BRITISH GEOLOGICAL SURVEY

MINERAL PROFILE

BUILDING AND ROOFING STONE

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British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Creating sustainable communities

MINERAL PROFILE: BUILDING AND ROOFING STONE

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1: Definition, mineralogy and deposits

1.1 Definition

Building stones are naturally occurring rocks of igneous, sedimentary or metamorphic origin which are sufficiently consolidated to enable them to be cut or shaped into blocks or slabs for use as walling, paving or roofing materials in the construction of buildings and other structures. Stones suitable for building occur throughout the geological column and have a worldwide distribution. Their exploitation is limited where overburden or structural complexities make their production uneconomic or where national or internationally designated conservation or heritage sites preclude active quarrying.

The principal rock types used as building stone are limestones (including marbles), sandstones, slates and granites.

Building stone is also commonly referred to as ‘Dimension Stone’ in many countries.

1.2 Texture, mineralogy and colour

Building stones show a very wide textural and mineralogical range dependent on whether they are of igneous, metamorphic or sedimentary origin. In the building stone trade colour is an extremely important aspect of the resource but is commonly provided in the form of subjective descriptions and does not follow an agreed, standardised colour scheme.

1.2.1 Igneous building stones

Igneous rocks are hard and crystalline. They are formed directly by the cooling of hot molten magma of varying composition and under variable conditions of temperature and pressure that consequently produce a very wide spectrum of rock types. They are widely used as building stone but are commonly termed ‘**granites’** by the trade**.** Scientifically, however, igneous rocks show a range from pale coloured, coarsely crystalline, quartzo-feldspathic varieties, that include the true granitic rocks, to dark coloured, finely crystalline basic or basaltic rock types.

1.2.2 Sedimentary building stones

Sedimentary rocks include our most common building stones, the **sandstones** and **limestones**. Unlike most igneous rocks, sedimentary rocks are characterized by a distinct layered or bedded structure and show either granular or crystalline textures.

- Sandstones are formed by the weathering and erosion of all types of pre-existing rocks. They consist of small fragments or grains held together by natural cements such as calcium carbonate (calcite), silica, iron oxide or clay mineral. Most sandstones consist of grains of quartz, feldspar and lithic (rock) fragments. It is their 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 grains. Some sandstones can be identified by the presence of distinctive mineral components e.g green glauconite (iron silicate). The sedimentary structure and mineralogy of a

sandstone can often distinguish whether it is of eolian (wind-blown dunes), fluvial (river channel) or marine origin.

- Limestones are principally composed of calcium (calcite) and/or magnesium (dolomite) carbonate and are relatively soft in comparison to sandstones. Most limestones are formed by the accumulation on the seabed of the broken shells of marine organisms, in tropical or sub-tropical settings. These fragments are cemented together by natural calcium carbonate. In coarse-grained limestones, fossil shell fragments are easy to 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 at the seabed as concentrations of millimetre-sized carbonate spheres (ooids) formed by algal accretion. Also included in this group of rocks are the magnesium-rich 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 a crystalline rock.

So-called 'stone-slates' are not metamorphic slates but thinly bedded, fissile sedimentary limestones and sandstones that naturally split into thin slabs suitable for roofing purposes.

An important feature of sedimentary rocks is their natural porosity. Pores are holes in the rock framework that allow fluids like rainwater to enter and leave the fabric. Most durable sedimentary building stones commonly have moderate intergranular porosity that also facilitates easier dressing and shaping of the stone.

1.2.3 Metamorphic building stones

Metamorphic rocks are formed by the alteration of all other rock types, over long periods of geological time, by extremes of heat and pressure. They show some of the characteristics of both igneous and sedimentary rocks often having a hard, crystalline structure but commonly retaining traces of original sedimentary bedding surfaces. Metamorphic rocks are not widely used commercially as building stone but fine-grained, cleaved slates are the principal source of roofing stone worldwide. **Slates** are formed by the recrystallization of fine-grained sedimentary or igneous rocks under extremes of temperature and pressure. Under such conditions, which develop over many millions of years, new minerals, most notably micas, grow and the characteristic slatey cleavage is formed. It is the alignment of these new minerals that enables the slates to be easily split into thin sheets. An important feature of metamorphic slates is their lack of porosity, which makes them impervious to fluid flow.

Included in the metamorphic rocks are the true **marbles.** Geologists apply this term only to limestones that have been recrystallized by metamorphism, however the building trade uses the term to cover any hard, polishable, limestone. Metamorphosed limestones (marbles) are texturally and colourfully distinctive but they are still principally composed of calcium or magnesium carbonate. The non-metamorphosed ‘marbles’ owe their distinctive textures and colours largely to the presence of concentrations of fossils.

1.2.4 Miscellaneous building stones

Some texturally and mineralogically distinctive rocks used widely for decorative building purposes include ironstone, flint, tufa, alabaster, septaria, onyx (sedimentary); pumice and scoriaceous lava (igneous / volcanic) and serpentinite (metamorphic). In areas where building stone is absent or in short supply, lithologically diverse cobbles and boulders from stream and river sections or other superficial sedimentary deposits are commonly used for building purposes.

1.3 Occurrences

Building stone resources occur in all geological systems of the stratigraphic column. There are complex issues involved in defining mineral reserves for building and roofing stone. The mineral has not only to be geologically appropriate but must provide good block stone that is suitable for working (for sawing, dressing or for splitting). Geological factors such as bedding planes, joint spacing etc are an important consideration, affecting yields at the quarry, as are physical characteristics (affecting durability) and visual appearance, colour and texture (architectural acceptance). All the quarries supplying sedimentary stones in particular have to consider such natural variations within any single deposit.

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2: Extraction methods and processing

2.1 Quarrying and mining

Traditionally building stones are quarried or mined without the use of blasting techniques, which could have serious detrimental effects on the structure of the softer stone varieties. The quarry face is initially opened up by exploiting naturally occurring lines of weakness in the rocks provided by joints and / or bedding planes. The large blocks produced are then reduced in size by drilling and splitting using iron wedges ('plug and feathers') or by diamond saw techniques.

Underground working of building stone takes place at relatively shallow depths accessed by adits or, more commonly in the past, by 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 excavation at the working face. Extensive, interconnecting underground gallery systems can be developed by this method. Depending on the hardness of the stone, the blocks are then removed using a range of mobile, mechanised saws.

Photo: BGS

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 minimal dressing or shaping.

2.2 Stone processing

Photo: BGS

Processing of the stone begins at the quarry or following transportation to centralised cutting sheds depending on the requirements of the contract. Softer stones, such as limestones, can be shaped and roughly dressed by hand or cut using a hand saw 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. Further details of these processes can be found in Smith (1999).

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3: Specification and uses

The building stone trade applies the following broad specifications based on the end-use of the product:

Building stone – natural rock material quarried for the purpose of obtaining blocks or slabs that can be subsequently dressed (shaped) or sawn (ashlared) for general building.

Stone cladding – natural rock material quarried, sawn and polished for non-load bearing walling material.

Walling stone – natural rock material quarried for non-dressed (rubble) blocks.

Flagstone – natural rock material quarried, sawn and split (riven) specifically for flooring or paving.

Slate – natural rock material with pronounced metamorphic cleavage allowing it to be split into thin sheets - principally for roofing but also for decorative cladding and monumental use.

Stone slate – natural rock material (other than slate) that is thinly bedded and fissile (easily split (or riven) into thin slabs), quarried specifically for roofing purposes (may include both limestones and sandstones).

Rockery stone – natural stone cobbles and boulders of varied lithological composition used in landscaping and gardening.

Monumental stone – natural rock material quarried cut, split, dressed or polished specifically for use in monuments, gravestones or memorial tablets.

Decorative stone – natural rock material quarried, sawn, worked and polished for (architectural) ornamentation.

Marble – geologists only apply this term to limestones that have been altered by metamorphism, however the building trade uses the term to cover any limestone that is hard enough to produce a polished surface.

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4: World production

There is a lack of reliable and consistent statistical data from the world's building stone industry. Much of the data is lost within general statistics on total stone exports that includes aggregate or crushed rock products. The world dimension stone production was estimated to be c. 68 million tonnes in 2001 (Dolley 2001)

4.1 Europe

"The stone industry is of significant importance to some economies including that of the European Union (EU). A significant part (65%) of the total world production can be attributed to the EU countries, representing a market of about 20 billion Euros. 81% of the European stone production comes from Southern European member states namely Italy (marble), Spain (marble & slate), Greece (marble) and Portugal (slate). A significant stone processing and machine production industry has been developed in the EU as a result of this activity. Nowadays, about 60,000 companies work in the Ornamental and Dimensional Stones sector in Europe, employing more than 500,000 people" (OSNET[†] 2003).

[†] OSNET is a Targeted Thematic Network on Ornamental and Dimensional Stones, funded by the European Commission under the Competitive and Sustainable Growth Programme. OSNET aims to bring together all the organisations active in the European Ornamental Stones Sector, industry, academia, research institutes, national centres and stone federations. It is expected to be an instrumental tool to meet the sector needs, as it will provide the necessary forum to share problems and experience and to facilitate the transfer and incorporation of technology to the interested European market companies and organisations.

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5: World trade

The top five building stone producing and exporting countries are China, Italy, India, Iran and Spain, together accounting for 74% of world production (Dolley 2001).

The UK building stone production for 2004 is estimated at 854,000 tonnes with a relatively small proportion going for export to other EU countries and rest of the world.

Political events can have a significant detrimental effect on the world trade in building stone. Both September 11th 2001 and the war in Iraq in 2003 saw a further decline in trade as a consequence of deteriorating international political relations.

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6: Prices

In the world markets there is growing competition in the export trade particularly from China and India where, for example, granite prices are a quarter or less than that of British producers (Natural Stone Specialist 2001).

In the relatively small and competitive UK market information regarding pricing of products is regarded as commercially sensitive and is rarely made public.

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7: Building stone - focus on the UK

Buildings are perhaps the most visible aspect of our cultural heritage and there is an increasing realization by Government that they play a major part in the UK economy through leisure activities and tourism. Natural stone has been used for building and roofing purposes in the UK for more than a millennium and the geological diversity of the country has meant that the variety of the stones used in our standing buildings is probably unmatched anywhere else in the world. Production and use of these stones has declined, since the highpoint of the industry in the late 19th century, largely because of competition from cheaper manufactured alternatives such as brick, concrete and steel. However, more recently there has been a noticeable increase in interest in, and demand for, stone and prospects for the industry remain buoyant. In order to maintain and add to this diverse built heritage it is important that mineral planning policies are effective in helping to create an economically and environmentally sustainable building stone industry (Symonds Group 2004).

7.1 Active building stone quarries in the UK

Building stone resources in England, Wales and Scotland have been extensively quarried and mined in the past, most notably in the 19th century. Although the industry has contracted substantially since that time, it is still currently producing a wide range of sandstones, limestone and slates, although the production of granite and other igneous rocks has significantly declined.

Currently there are 437 active building stone quarries in the UK - 46 in Wales; 51 in Scotland; 328 in England; 7 in the Isle of Man; 5 in Northern Ireland; and 3 in the Channel Isles.

Table 7.1.1 The distribution of active building stone quarries in the UK in 2005

	England	IOM	Channel Isles	Scotland	Wales	Northern Ireland	Total
Building sandstone	164	0	0	21	15	1	201
Building limestone & chalk	118	2	0	3	11	2	136
Granite & other igneous rocks	14	1	3	25	4	2	46
Slate & marble	22	4		2	16	0	44
Ironstone, flint, serpentine etc	10	0	0	0	0	0	10

Source: BGS BritPits database

The distribution of these quarries is shown in Figure 7.1.1.

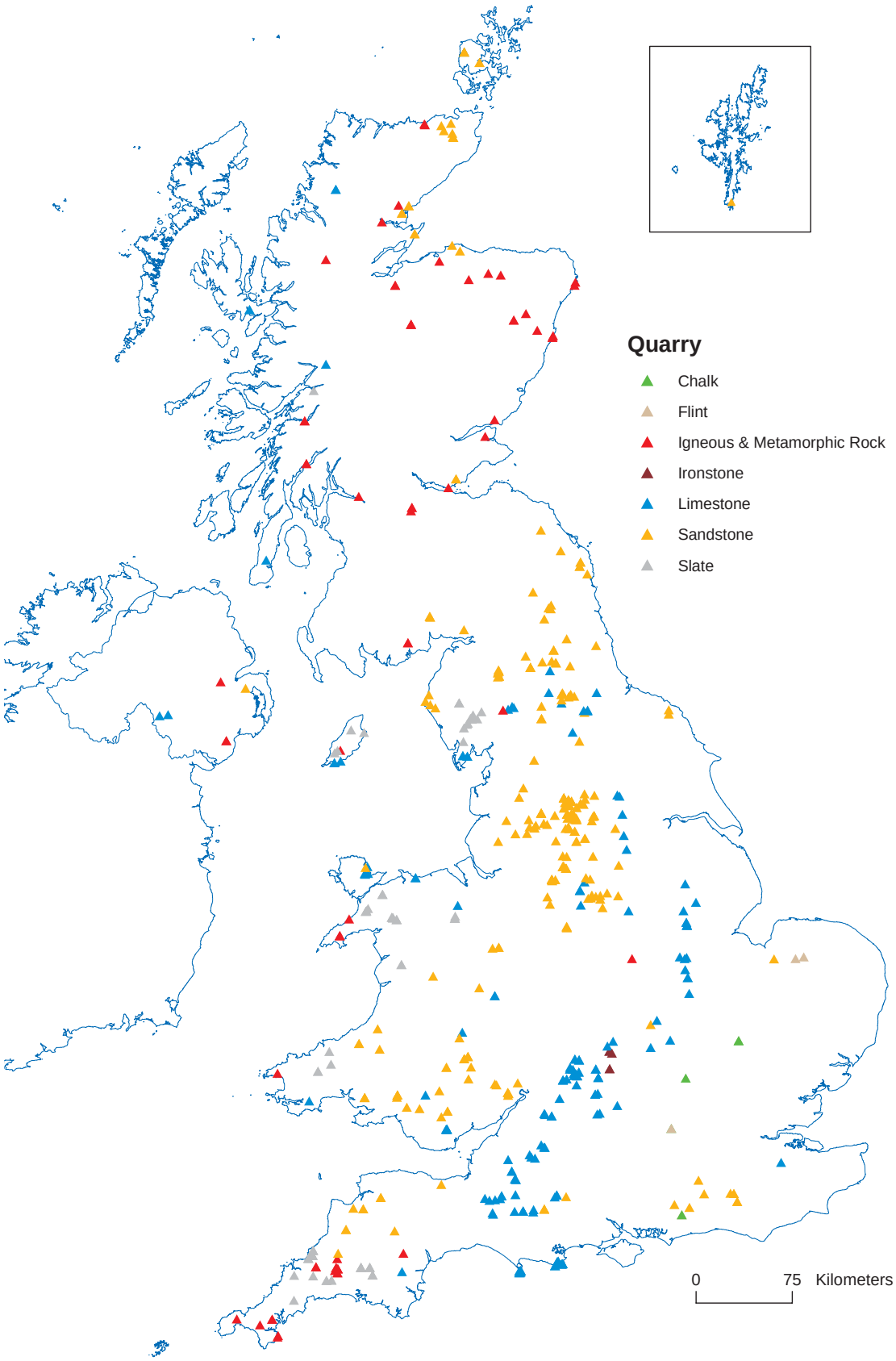

Figure 7.1.1 The distribution of active building stone quarries in 2005

7: Building stone - focus on the UK

7.1.1 Sandstone

Sandstone production for blockstone, roofing and paving is the mainstay of the current industry with production concentrated in the Millstone Grit and Coal Measures groups (Carboniferous). There is growing small-scale production for roofing from the Old Red Sandstone (Devonian) in England and Wales, and the production of paving and roofing stone from the Caithness Flagstone Group (Devonian) in Scotland has expanded substantially.

Production of sandstones from the Permian and Triassic is centred on Somerset, Shropshire, Staffordshire and Cumbria in England; Dumfries, Fife and Moray in Scotland.

7.1.2 Limestone

Limestone production for blockstone and roofing purposes is centred on the Jurassic succession in England. The principal quarries are concentrated in the Lias Group (Lower Jurassic) in Somerset; Inferior and Great Oolite groups (Middle Jurassic) in Somerset, Wiltshire, Gloucestershire and Lincolnshire: the Portland and Purbeck limestone groups (Upper Jurassic) in Dorset and Wiltshire. A small number of quarries continue to produce Kentish Ragstone (Lower Cretaceous) in Kent in association with aggregate production. A small number of quarries are working the Chalk or Clunch (Upper Cretaceous) for blockstone.

A number of quarries produce polishable limestones for decorative work from the Devonian, Carboniferous and Lower Cretaceous successions.

Fissile limestones in the Middle Jurassic are still worked in Gloucestershire, Wiltshire and Lincolnshire for stone roofing slates.

Dolomitic limestone is quarried for blockstone from the Cadeby Formation (Permian) in England.

7.1.3 Granite and other igneous rocks

Granite is currently produced in the UK at quarries in Devon and Cornwall in England; in the Isle of Man; in the Channel Isles; Gwynedd in Wales; Aberdeenshire, Argyll & Bute, Moray and Highland in Scotland; County Down in Northern Ireland.

7.1.4 Metamorphic slate and marble

Metamorphic slate production is centred on the quarries of North Wales (Cambrian to Ordovician), Cumbria (Ordovician) and Devon (Devonian). In the Isle of Man production is from the Manx Group (Ordovician). In Scotland there is currently an attempt to revive slate production in the Foudland and Ballachulish (Precambrian) quarries.

A single quarry produces metamorphic marble at Ledmore (Cambrian) in the Highland region.

7.1.5 Miscellaneous

Three quarries produce ironstone (Lower Jurassic) for building purposes, one in Warwickshire, two in Oxfordshire. Flints are generally produced as a by-product of Chalk lime production in the Upper Cretaceous.

7.2 Resources

The UK has an extensive resource of well-documented building stones (Figure 7.2.2). Building stones, being natural materials, show considerable variations in their physical characteristics, not only from quarry-to-quarry but also from bed-to-bed within a single quarry. Based upon factors such as their mineralogical composition, colour, texture and geological age each building stone could be considered unique. However, it is still possible to recognise a number of smaller generic groupings, based on these geological characteristics, which share many similarities in terms of their physical character and rock properties in general. This is an important consideration for the conservation industry where many historically important building stone quarries are no longer producing stone and in many cases are no longer accessible for a variety of reasons. The principal examples of these generic stone groups are:-

7.2.1 Carboniferous sandstones

The term Pennant sandstone is used to cover all the sandstones quarried from the Carboniferous (Coal Measure (Westphalian)) sandstones of South Wales and the Forest of Dean in Gloucestershire. The term York Stone or Yorkshire Gritstone is often applied to any sandstones from the Carboniferous (Millstone Grit (Namurian) and/or Coal Measures (Westphalian) of Yorkshire. However, other Carboniferous sandstones from Derbyshire, Lancashire, Northumberland and the Midland Valley of Scotland have similar characteristics to the Yorkshire stones and have been substituted in conservation work.

7.2.2 Jurassic limestones

The term Blue Lias or Lias limestone can be applied to all the hard grey limestone beds of the basal Lower Jurassic, whose outcrop stretches from the Dorset to North Yorkshire coast. The term Lincolnshire Limestone can be used to cover most of the Middle Jurassic (Bajocian) limestones quarried in Lincolnshire and Rutland (Ancaster, Clipsham, Ketton Weldon). The term Cotswold Stone is used to cover all of the Gloucestershire (Cotswold) Middle Jurassic (Bajocian and Bathonian) limestone quarries, both block stone and roofing stones. The term Bath Stone encompasses all the Middle Jurassic (Bathonian) limestones of the Bath area which are generally known under a plethora of different local quarry / mine names e.g. Corsham, Box Ground, Monk's Park etc.

7.2.3 Ironstones

Orange-brown to grey green, ferruginous sandstones and limestones, commonly termed 'ironstones' occur at a number of levels in the Jurassic and Cretaceous rocks of England and Wales. In the past they were extensively quarried for local building stone along their outcrop. Today only a few quarries in the Oxfordshire and Northamptonshire areas (Great Tew, Hornton, Wroxton, Harlestone) provide 'ironstone' for a potential market which extends from Dorset to Oxfordshire, Northampton, Leicestershire and Lincolnshire.

7.2.4 Metamorphic slates

Welsh roofing slates although showing subtle individual differences in colour and texture are generally very similar in their physical characteristics. Cumbrian slates, though very different in character to the Welsh slates, together form a distinct generic grouping, differing only in colour and other textural subtleties. The majority of slate quarries in Devon

and Cornwall produce the slate blocks for walling and paving, and only a few still supply slate for roofing, notably Delabole (one of our oldest slate quarries) and Trevillet.

m.y.		
	QUATERNARY	
2.4	NEOGENE	
65	PALEOGENE	
	CRETACEOUS	Chalk / Clunch, Flint Lower Cretaceous Greensands Kentish Ragstone
142	JURASSIC	Portland, Purbeck & Chilmark limestones Bath, Cotswold, Lincolnshire limestones Ironstones Lias & Ham Hill limestones
205	TRIASSIC	Red and White Sandstones
248	PERMIAN	Red Sandstone Magnesian Limestone
290	CARBONIFEROUS	Midland Valley Sandstones Pennine Sandstones Pennant Sandstones Carboniferous Limestone
354	DEVONIAN	Old Red Sandstone Slates
417	SILURIAN	Welsh & Cumbrian Slates
443	ORDOVICIAN	Welsh & Cumbrian Slates
495	CAMBRIAN	Welsh Slates
545	PRECAMBRIAN	Scottish Slates
	GRANITES AND OTHER IGNEOUS ROCKS (GEOLOGICAL AGE UNSPECIFIED)	

Figure 7.2.1 The distribution of UK building stone resources in the stratigraphic column

7.2.5 Stone roofing slates

These sedimentary ‘slates’ were principally quarried from two geological systems, the Carboniferous and Middle Jurassic. The Millstone Grit and Coal Measures sandstones of the Carboniferous rocks were widely used throughout the Pennine areas of Derbyshire, Lancashire and Yorkshire for roofing slate. Both were produced from fissile sandstones (those that can be easily split along laminations in the beds) and although showing subtle textural differences, are in general, quite similar in character and therefore interchangeable in conservation terms. The second major source of stone slates is the fissile or thinly bedded limestones of the Middle Jurassic succession of southern England. These include the Colleyweston, Stonesfield, Cotswold and Forest Marble varieties. The first three slates in particular, in their dressed state, though subtly different are similar in colour range and textural character. The Forest Marble can however differ substantially in character from the others. Other stone slates have been used but only on a very much more restricted local basis e.g. Harnage, Pennant ‘Tilestones’.

7.2.6 Red sandstones

Red sandstones are principally produced from the Permo-Triassic succession of Dumfrieshire, Cumbria, to a small extent in Gloucestershire, and from the Devonian of Herefordshire and Gwent.

7.3 Reserves

Although the level of reserves of building stone in the UK are considered to be substantial, quantifying their total volume is difficult because: -

i) commercial considerations often prevent accurate data being made available

ii) the varied geometries and lateral continuities of different rocks units can make it difficult to determine volumes accurately. For example, in three dimensions, the 'globular' shape of a granitic boss is markedly different from the thin, sinuous, lenticular shape of a channel sandstone body.

iii) The difficulties of obtaining planning permissions for quarrying extensions and new quarrying activity have been highlighted by the industry as a key obstacle to the future development of the industry. Research carried out by the Symonds Group on behalf of ODPM provided a policy analysis and background information needed for a future review of the mineral planning guidance for building and roofing stone. The results of this study were incorporated into an annex to Mineral Policy Statement 1 (MPS1) on 'Natural Building and Roofing Stone Provision in England' which has been published by ODPM for consultation in 2005.

7.4 Structure of the Industry

Quarries producing building stone in the UK are very variable in their size and output levels. They range from large quarrying operations where building, roofing and / or paving stone production is a minor by-product of aggregate production to specialist building stone producers. The latter are divisible into larger operators, controlling several quarries usually in different geological rock types, serving an extensive national market with annual production in the order of 5-10,000 tonnes, and small producers, usually single quarries, principally serving local markets with an annual production of less than 500 tonnes.

The industry is officially represented by the professional trade association: -

- *Stone Federation Great Britain*
  Channel Business Centre,
  Ingles Manor,
  Castle Hill Avenue
  Folkestone,
  Kent, CT20 2RD
  Tel: 01303 856123 Fax: 01303 221095
  http://www.stone-federationgb.org.uk/

7: Building stone - focus on the UK

7.5 Production

Production figures for the UK building stone industry are presented in Table 7.5.1. The figures are collated on behalf of the ODPM by the Office For National Statistics through their Annual Minerals Raised Inquiry (AMRI). However, it is clear that some of the figures supplied show some inconsistencies and may need to be treated with caution. In particular, the figures presented for 'granite' may include use as both building stone and aggregates.

Commodity		1999	2000	2001	2002	2003	1999	2000	2001	2002	2003
		Tonnes					£ thousand				
Building and dimension stone											
Production (a)											
Sandstone		455,000	239,000	…	…	327,000					
Igneous rock		184,000	…	479,000	217,000	212,000					
Limestone		(b) 301 000	(b) 305 000	(b) 220 000	191 000	…					
Dolomite		14,000	15,000	34,000	9,000	7,000					
	Total	(b) 954 000	…	…	…	…					
Imports											
Unworked–											
Marble and other calcareous stone		8,473	29,015	9,985	12,708	18,565	7,976	7,709	7,727	8,855	11,930
Granite (c)		1,045,451	865,710	1,781,220	1,656,235	1,145,887	23,980	36,452	28,908	29,447	30,386
Sandstone		10,705	13,800	17,202	50,214	72,589	1,932	3,113	2,577	7,050	10,803
Other stone		148,015	5,228	9,857	259,070	300,324	2,607	1,181	1,498	3,448	4,968
Worked–											
Marble and other calcareous stone		53,639	32,425	64,637	48,237	60,473	21,566	23,668	28,291	32,555	40,413
Granite		25,961	34,928	37,533	57,885	76,177	19,214	24,215	26,334	37,543	45,125
Other stone		12,018	17,839	21,256	27,063	31,600	8,688	10,538	10,947	13,552	14,987
Paving stones and flagstones		20,874	41,589	47,501	75,640	88,509	6,573	8,562	8,161	10,754	12,652
Exports											
Unworked–											
Marble and other calcareous stone		6,084	8,668	4,140	4,853	6,203	425	501	770	585	447
Granite		983	1,594	1,558	931	1,369	133	331	370	252	251
Sandstone		4,445	5,974	4,998	5,789	6,424	467	522	1,038	1,184	1,281
Other stone		…	809	281	1,168	932	…	513	134	408	176
Worked–											
Marble and other calcareous stone		622	839	526	946	1,072	1,366	1,407	1,456	1,893	3,320
Granite		85	713	53	732	290	82	360	99	755	399
Other stone		1,475	1,401	3,596	3,820	4,602	1,531	1,306	1,914	2,269	2,850
Paving stones and flagstones		4,328	3,168	5,029	5,057	4,980	1,104	937	780	1,217	1,105

(a) Great Britain only.
(c) Figures believed to be too high. May include aggregate.

Table 7.5.1 UK Summary 1999-2003: production, imports and exports of building and dimension stone

7.6 Consumption

The market for new build projects has fluctuated in recent years and is very much dependent on securing input to the numerous national and local regeneration projects, many being undertaken with Lottery Heritage Funding. An important growth area is in the provision of stone for streetscape architecture in many city centre developments.

The conservation market for stone is growing. Stricter national and local planning regulations encourage, wherever possible, like-for-like replacement of stone in building conservation. In addition, new build and extensions to existing buildings within conservation areas are increasingly required to use materials compatible with the surrounding historic built environment. The completion of the Millenium Tower at Bury St Edmunds Cathedral, for example, required 7400 tonnes of Middle Jurassic limestone (Natural Stone Specialist 2005).

The construction of new buildings and infrastructure for prestigious projects can have a marked effect on stone demand. The successful bid to stage the 2012 Olympics in London is likely to have a considerable and beneficial impact on UK stone production as a whole.
The conservation market for stone is growing. Stricter national and local planning regulations encourage, wherever possible, like-for-like replacement of stone in building conservation. In addition, new build and extensions to existing buildings within conservation areas are increasingly required to use materials compatible with the surrounding historic built environment.

The diverse nature of our stone built heritage has meant that many local stones are no longer available. This shortage of local materials has already reached a critical point in some areas of the UK (e.g. Reigate Stone, Bromsgrove Sandstone, Craigleith Sandstone, Pennine Stone slates, Collyweston Stone Slate, Scots Slate) and is likely to become even more acute in the future.

Swithland Slate (Cambrian), Leicestershire

Craigleith Sandstone (Carboniferous), Edinburgh

Figure 7.6.1 Some examples of our stone-built heritage

7: Building stone - focus on the UK

7.7 Trade

The export market for building stone, with few notable exceptions, is for specialized products of high value and low volume e.g. Cumbrian St Bees sandstone to the US; Portland Stone to Spain; Welsh slate to Australia following the severe storms of 2000; but there are limited opportunities for expansion. The major importing and exporting countries of building stone are summarised in Figures 7.7.1, 2, 3 and 4.

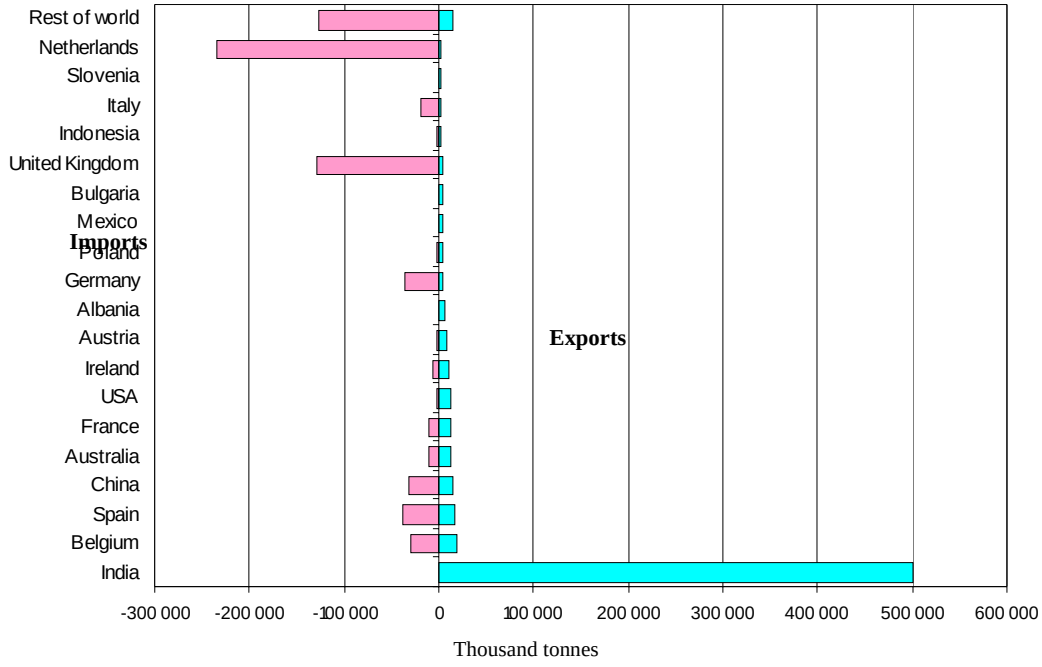

Figure 7.7.1 Major sandstone importing and exporting countries, 2005

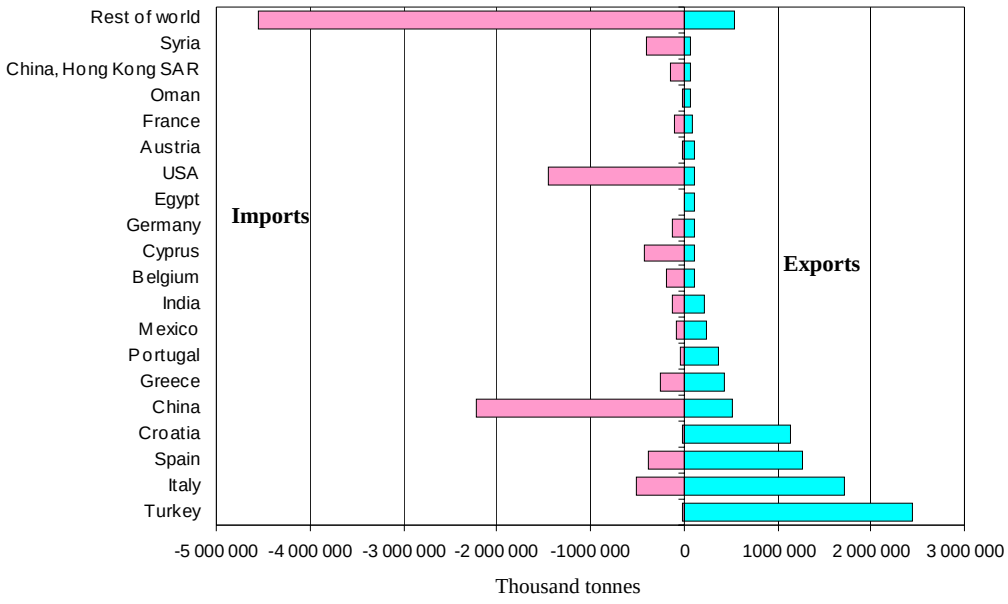

Figure 7.7.2 Major limestone importing and exporting countries, 2005

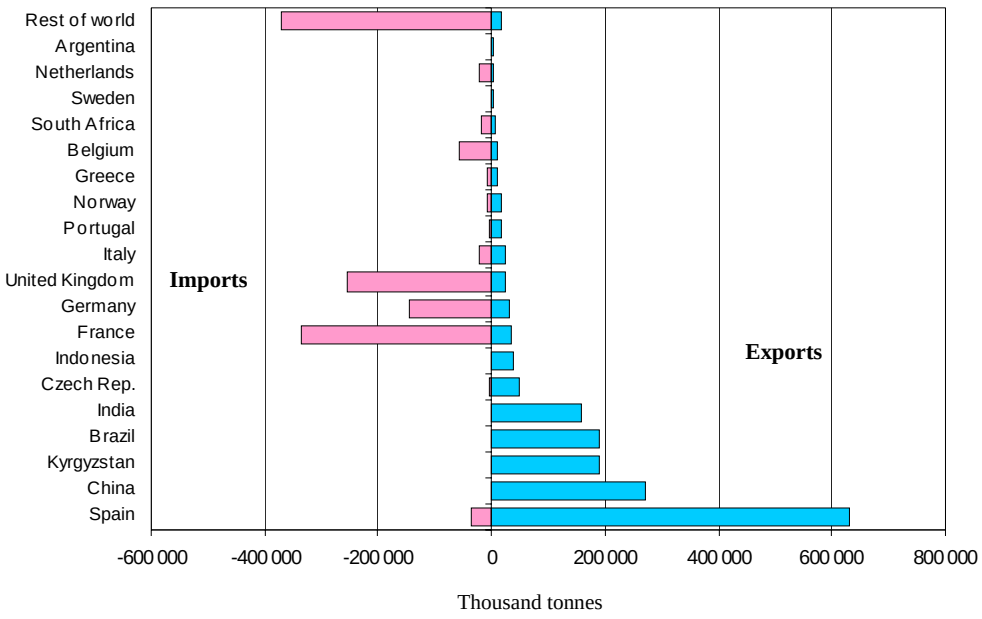

Figure 7.7.3 Major roofing slate importing and exporting countries, 2005

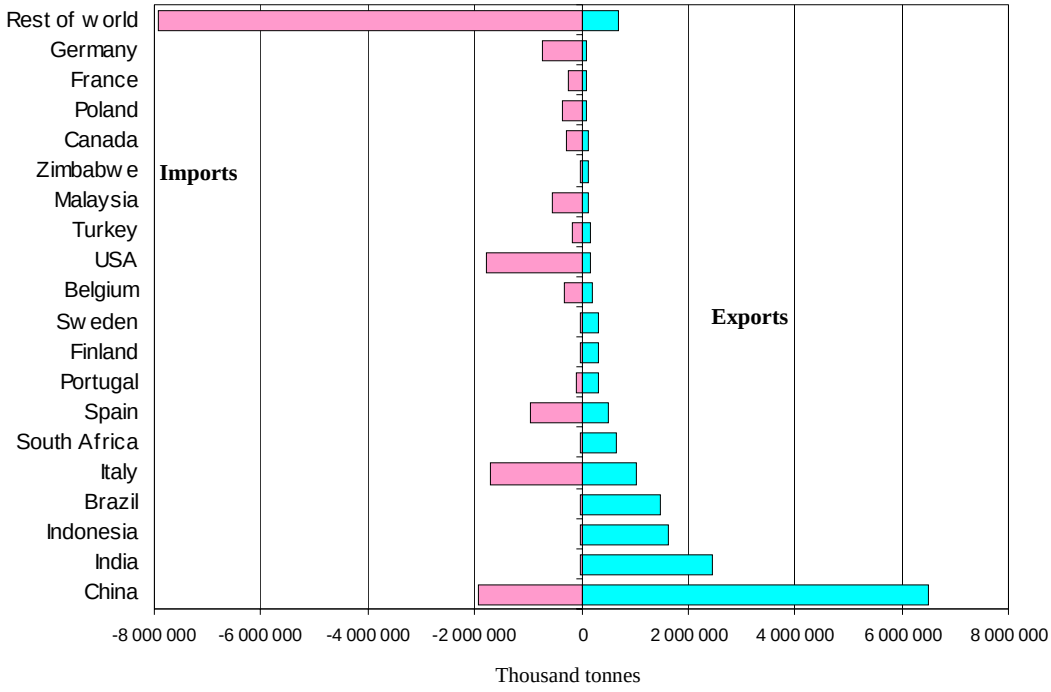

Figure 7.7.4 Major granite importing and exporting countries, 2005

Source: UN Comtrade database

7.8 Prices

Prices for stone are very much dependent on the volume of material required and the amount of processing undertaken after the rough block is produced.

However, a recent example of the competitive nature of the world market is given by the refurbishment of the John Madejski Garden at the Victoria and Albert Museum in central London. Two stones were used: a pale yellow Carboniferous sandstone from Yorkshire and a red sandstone imported from China. The latter was chosen both on aesthetic grounds and because it was available at 25% of the cost of an equivalent red sandstone from the UK (Natural Stone Specialist Aug 2005).

7: Building stone - focus on the UK

7.9 Current Issues

7.9.1 Continuity of production

The industry relies on a small but highly skilled workforce and high levels of capital investment in both mineral extraction and dimensioned stone production. Continuity of production is essential to make the industry economically viable. The industry currently benefits from a resurgence in demand for traditional materials, a situation that will, hopefully, continue. However, the industry cannot survive on restoration markets alone. There is a need for innovation in production techniques and development of product ranges and it must, at the very least, maintain its current market penetration into the building material supply chain.

Each year changes in ownership within the industry may affect short-term stone supply. In 2005 the initial closure and subsequent re-opening of Woodkirk Stone Ltd under new management, the closure of Hanson Blaise Quarry (Kentish Ragstone) and the sale of the Hanson Bath and Portland limestone quarries mark three such significant changes.

7.9.2 Production planning

The working of a quarry is governed by many factors, but in essence it is necessary for building stone: -

- to be available to suit short contractual time scales.
- to be extracted in a manner that conforms to environmental and safety standards.

This has to be achieved out at the lowest possible cost to maintain the viability of the quarry. As a consequence the majority of quarries have had to find markets for a large percentage of the materials that they extract; it now being a commercial impossibility to survive by selling only the “very best” of the stone available. Having created markets for such materials, it then becomes necessary to have adequate supplies to suit longer-term demand. It is often 2 years or longer between a material being specified and production details being supplied. The ability to satisfy orders in such circumstances requires considerable flexibility in planning where stone extraction is to take place.

The working of stone to produce aggregates does not generally have to satisfy such parameters. This is one major reason why the industry believes that planning process for aggregates is inappropriate for building and roofing stones.

Despite the obvious value of stone buildings in the UK’s historic and cultural heritage there is no current planning policy specific to the supply of building stones that recognizes this fact (see report Symonds Group Ltd 2004). Consequently many former sources of building and roofing stone have already been, or are likely to be further, sterilized if more considered / flexible regulations are not introduced. It is important to recognise that some stone resources are of national importance and are used well away from their traditional quarrying areas e.g. Portland and ‘York’ stones.

7.9.3 Imported stones

Major urban regeneration projects often use substantial amounts of natural stone. However, an increasing proportion of this stone is now sourced from overseas. The major

sources of stone imported into the UK for building purposes are summarised in Table 7.9.1.

Table 7.9.1 Principal sources of UK stone imports, 2000

Country of origin	**Imported value (millions UK pounds)**
US	2.7
India	12
China	4
Total (non-EU)	**18.7**
Spain	29
Italy	18
Portugal	9
Germany	4
France	3
Ireland	0
Total (EU)	**63**

Source: Natural Stone Specialist, 2001

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8: Further reading and contacts

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Contacts

Organisations concerned with issues related to indigenous building stone resources include:

- *Scottish Stone Liaison Group*
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  Roslin,
  Midlothian, EH25 9RE
  Tel: 0131 448 0313 Fax: 0131 440 4032
  http://www.sslg.co.uk/

8: Further reading and contacts

- *Welsh Stone Forum*
  Steve Howe
  The Department of Geology
  The National Museum and Gallery
  Cathays Park
  Cardiff, CF10 3NP

  Dr Tim Palmer
  IGES
  University of Wales Aberystwyth
  Ceredigion, SY23 3DB

  http://www.nmgw.ac.uk/geology/collections/2002/stone/

- *English Heritage*
  Customer Services Department,
  PO Box 569,
  Swindon, SN2 2YP
  Tel: 0870 333 1181 Fax: 01793 414926
  http://www.english-heritage.org.uk/

- *Historic Scotland*
  Longmore House,
  Salisbury Place,
  Edinburgh, EH9 1SH
  Tel: 0131 668 8600 Fax: 0131 668 8669
  http://www.historic-scotland.gov.uk/

- *CADW*
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  http://www.cadw.wales.gov.uk/