rocks which are sufficiently consolidated to enable them to be cut, shaped or split into blocks or slabs for use as walling, paving or roofing. Their use extends beyond buildings to structures such as bridges, and also monuments. The term **natural stone** does not include manufactured products, such as reconstituted stone, although these are an increasingly important sector of the building materials market. Flint, chert and concretions of other types, together with boulders, can be important local building materials, and flint was perhaps used more widely than any single building stone. However, most of these materials were, and are, produced adventitiously as a by-product of other mineral extraction or operations and thus do not fall within the scope of this factsheet.

Bloomberg's European HQ, London, clad in Millstone Grit sandstone from Derbyshire.

Many different rock types serve as building stone, including sedimentary limestones and sandstones, metamorphic slates and marbles, and igneous rocks of the granite family. The suitability of a particular rock for building stone purposes depends not only on factors such as strength and durability, but also on commercial considerations such as the size of block or slab that can be extracted, and on its aesthetic qualities such as colour and texture. Other factors, including the bed thickness, ability to 'take' a polish, and ease of carving or sawing for mouldings, may also be important. Dark, roughly dressed, thinly bedded sandstone slabs impart local character to the vernacular buildings in the countryside of the Pennines, Mid Wales and Cornwall, but contrast markedly with the sizeable, precisely cut, blocks of pale Cornish granite or Portland Limestone that convey monolithic grandeur to prestige buildings in our major towns and cities.

Demand

Two principal markets — **new buildings** (**'new-build'**) and the **repair** of historic structures — drive the demand for natural stone products.

- **'New-build'** encompasses stone use in both the perpetuation of vernacular styles using materials that are sympathetic to traditional local building practices and in meeting contemporary design requirements (including both internal and external decoration). New-build also includes prestige or major commercial projects that potentially have a high-tech, contemporary or classical, style where the use of a specific stone may be a secondary consideration but adds to the architectural impact. It is worth bearing in mind that every stone building was at one stage a new-build project. Imported stone has had a share of the prestige new-build market since at least the 11th century when Caen Stone (from Normandy) became

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widely used, for example in Canterbury, Winchester and Norwich cathedrals.

- **Repair and conservation** of historic buildings and structures requires the use of material from the original or a compatible quarry source.

The new-build market for stone is small and specialised, but locally relatively buoyant. There remains demand for individually designed stone-built houses that can command premium prices. Indigenous natural stone is also sought after for large, high-profile building projects such as the European headquarters of Bloomberg in London. Even where brick or reconstituted block is the main walling material, details such as steps and lintels may be in stone. In addition, stone is becoming more widely used in boundary walls and street furniture.

The conservation market is of increasing importance, though challenged by an ever-diminishing number of readily available indigenous stones. Britain has many historic stone structures which are protected by legislation and require like-for-like stone replacement wherever possible during conservation projects. These structures form an important part of the nation's cultural heritage and are a draw for both domestic and foreign tourists. In essence, they provide a 'sense of place' and contribute to the character of our cities, towns and villages. The need to protect, restore and conserve these buildings is recognised as a key objective in the maintenance of landscapes and townscapes.

Natural building and roofing stone products are rocks quarried for the purpose of obtaining blocks or slabs that can be used non-dressed or subsequently dressed (shaped), riven (split) or sawn for general building use. They include:

Stone cladding — material quarried, split, sawn and/or polished for non-load bearing walling material.

Kerbstone — stone used for edging roads and footpaths.

Setts — stone roughly squared for roads and paving.

Flagstone — stone quarried, sawn and split specifically for flooring or paving.

Slate — rock possessing a well-developed slaty cleavage of metamorphic origin, which allows it to be split into thin slabs and used principally for roofing but also for decorative cladding and monumental purposes.

Stone-slate ('tilestone') — limestones and sandstones (as opposed to metamorphic slates) that are thinly bedded and sufficiently fissile (thus easily split or riven into thin slabs) to be quarried specifically for roofing purposes.

Monumental stone — rock quarried then cut, split, dressed or polished specifically for use in monuments, gravestones or memorial tablets.

Decorative stone — rock quarried, sawn, worked and polished for architectural ornamentation (e.g. fireplaces, stone mouldings).

Marble — geologists apply this term strictly to limestones that have been altered by metamorphic processes within the Earth's crust, although the building trade applies this name to any limestone that is hard enough to 'take' a polish (i.e. yield a polished surface when appropriately treated).

Walling stone — non-dressed (rubble) and dressed blocks of stone used for the likes of dry stone walling.

Rockery stone — stone cobbles and boulders, of varied lithological composition, used in hard landscaping and gardening.

Supply

Quarries primarily producing building stone in Britain vary significantly in size and output. They range from relatively large operations with areas in excess of 50 ha and operating near-continuously with high and/or laterally extensive faces, to very small sites less than 0.5 ha and worked very occasionally to recover stone from a single thin bed. Crushed rock aggregate quarries can also produce building stone as an ancillary product. Larger operators, controlling several quarries, commonly in different geological rock types, serve a national (and sometimes international) market with production in the order of 5–10 000 tonnes per year. Small producers, usually operating a single quarry, principally serve local or national niche markets and have an annual production of less than 500 tonnes.

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Table 1 Distribution of active building stone quarries in the UK, January 2024.

	England	Scotland	Wales	Northern Ireland	Isle of Man	Total
Building sandstone	139	24	10	9	0	182
Building limestone, incl. chalk	105	6	9	12	1	133
Granite & other igneous rocks	15	34	5	9	0	63
Slate & marble	19	1	12	1	2	35
Ironstone, flint, serpentine etc	7	0	0	0	0	7

Source: BGS

As of 2023, there are 420 active building stone and slate quarries in the UK — 285 in England; 65 in Scotland; 36 in Wales; 31 in Northern Ireland; and 3 on the Isle of Man (Table 1). The distribution of these quarries is shown in Figures 1–3. The industry is still capable, with a few notable exceptions, to meet the current demand for natural stone.

Two major groups of resources dominate the supply of building stone in Great Britain; the various Jurassic limestones in the Midlands and South of England (Dorset, Wiltshire, Gloucestershire and Lincolnshire) and Carboniferous sandstones in Yorkshire & the Humber (West Yorkshire), the East Midlands (Derbyshire and the Peak District) and the North West. Scotland is the main source of igneous rock.

Slate output is dominantly from North Wales and the Lake District, but there is also a small output from Cornwall and Devon for local markets.

Trade

The UK is a major and increasing net importer of dimension stone and slate, and low-cost imports are a major, if not the biggest, threat to the natural building stone industry. These imports are primarily of material used in prestige construction projects, street furniture and internal decoration. Imports are also impacting the local market for stone house building and walling in some areas, while imports of paving material continue to increase; imports of roofing slate substantially exceed domestic production. Overall imports from Europe, which has been the traditional source of imported natural stone for the UK, have been increasingly challenged by imports from India, China, Turkey and South America during the last 25 years.

Trade is in both 'unworked' stone and slate, that is roughly trimmed or cut into square or rectangular blocks, and 'worked' stone and slate, including articles thereof. Total trade in these categories is shown in Table 2. It should be noted, however, that a large proportion of the imports of unworked stone is believed to be armourstone (for coastal protection works) from Norway, which is not building stone. Imports and exports of 'worked' stone for the period 2019–2021 are shown in Table 3, broken down by major type.

Consumption

The total UK output of building and dimension stone consistently averages over one million tonnes a year. This figure is in sharp contrast to the *c.* 200 million tonnes of (primary) natural aggregates that are consumed in the UK each year. It is important to recognise, however, that the unit value of building stone is much greater than for aggregates.

The domestic building stone industry is broadly able to meet local demand. Imports are still required for

Table 2 UK trade in 'unworked' and 'worked' building and dimension stone (including slate), 2021.

Building or monumental stone	Imports		Exports	
	Tonnes	£ thousand	Tonnes	£ thousand
'Unworked' building and dimension stone	4 607 689	264 539	6710	3854
'Worked' stone and slate	759 143	344 281	24 341	14 354

Source: HM Revenue and Customs

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Table 3 UK trade in 'worked' building and dimension stone (including slate), 2019–2021 (a = BGS estimate; b = figures include aggregates of slate).

	2019	2020	2021	2019	2020	2021
Building and dimension stone	Tonnes			£ thousand		
Production						
Sandstone	-	-	-	-	-	-
Igneous rock	-	-	-	-	-	-
Limestone	-	-	-	-	-	-
Dolomite	-	-	-	-	-	-
Slate	160 000	160 000	170 000	-	-	-
Totals (a)	**1 260 000**	**1 060 000**	**1 370 000**			
Imports						
Marble and other calcareous stone	55 830	42 766	27 745	59 458	40 933	15 827
Granite	69 443	51 295	62 799	54 037	40 345	57 130
Other stone	25 961	44 764	109 924	29 027	25 000	60 519
Paving stones and flagstones	313 922	346 515	370 649	74 254	68 472	115 945
Roofing and wall tiles	142 175	141 755	160 136	65 597	64 581	79 463
Other worked slate	22 262	23 504	27 890	11 093	9 920	15 397
Totals	**629 593**	**650 599**	**759 143**	**293 466**	**249 251**	**344 281**
Exports						
Marble and other calcareous stone	1150	1213	508	4666	3589	1314
Granite	689	1604	870	1330	1508	1611
Other stone	2071	1721	2361	4968	2924	1622
Paving stones and flagstones	4231	7486	4633	1223	2343	2092
Roofing and wall tiles	6311	6556	8148	4248	4536	6570
Other worked slate (b)	2549	2285	7821	1721	971	1145
Totals	**17 001**	**20 865**	**24 341**	**18 156**	**15 871**	**14 354**

Source: HM Revenue and Customs

the more specialised types of dimension stone, however, notably marble (of which there are only minor indigenous resources) and also the many types of igneous rock that are widely used for cladding. Furthermore, imports are increasingly penetrating other sectors of the market.

The market relating to new-build projects has fluctuated in recent years. This is also true of the prestige sector, and is reflective of the more general state of the economy. The heritage repair market for stone continues to grow. Best practice in building conservation is to replace the existing stone on a like-for-like basis, and this is encouraged by planning regulations. At a national level, the National Planning Policy Framework (NPPF) broadly emphasises the need to ensure that 'there is a sufficient supply of minerals' to meet the country's needs (Paragraph 215), whilst explicitly stating that 'Planning policies should provide for the extraction of mineral resources of local and national importance' (Paragraph 216). 'Mineral[s] re-

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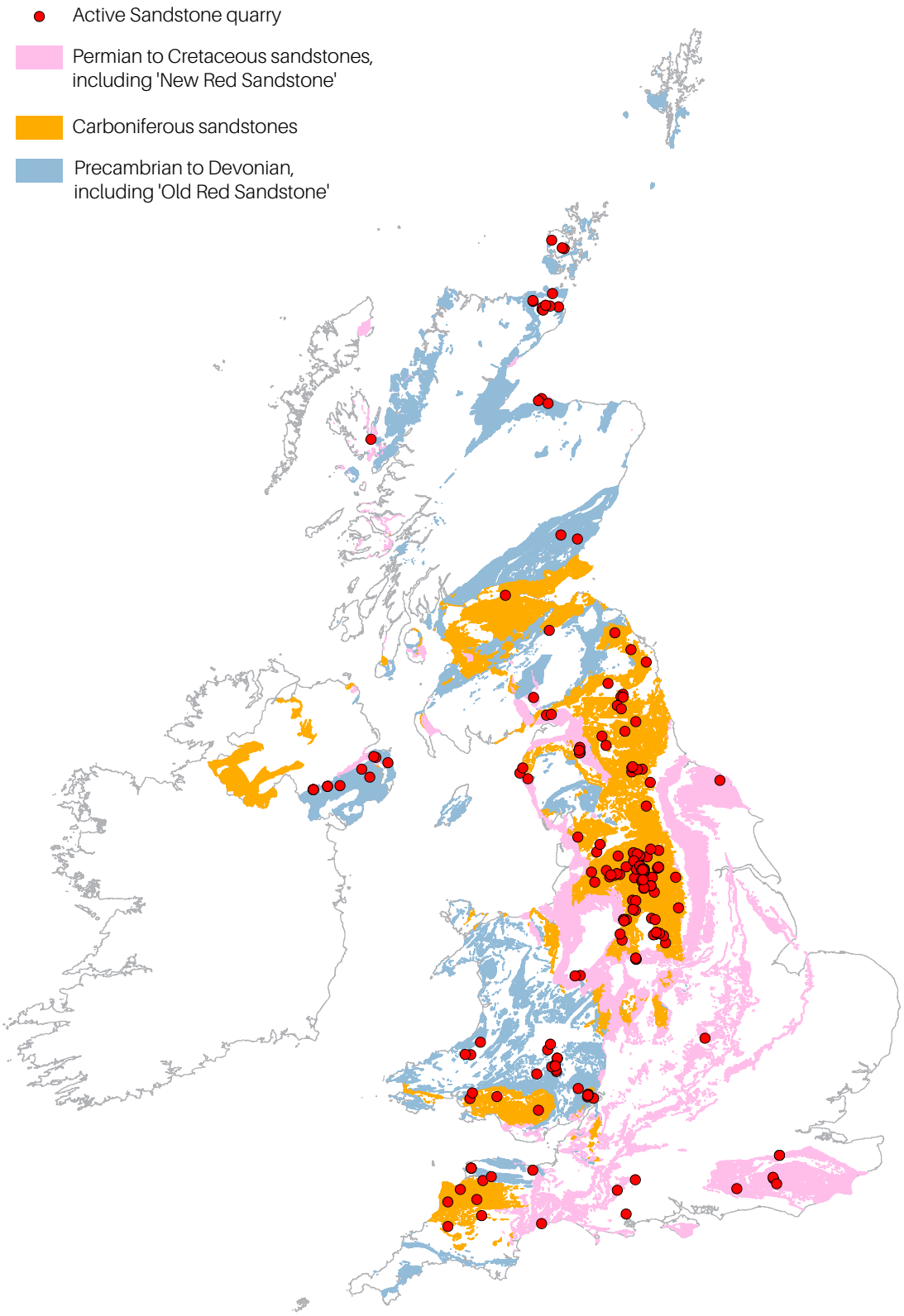

Figure 1 Distribution of principal building sandstone resources and active quarries. Includes stone used for paving, roofing and hard landscaping.

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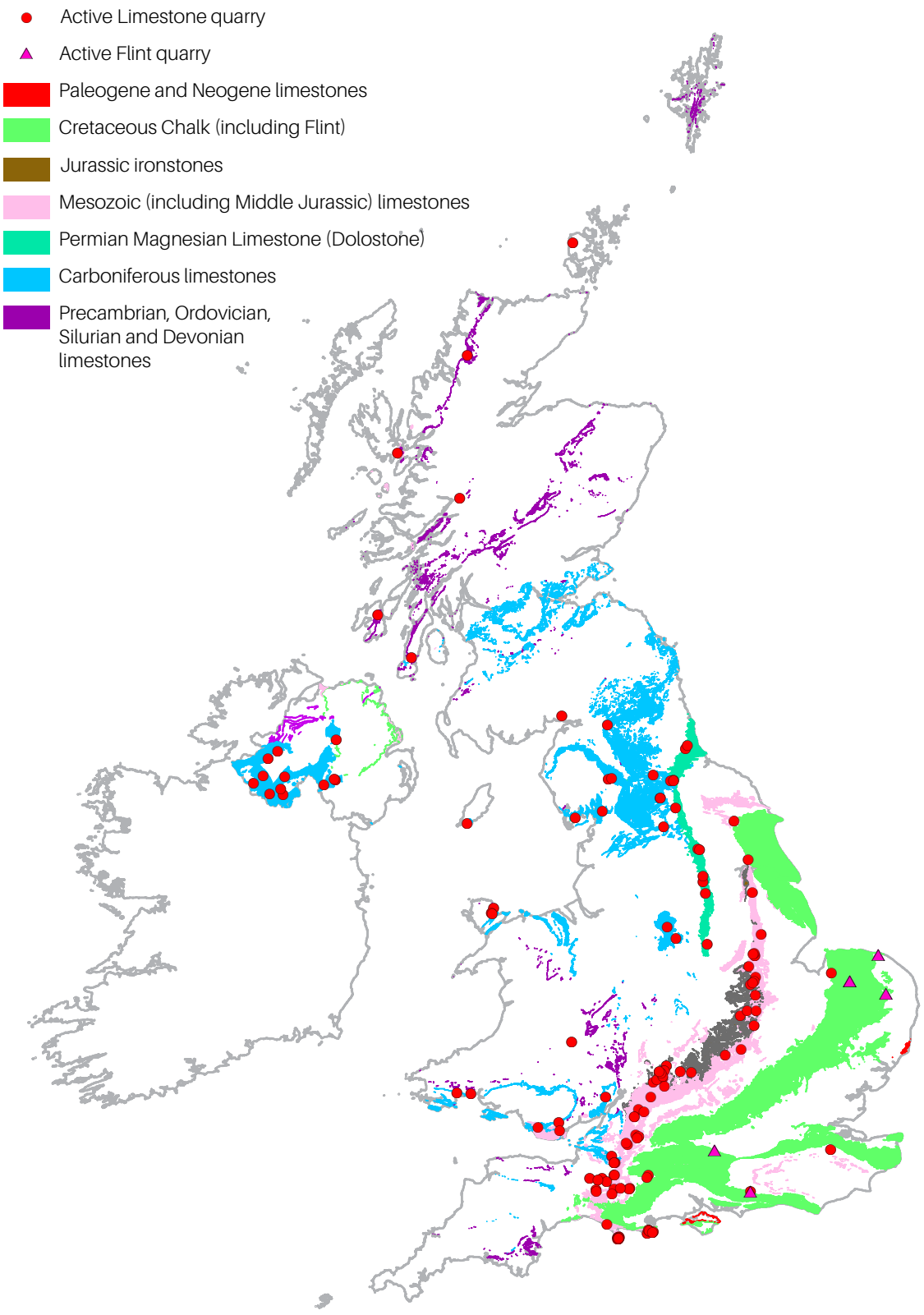

Figure 2 Distribution of principal building limestone and chalk resources and active limestone, Chalk, marble and flint quarries. Includes stone used for paving, roofing and hard landscaping.

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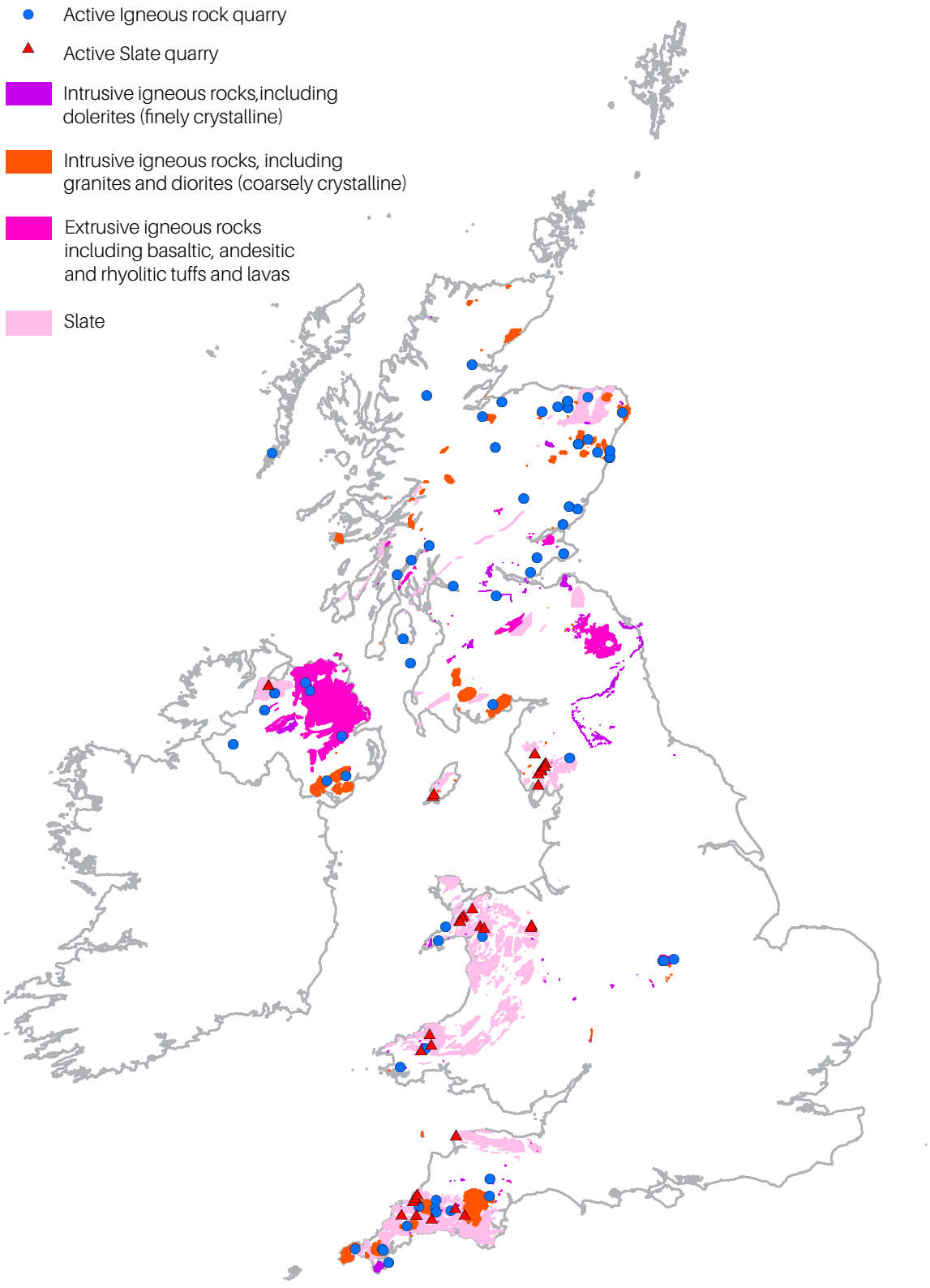

Figure 3 Distribution of principal igneous rock and slate resources and active quarries. Includes stone used for paving, roofing and hard landscaping.

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sources of local and national importance' are defined as encompassing 'local minerals of importance to heritage assets and local distinctiveness' (NPPF Annex 2: Glossary) — this having clear implications for the provision of building stone. New-build structures, extensions to existing buildings, paved areas and walls within Conservation Areas are required to use materials that are sympathetic to the surrounding historic built environment. In addition, the desire to create a variety of building forms employing a wider range of materials in new housing schemes outside of Conservation Areas has somewhat increased demand for natural stone.

Many local stones are no longer available for one or more reasons. This shortage of local materials has already reached a critical point in some areas of Britain, e.g. with Reigate Stone (in the South-East), 'White' Triassic Sandstone (in the Midlands), Craigleith Sandstone (in the Edinburgh area) and Carboniferous flagstone roofing 'slates' (in central Northern England). Although the problem is becoming increasingly acute, it should be recognised that the areas of use and level of demand for some stones will be very limited. This may not justify either the environmental or the economic costs of opening disused quarries or altogether new workings, and an alternative material may therefore need to be used.

Economic importance

Building and dimension stones have an inherently higher unit value than most other minerals produced in Britain. Prices can range from a few tens of pounds per tonne to several hundreds of pounds, in some cases exceeding £1000 per tonne, with the 'bottom line' price being essentially a function of the degree of processing that the quarried rock has undergone. The consequent variation makes it very difficult to estimate the true value of the industry.

Structure of the industry

The Stone Federation of Great Britain (https://www.stonefed.org.uk/) is the trade association that represents the industry in its widest sense. It has some 230 members (as of late 2023), which in addition to domestic stone producers include importers of stone and stone products, and stone processors and masons. UK building stone producers include:

Limestone
Albion Stone Plc
Blockstone Ltd.
Johnston Quarry Group
Lovell Stone Group Ltd.
Stamford Stone Company Ltd.

Sandstone
Blockstone Ltd.
Dunhouse Quarry Co. Ltd.
Hutton Stone Co Ltd.
Johnsons Wellfield Ltd.
Marshalls Mono Ltd.

Slate
Burlington Slate Ltd.
The Delabole Slate Co. Ltd.
Welsh Slate (Breedon Group)

Resources

Britain has extensive bedrock resources that are potentially suitable for use as building stone. Reflecting the underlying geology, different parts of the country have distinctive rock types, which results in the distinctive character ('sense of place') of the built environment in these areas. This can make it difficult for building stones to be satisfactorily matched from other sources.

The principal building stone resources, both past and present, are listed in Table 4 and their distribution is shown in Figures 1–3. The seemingly extensive nature of these resources disguises the fact that the volumes of rock suitable for use as building and roofing stone may be highly localised. This is a direct function of the local geology, where bed thickness and lateral continuity, incidence of joints and other fractures, and the degree of natural cementation all have a fundamental effect on the suitability of the rock for use as building stone. Accordingly, workable deposits may be difficult to find and where they do occur may be very restricted in extent. Subtle or substantial lateral differences in stone properties can significantly affect the characteristics of the product. Minor changes in shell content, cementation or grain size, for example, may have not only aesthetic impacts but also affect weathering properties and thus durability — which may be particularly important in restoration work or where a large façade needs to maintain a consistency of character. Changes in bed thickness alone within the same rock unit can create

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Table 4 Principal building stone resources in Britain.

Sandstones	Principal producing areas
Palaeogene	Dorset (Heathstone); Wiltshire (Sarsen Stone); South-East England (Ferricrete, Puddingstone)
Lower Cretaceous	Sussex; Wiltshire; Norfolk (Carstone)
Middle Jurassic	North Yorkshire
Triassic (red & white)	Gloucestershire (red); Somerset (red); Staffordshire (red and white); Shropshire (white); Cheshire (red); Cumbria (red); Dumfries & Galloway (red); Moray (white)
Permian (red)	Westmorland & Furness; Dumfries & Galloway
Carboniferous	Northumberland; Durham; Lancashire; Yorkshire; Derbyshire; Central Scotland; Forest of Dean and South Wales (Pennant)
Devonian (Old Red Sandstone — red-purple)	Devon; Herefordshire; Caithness (dark grey flagstone); South Wales
Lower Palaeozoic (dark grey-green)	Wales

Limestones	Principal producing areas
Upper Cretaceous (chalk/clunch)	Cambridgeshire; Bedfordshire
Lower Cretaceous	Dorset (Purbeck); Kent (Kentish Rag)
Upper Jurassic	Dorset (Portland); Wiltshire (Chilmark)
Middle Jurassic	Wiltshire and Somerset (Bath); Gloucestershire (Cotswold); Lincolnshire, Rutland and Northamptonshire (Lincolnshire Limestone); Oxfordshire, Buckinghamshire and Dorset (Corallian, Forest Marble, Inferior Oolite)
Lower Jurassic	Somerset (Lias); Warwickshire and Oxfordshire (Ironstone)
Permian	Nottinghamshire, Yorkshire, Northumberland and Durham (Magnesian Limestone)
Carboniferous	Derbyshire, Westmorland & Furness and Durham (including decorative 'marble')

Slate (metamorphic)	Principal producing areas
Devonian	Devon; Cornwall
Silurian	Cumberland; Westmorland & Furness; Denbighshire
Ordovician	Cumberland; Westmorland & Furness; Carmarthenshire; Pembrokeshire
Cambrian	Gwynedd

Granites & other igneous rocks	Principal producing areas
	Cornwall; Devon; Leicestershire; Westmorland & Furness; Aberdeenshire; Argyll & Bute; Fife; Northern Scottish Highlands; Wales

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a different building product (block as opposed to thin slab), which, if used together, can totally alter the appearance of structures and have an incongruous impact.

The major rock types used as sources of building stone are:

- **Sandstones**, which are formed by the consolidation of the detritus generated through the weathering and erosion of all types of pre-existing rock. They consist of small fragments or 'grains' held together by natural cements such as calcium carbonate (calcite), silica, iron oxide or clay minerals. Most sandstones consist of individual grains of quartz and feldspar, and residual pieces of rock (lithic fragments). It is their typically high quartz content that makes them hard, durable building stones. Sandstones can be divided into fine-, medium- or coarse-grained types by measuring the average size of the constituent grains. Sandstones from the Devonian, Permian and Triassic are characteristically red because of the presence of coatings of iron oxide minerals on the grains. Some sandstones can be identified by the presence of distinctive mineral components e.g. green glauconite (an iron-bearing silicate mineral). The sedimentary structures and mineralogy of a sandstone can be indicative of whether it is of aeolian, fluvial or marine origin.
- **Limestones**, which are principally composed of calcium and/or magnesium carbonate and are relatively soft in comparison to sandstones. Most limestones are formed by the accumulation on the seabed of the fragmented remains of marine organisms, in tropical or sub-tropical settings. These bioclastic grains are cemented together by natural carbonate precipitates. In coarse-grained limestones, fossil shell fragments are easy to

Cadeby Quarry, Doncaster, South Yorkshire, where beds of Permian dolomitic limestone are worked for building stone.

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Church of St John the Baptist, Stibbington, Cambridgeshire, constructed of Middle Jurassic Lincolnshire Limestone.

see with the naked eye. In contrast, chalk is an example of a fine-grained limestone composed entirely of the calcitic skeletons of microscopic organisms known as coccoliths. A distinctive group of building limestones are the ooidal limestones formed on the seabed as concentrations of millimetre-sized spherical ooids (formerly known as 'ooliths'). Also included in this group of rocks are the magnesium-rich ('magnesian') or dolomitic limestones. Dolomitic limestones are principally formed by the chemical alteration of an original calcium-rich limestone. This alteration process may preserve any original shelly or ooidal limestone fabric or completely destroy it to produce an entirely crystalline rock.

- **Slate**, which is a fine-grained metamorphic rock showing strong fissility (i.e. slaty cleavage), thus allowing the rock to be split into thin slabs of consistent lithology. Slates are formed by the recrystallization of fine-grained sedimentary or igneous rocks (usually volcanic debris in the case of the latter) under the effects of elevated temperature and pressure — so-called metamorphism. Under such conditions, which typically develop over many millions of years, new minerals — most notably micas — grow in alignment, and the characteristic slaty cleavage is formed. It is the alignment of these new minerals that enables the slates to be easily split into relatively thin slabs. An important feature of true metamorphic slates is their lack of porosity, which makes them impervious to fluid flow and highly suitable for use as a roofing material. It should be recognised that the industry traditionally regards certain types of thinly bedded, fissile, sandstone and limestone which have seen historic use as roofing material as 'slate'. Such non-metamorphic 'slate' may also be referred to as 'stone-slate' or 'tilestone'.

- **Marbles**. Geologists apply this name only to limestones that have been recrystallised through

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metamorphism within the Earth's crust. However, the building trade uses 'marble' in connection with any hard limestone that can be polished. Metamorphosed limestones (i.e. true marbles) are texturally and colourfully distinctive, but they are still composed predominantly of calcium or magnesium carbonate.

- **Igneous rocks**, which are principally hard, crystalline rocks formed by the cooling and crystallization of hot molten magma on or within the Earth's crust. Variability in the chemical composition of the magmas produced by the Earth results in a broad spectrum of rock types, which are widely used as building stone and collectively termed '**granites**' by the trade. More exactly, however, igneous rocks range from pale-coloured, coarsely crystalline, quartzo-feldspathic varieties, that include true granitic rocks, to dark coloured, finely crystalline, basaltic rock types ('Whinstone'). Other specific varieties of igneous rock used for building or decorative purposes include diorite, monzonite (e.g. Larvikite) and gabbro.

Reserves

Total reserves of building and roofing stone with planning permission are not available for reasons of commercial confidentiality. Irrespective of this, quantifying building stone reserves remains difficult. This is because of variations in the physical quality, geometry and lateral continuity of different rock units, inclusions of chert, clay or 'country rock', and variable joint and fracture patterns, all of which can markedly affect yields. Indeed, yields may not be quantifiable until the stone is actually extracted.

The difficulty of obtaining planning permissions for extensions to existing quarries and opening

Maison Dieu Bedehouses, Melton Mowbray, Leicestershire, built of ferruginous limestone ('ironstone') and roofed with Collyweston Stone-slate (all of Jurassic age).

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Harewood House, near Leeds, West Yorkshire, constructed of Carboniferous Millstone Grit sandstone.

altogether new ('greenfield') quarry sites has been highlighted by the industry as a key obstacle to the future development of the industry.

Relationship to environmental designations

Large areas of Britain are now covered by national landscape and nature-conservation designations. Any proposed development in these areas is subject to intense scrutiny and it is therefore increasingly difficult to obtain planning permission for minerals extraction. Many of these designated areas coincide with building stone resources and the sites of current and former operations. Notable examples include granite on Dartmoor, slate in the Lake District, sandstone in the Peak District and limestone on the Isle of Purbeck. There is consequently concern in the industry that sterilisation of building stone resources by these designations may eventually prove to be a serious threat to future building stone supply and, as a result, the conservation of the country's stone-built heritage.

Stone used in buildings, walling and other structures frequently makes a conspicuous contribution to the visual character and cultural history of protected landscapes. As the objective of planning policy associated with such designations is to maintain and enhance that character, adequate provision of local building materials is a necessary function of the planning process. It is also arguably in the public interest that materials necessary to repair and restore buildings of national importance — and to maintain a 'sense of place' with local new-build developments and cater for new prestige buildings both locally and further afield — continue to be provided from areas covered by designations.

Extraction and processing

Building stones are mainly extracted by surface quarrying. Underground mining, although formerly more widespread, is still carried out in a number of places for limestone extraction, for example Bath Stone in Wiltshire. Jurassic limestone is also mined at Chilmark near Salisbury, and mining has now been introduced on the Isle of Portland for the extraction of Portland Stone.

Unlike procedures employed in aggregate quarrying, where the objective is to reduce the stone to small

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fragments, blasting is seldom used in the extraction of building stone (in particular, stones of sedimentary type) as the requirement here is to recover large undamaged blocks from the quarry face that can be subsequently dressed. Blasting can have a serious detrimental effect on the integral structure of the softer stone varieties especially if not undertaken with care. The quarry face is initially opened up by exploiting the naturally occurring lines of weakness, corresponding to joints and/or bedding planes, in the rock mass. These determine the maximum size of the raw block that can be produced. Large blocks extracted from the face are reduced in size by hammer and chisel, by drilling and the insertion of iron wedges ('plug and feathers') or by mechanical sawing techniques. However, for some monumental and prestige work, very large blocks (more than 2 m on bed) may be specifically sought. With many sedimentary rocks, blocks are recovered directly from the face by mechanical excavators. Joint and bedding plane surfaces rarely provide a near-cubic or rectangular block and more typically will produce rhombic shapes that need careful cutting to maximise the saleable block and minimise waste.

Underground working of building stone takes place at relatively shallow depths accessed by adits or, more commonly in the past, by steep inclines and narrow vertical shafts. Stone production relies on the 'room and pillar' method of extraction, where pillars of stone are left in place to support the overlying rock mass and facilitate excavation at the working face. Extensive, interconnecting underground gallery systems can be developed by this method. Depending on the hardness of the stone, bed height and block size, the blocks may be removed using a range of mobile, mechanised saws or alternatively by removing a top waste band and then lifting blocks by plug and feathers or drilling.

In some cases, the material to be used as a building stone will be in the form of nodules (flint, chert or septaria) or cobbles, which require greater or lesser amounts of dressing or shaping dependent on the exact end-use.

Processing of the stone begins at the quarry or following transportation to centralised cutting sheds, in part dictated by the requirements of the contract of supply. Softer stones, such as limestones, can be shaped and roughly dressed by hand or cut using a handsaw or mechanical guillotine at the quarry. Harder stones may need to be sawn using frame-saws, gang-saws, diamond rotary blades, diamond wire saws or high pressure water-jets. Surface finishing of some stones can involve polishing using abrasives and flame-jet texturing. Riven stone is produced either mechanically or by hand.

By-products

The extraction and processing of building stone generally involves the production of a large proportion of mineral waste, sometimes in excess of 80% of the raw material extracted. Owing to the intrinsic nature of most of the building stone produced, which tends to have low impact resistance, this material is only suitable for less demanding aggregates applications. Nevertheless, aggregates are produced, to a greater or lesser extent, at the majority of building stone operations. The total quantities involved are not known, but for many sites the amount will considerably exceed the tonnage sold as building stone. Use of this material improves overall resource utilisation, replacing primary aggregates that might be extracted elsewhere. However, it may also result in a greater impact on the environment than would be associated with pure building stone production. This is largely due to lorry movements and to some degree mode of processing. Nonetheless, using stone waste avoids creating the disproportionately large and sometimes prominent stockpiles that may be visually intrusive, delay restoration or need to be disposed of through landfill elsewhere. Some building stone quarries also produce armourstone and stone for hard landscaping projects.

In the case of slate production, as little as 5% of the material extracted is actually used for high quality slate products. The waste generated is increasingly being used as crushed rock aggregate, mainly in road construction but also in ready-mix concrete and for decorative purposes. Slate granules are also produced for coating roofing felt, and slate powders can be used for filler applications, for example in rubberoid products.

Building stone is produced as a by-product at a number of aggregate quarries and also at a few sites producing cement raw materials.

Alternatives/recycling

Building stones are valued for their physical properties, such as colour, texture, strength and durability.

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The National Wallace Monument, near Stirling, Central Scotland, constructed of Carboniferous sandstone quarried from the Abbey Craig on which the tower stands.

In some cases, these properties are little altered in use and such building stones can be readily recycled into other structures. This has long been recognised and many historical structures have been 'robbed' over the centuries, resulting in damage or complete destruction. Theft of building and roofing stone from existing structures continues to be a problem today. Stone recovered by recycling derelict buildings was formerly a major source of local stone for house building, although the quantities of usable stone were, and are, variable due to in-service weathering.

As individual types of building stone often have very distinctive characteristics they cannot be easily matched with stone from other sources. Maintaining a supply of local stone is, therefore, important to preserving the continuity of local vernacular styles of architecture.

Concrete, brick and steel are alternative construction materials, although they cannot be viewed as alternatives to natural stone. The production of 'artificial stone' or 'reconstituted stone' products has increased substantially in recent years and poses a potential commercial threat to the industry. Crushed rock fragments bonded together by lime, cement or organic resins are now a commonplace, cheaper alternative to natural building stone. The roofing industry has used concrete tile products for some time, but recently the use of 'tiles' made by blending natural rock fragments or synthetic materials with cements or resins in place of stone-slates and metamorphic slates has become more commonplace. Similar products are also produced for paving purposes. In many cases, the raw materials used in these products are derived from the waste produced at building stone quarries. However, all these 'alternatives', although cheaper, lack the aesthetic qualities and prestige of natural stone products.

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Raglan Castle, Raglan, Monmouthshire, built of 'Old Red Sandstone' from the Welsh Borderlands.

Effects of economic instruments

The Aggregates Levy was introduced in April 2002 at the rate of £1.60/tonne, and is currently £2.03/tonne. Although natural building and roofing stone are exempt, sales of waste rock from building stone quarries as aggregate are subject to the Levy, irrespective of whether the aggregate is a mineral waste from quarrying or processing. It is reported by the industry that the introduction of the Levy has had an adverse effect on sales of these low-grade aggregates, which can command only low prices, resulting in disposal problems at the quarry.

Slate, including slate waste, is exempt from the Aggregates Levy. The rationale for this is the legacy of hundreds of millions of tonnes of slate waste on tips, particularly in North Wales (estimated by the Welsh Government to be 700–900 million tonnes in this area alone), but also in the Lake District and Cornwall, all of which is potentially available for use as aggregate. Slate waste has been used for aggregate purposes for many years, although most of this is quarry and processing waste from relatively recent or active operations.

Planning issues

With such a variation in the scale of operations, the impacts of and planning issues associated with building stone extraction can also show marked differences. This variation is further increased by locational considerations. Quarries may have to be sited prominently in exposed uplands or coastal locations where climatic conditions are more severe, thereby making day-to-day operations and eventually landscaping and restoration more challenging. Nonetheless, it may still be possible to locate a new quarry where the topography and/or vegetation effectively screen the workings and processing facilities.

Quarries, particularly those with a long history, may now suffer from urban encroachment, constraining development options and sterilising valuable and scarce resources. Shifting economic conditions may now mean that nearby properties are no longer occupied by the quarry workforce, but by those who have no interest in the continuation of production. Underground extraction may offer a way forward in some cases, although the potential merits of this must be tempered by concerns over extraction rates,

recoverable block size and waste, all of which may be of significance set against the value, rarity and geological characteristics of the stone.

The impacts of the extraction of building and roofing stone cannot, therefore, be categorised simply. Generally, although by no means always, impacts are much less than for the quarrying of aggregates, mainly because the scale of extraction is much smaller. Associated impacts on residences and amenities, such as noise, dust, road mud and travel disruption, are also not so great. It remains the case that the total number of movements may be higher, if only relatively so, as the transport of building stone block may involve only a small tonnage per movement. Actual impacts will vary from site to site, depending not only on output but also location with respect to sensitive designations and the rock type being produced and the amount of associated waste. For example, slate extraction and processing, as already noted, involves the production of a very large proportion of waste.

Under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, formal Environmental Assessments (EAs) are required for all quarrying operations irrespective of their scale (the former 25 ha surface area threshold no longer applying). In addition, Mineral and Local Planning Authorities often expect other environmental studies to be undertaken. For smaller operators, the associated costs are perceived as a disincentive to making a planning application for a new quarry or even an extension. However, the evidence for this appears to be contradictory. Major planning-related problems for the industry are the disconnection in local planning policies between the objective of maintaining local character and the associated need for locally sourced materials, sterilisation concerns and the imposition of unrealistic conditions on operations and subsequent restoration. There is a notable absence of mineral planning guidance that explicitly recognises the distinctions between building and roofing stone quarries and much larger (often by a magnitude of one or two) aggregate quarries.

Planning policies as applied in the various parts of the UK can be accessed via the links listed under the Further information section of this factsheet.

Further information

https://www.gov.uk/government/publications/national-planning-policy-framework--2

https://www.gov.scot/publications/scottish-planning-policy/

https://www.gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf

Historic England Technical Advice Note: Sourcing stone for Historic Building Repair (2016) — downloadable at: https://historicengland.org.uk/advice/technical-advice/buildings/building-materials-for-historic-buildings/identifying-and-sourcing-stone-for-repair/

https://www.infrastructure-ni.gov.uk/publications/strategic-planning-policy-statement

Other useful websites:

Stone Federation website: https://www.stonefed.org.uk/

Building Research Establishment: https://www.bre.co.uk/

Stone Roofing Association: http://www.stoneroof.org.uk/Traditional/Roofing_traditions.html

English Stone Forum: https://www.englishstone.org.uk/About_ESF.html

National Stone Institute: https://www.naturalstoneinstitute.org/

Welsh Stone Forum: https://museum.wales/curatorial/geology/welsh-stone-forum/

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Mineral Planning Factsheets for a range of other minerals produced in Britain are available for download from www.mineralsUK.com

The coastline in figures 1–3 is courtesy of the USGS.

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