

	dolerites, trachytes and andesites	rocks	It is unlikely that any of the remaining deposits constitute an economic resource.			building sand. At Hullerhill Quarry about 10 m thickness of white sandstone is worked. It produces washed moulding sand and half white (coloured) glass sand, indicating an iron content of about 0.25%. The adjacent Monkredding and Sevenacres quarries in nearly	uncertainty with respect to these various factors has resulted in a lack of interest in this area. New techniques of coalbed methane exploration and their profitability, in more favourable areas of the UK, have to be demonstrated first before exploration will resume in this	
	Sedimentary rocks		Baryte, lead, silver			equivalent sandstone beds formerly produced moulding sand. West of Kilwinning, at the former Lochcraigs quarry, similar sandstone is	area.	
	Greywacke sandstone	Ordovician and Silurian	Several baryte veins are known in the Muirkirk-New Cumnock area, generally with a NW-SE trend, cutting Devonian and Carboniferous	Aking Print Sport France		generally white, medium to coarse-grained and friable. It produced sand with about 98% SiO ₂ and 0.02% Fe ₂ O ₃ , which could be considered as a silica sand.		
60			 sandstones. The thicker veins were mined up to the 1960s at Gasswater at which time it was the largest producer in the UK yielding over 500 000 tons. This deposit is probably exhausted as far as economic mining is concerned but small veins are still present. The age of the 			Some dune sand in the Irvine area has been worked to supply local demand for moulding and coloured (amber) glass sand. These sands		60
			mineralisation is post-Carboniferous since it occurs in faults affecting late Carboniferous rocks and geochemical evidence indicates that all the baryte veins belonged to one phase of deposition, which was probably Carboniferous in age.			although composed mainly of quartz, also include shelly and coaly fragments. The sands have a reddish appearance and are known to	FIRECLAY	
	BRICK CLAY					contain about 1.5% iron oxide. Most of the pits are now disused. The sand produced by the Ardeer pit is used for washed moulding sand; it could also be used in filtration beds.	Fireclay is a non-marine sedimentary mudstone consisting essentially of the clay mineral kaolinite with varying proportions of hydrous	
	Superficial deposits		Smaller baryte veins near Myres Burn, south of Eaglesham, were formerly exploited. Lead was found in the form of galena within baryte veins formerly worked near Montgomerieston in South Ayrshire prior to 1845 and the ore was stated to contain a high proportion of	Reging Hill 22 Strange V, Koosta G, Koosta G, Rock V, Koosta G, K			mica and quartz, together with some minor impurities such as ironstone nodules and carbonaceous matter. In the past, the uses of	
			silver. Small veins containing galena were also reported from St Murrays Quarry north of Maybole but none are economic prospects.				fireclay stemed from its refractory nature, that is its ability to withstand high temperatures without deforming or becoming chemically unstable. These properties are dependant on the alumina content which is generally between 40 and 45% for these kaolinitic clays. The	
	Lake deposits		Gold	Lingster Hankland Lingster Hankland Lingster			value of the raw material depended greatly on the content of alkalis, iron oxides and carbon. However, fireclays are now valued chiefly as a raw material in the manufacture of high-quality, weather resistant, buff coloured facing bricks.	
	Bedrock deposits		In the 19th century antimony was obtained on a very small scale from a narrow quartz vein including stibnite, which cuts the Hare Hill					
	· · · · · · · · · · · · · · · · · · ·	Carboniferous: Lower Limestone	Granodiorite intrusion near the Southern Upland Fault. This intrusion is host to zoned As-Sb-Cu-Pb-Zn mineralization associated with				Fireclay occurs commonly in association with Carboniferous coal-bearing strata or silica sandstones in the Passage Formation. These clays are therefore shown as coincident with coal and silica sand on the map.	
	Common shale for brick	\int Formation	gold anomalies. The gold is closely associated with arsenopyrite within zones of sericitised granodiorite. The highest grades (> 1 ppm) occur adjacent to late-stage N-S veins containing antimony and lead. No significant discoveries were made but it is possible that		Sud Bowfield Bay			
	Common shale for brick coincident	Carboniferous: mainly Lower and	additional exploration may be carried out in the future.				Within the Passage Formation, the Ayrshire Bauxitic Clay contains some of the highest quality fireclays in the UK, although its quality is variable. It is a residual deposit which is the result of decomposition of the underlying basaltic lavas and is locally absent or up to 10 m	
	with areas of shallow coal	Middle Scottish Coal Measures and Limestone Coal Formation	A gold prospect, associated with the diorites, lavas and tuffs of the early Devonian Fore Burn Complex, occurs 7 km SE of Straiton. Here		L'entret	At A	thick, averaging 1.5 m thick. Until recently, clay was extracted from the Ayrshire Bauxitic Clay at High Smithstone, near Kilwinning, and from another bed (possibly equivalent to the Douglas Fireclay) in the Passage Formation at Bankhead, Dalry. In East Ayrshire, it was	
			auriferous quartz-sulphide veins are associated with fault structures that cut the volcanic breccias and tuffs. In the eastern part of the complex a stockwork of guartz-sulphide veinlets is hosted by a small porphyritic diorite body. Both the igneous complex and the country				formerly mined near Langside, and a significant resource remains in the district but is unlikely to be an economic prospect as the market	
	BUILDING STONE		rocks are tourmalinised. The mineralisation here has been compared in style with known sub-volcanic Cu-Mo-Au porphyry systems and further exploration is possible in the area.	Loss terms to the second secon	and and a set of the s		declines.	
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	Sandstone	Carboniferous	The British Geological Survey investigated the Permian Mauchline Volcanic and Sandstone formations for a particular type of gold mineralisation associated with the unconformity of the sandstones with the underlying rocks in the presence of basaltic volcanic	Brigard Fairer State and Control Contr	dieton ate ate			
			intrusions. Widespread indications of gold grains with an unusual composition, were found. Following the publication of the report a		Creshead Jobro			
	Important former quarries in		private company carried out some surface work, but no significant discoveries were made. It is unlikely that further work will be undertaken.		East Brackweinnung Lington Brackweinnung Fragebornung			
	Carboniferous sandstones		Nickel, chrome and copper		Thoughtstand 10 Moneyacres	teriburg the second sec		
50				18 Cardinal Control Co	Brandlow Freedom F	Teneod Contraction		50
	LIMESTONE		The altered ultramafic rocks of the Ballantrae Ophiolite in South Ayrshire include chrome spinel as an accessory mineral. The rocks are possibly prospective for nickel and chromium. During the 1970s a phase of exploration drilling at Ballantrae found disseminated and		Duniop Hereit	Calabasery Radio Calabaser Rad		
	Limestone	Carboniferous: Lower and	massive nickeliferous marcasite.		167 10 - 20 - 20 - 20 - 20 - 20 - 20 - 20 -	Concept F2 Concept Con		
	Linestone	\int Upper Limestone formations	In addition, near Pinbain Bridge, chromite occurs in a zone 4-5 m wide in which it forms 30- 95% of the rock.	Fariand Head Ser Contraction of the series o	therhull Holehouse	The part of the pa		
			Two trials for copper have been made in the past, close to the Ballantrae Ophiolite, one at Balkeachy, south of Girvan and another on the		A Sector			
	SILICA SAND		eastern flank of Byne Hill but neither produced economic quantities. It is possible that exploration could be resumed, but there are no		nahili Magbet-i	Anterior and a second and a second and a second a		
			for you would be indications of a concerning with evaluation		Carley Land			
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ADMINISTRATIVE AREAS

Local Authority boundary

Uncoloured areas on the map indicate undivided bedrock and superficial surface deposits. Unspecified mineral resources may be present locally at surface or at depth.

CRUSHED ROCK AGGREGATE

A variety of hard rocks have been extracted and used for aggregates in the past. Their technical suitability for different applications depends on their physical characteristics, such as crushing strength and resistance to impact and abrasion. Higher quality aggregates are required for road surfacing and use in concrete.

Hard rock for aggregate is a principal resource in Ayrshire and both igneous and sedimentary rocks are being worked at the present time.

Igneous rock

The main sources of hard rock aggregate in South Ayrshire are the dolerite or microgabbro sills in the north of the area. Sills are shallowly dipping sheets of igneous rock intruded roughly parallel to adjacent sedimentary beds. Extraction of the dolerite has continued over a number of years at Hallyards, Hillhouse and Craigiehill quarries. The Hillhouse Sill at Dundonald is at least 45 to 60 m thick and is worked by the Hillhouse and Hallyards quarries. Hillhouse is one of the largest hard rock quarries in central Scotland and produces a wide range of crushed rock products including pre-coated chips, all categories of roadstone, concreting aggregate and rail ballast. The freshness of the Hillhouse Sill, in particular the freshness of the constituent olivine crystals, results in the rock being especially well suited for dense 'low-shrinkage' concreting aggregate. Craigiehill Quarry works the Craigie Sill of a similar composition for crushed rock aggregate and rock aggregate and rock for coated roadstone, concrete blocks and ready mixed concrete. None of the other sills are worked currently.

In the past the thicker more uniform andesitic and basaltic lavas from the Carrick Volcanic Formation have been quarried e.g. at Howmoor Quarry. However, even these rocks were spheroidally weathered and are not likely to meet modern specifications for aggregates. Andesitic rocks tend to be fresher and were intermittently worked south of Dunree and near Ballycoach. Former small quarries (e.g. Markland, now infilled) worked the Troon Volcanic Member. These basaltic lavas are considered too variable in quality to be economic at the present time.

Other hard rocks, such as the microdiorite near Guiltree Farm, as well as andesite sills and dolerite dykes have formerly been quarried on a small scale.

The Loch Doon Granite Pluton partly lies within South Ayrshire but so far no significant use of this source of igneous rocks has been made. This is an environmentally sensitive area and may be too remote from economic markets.

East Ayrshire contains very large resources of rock suitable for crushing into aggregate. However, because of the cost of transport, poorer links to the main markets, and competition from other suppliers in central Scotland, development has been limited.

At present only the quarry at Tincornhill, Sorn is operating in East Ayrshire. It produces crushed rock aggregate of fine-grained granodioritic rock from an intrusion and the adjacent baked sandstone is also crushed into aggregate. Both rocks are extremely hard and durable. The resulting product has about 60% baked sandstone and 40% granodiorite and quartz-diorite. The large granitic intrusion of the Distinkhorn Complex, south of Darvel, is another potential hard-rock source.

Varieties of dolerite or microgabbro have proved most suitable for aggregates in much of central Scotland and typically occur in near-horizontal sills up to 75 m thick. In the Cumnock area the larger sills form the Craigs of Kyle, Benbeoch, Benbain, Benquhat and High Mount. In the past quarries worked the fresh olivine-bearing microgabbro (dolerite) at South Craig and Cloquhairnan in the Craigs of Kyle Sill. These olivine-bearing dolerites are not likely to possess Polished Stone Values (PSVs) comparable to the best of the quartz-dolerites of central Scotland. High PSV aggregates have a high degree of skid-resistance when used in surfacing roads. The rock should be capable of making excellent coarse aggregate for basecourse, roadbases and sub-bases with PSVs in the range 55-60, Aggregate Abrasion Values less than 14, and Aggregate Impact Values less than 25. The rocks have potential for making concrete with drying shrinkages less than 0.045% and fall into the low shrinkage category for concreting aggregate.

In the past around Kilmarnock early Carboniferous and early Devonian lavas and sills have been extracted for hard-rock aggregate to meet local demand from small quarries. Larger quarries in trachybasalt were sited at Bannerbank and Pilmuir and in trachytic lavas at The Totherick and Craignaught. The characteristic variability of these lavas tends to restrict their use as a present-day hard rock aggregate.

In North Ayrshire, a variety of hard rocks have been quarried in the past and used for aggregates. The early Carboniferous pile of lavas that form the Clyde Plateau Volcanic Formation is a potential source of aggregate but the variable quality of the predominantly basaltic rocks means that they are not a very attractive target. The more acidic trachyte and rhyolite lavas tend to be less altered and produce a more durable product. Currently the only active hard rock quarry in North Ayrshire is at Swinlees, Dalry where early Carboniferous rhyolite is being worked. This is used as crushed rock aggregate and roadstone. Some of the stone is coated in asphalt and some is used in ready mixed concrete.

Until recently, however, several other quarries worked basalts. One near Beith was Loanhead Quarry, which worked basaltic lavas both massive and amygdaloidal together with a basalt dyke. The Troon Volcanic Member is a potential resource in its outcrop between Kilwinning and Kilmaurs. The member includes some hard basaltic lavas but they are commonly decomposed. Few of the lava flows will yield as much as 10 m of massive unweathered rock and the flows are interbedded with softer sedimentary rock. No quarries are presently extracting these lavas but they were formerly worked at Auchenharvie and Bowertrapping.

Intrusive dolerite sills are of limited extent in North Ayrshire and many crop out in built up areas.

Sedimentary rock

The greywacke sandstones in the southern part of South Ayrshire are marine sedimentary rocks consisting of compact, grey sandstone interbedded with siltstone and mudstone beds though only sandstone grade rocks are potentially aggregates, as the finer grained material tends to be softer and break into flakes. The ratio of sandstone to siltstone/mudstone varies from area to area and detailed investigation would need to be made before any quarry could be opened. In the best areas sandstones are several metres thick and have almost no interbedded siltstone. Elsewhere sandstone beds are 0.01-1 m thick with a high proportion of siltstone, which would be difficult to separate. The sandstones have a high percentage of clay minerals in their matrix and also in part as replacement products of unstable lithic grains. This clay content can give rise to excessive shrinkage in concrete produced from greywacke aggregate. However,

LIMESTONE

content they grade into dolostones $(CaMg(CO_3)_2)$. Most limestones and dolostones are hard and durable and therefore useful for aggregate. They are common rock types and consequently widely extracted for aggregate materials although generally this is not the case in central Scotland as there are numerous hard rock alternatives. Limestone is, however, also used for cement manufacture and both limestone and dolomite are valued for a range of industrial uses which, like cement manufacture, utilise their chemical properties. Limestone can be used in industry and agriculture and as aggregate or filler. Limestone extraction was widespread in central Scotland in the past but difficulties in exploiting the thin and, commonly, lower quality limestones available compared with those in other parts of the UK led to a decline in the industry. Future limestone extraction is likely to be in quarries with moderately thick limestone beds, lying at shallow depths. These criteria can be found in the Carboniferous limestones of North Ayrshire which are the main limestone resource in the west of Scotland. These limestones that are mostly grey, thick-bedded and consistent units. Because they are shallow dipping and structurally simple, they can be quarried fairly extensively and economically. Quality depends on the percentage of fresh solid limestone extracted; the interbedded calcareous mudstone and local chert are potentially deleterious components. The chemical purity is another factor and these limestones fall into the medium purity to impure range (97.0 % to <85% CaCO₃). They have low MgO contents and low acid-insoluble residues so may be suitable for cement manufacture or ground agricultural limestone.

Limestones are sedimentary rocks composed mainly of calcium carbonate (CaCO3). With an increase in magnesium carbonate (MgCO3)

The only quarry presently active in North Ayrshire is at Trearne, near Beith, working the early Carboniferous Blackhall (Dockra) Limestone for industrial use. This equivalent limestone and the underlying Hurlet Limestone were formerly extracted at Broadstonehall, Beith. These limestones extend into East Ayrshire in the Lugton-Stewarton area. Some of the raw material is processed at Middleton Quarry, Midlothian.

In East Ayrshire, many of the thin Carboniferous limestones of the Upper and Lower Limestone formations and some of the pedogenic limestones in the Kinnesswood Formation were quarried and locally mined for agricultural lime. The local limestone at the base of the Kinnesswood Formation at Craigdullyeart, besides being quarried, was mined by the pillar and stall method. Limestone samples from here contain 10.7% SiO₂. In the past the uppermost Hosie (McDonald) limestones in the Lower Limestone Formation were quarried at Muirkirk. In the Upper Limestone Formation Calmy (Blue Tour) Limestone was quarried near New Cumnock and the Keirs Limestone, south of Waterside.

The Hurlet (Patna) Limestone, near Patna, was formerly mined because of its high purity (up to 97% CaCO₃), but the seams are only 3 to 4 m thick. It is unlikely that the remaining resources would be an economic prospect today and there is no active limestone quarrying in East Ayrshire.

In South Ayrshire, the Ordovician Stinchar Limestone at Tormitchell is quarried for roadstone (coated), crushed rock aggregate and ready mixed concrete. The Tormitchell quarry now extends in to the surrounding Ordovician sandstones and conglomerates, which are crushed for use as aggregate. Within the Girvan area, the Stinchar Limestone has been worked for many years and was originally quarried for agricultural purposes at Aldons, Craigneil and Bougang. The Ordovician Craighead Limestone was also quarried in the past but is practically exhausted. Within the Carboniferous beds only very small pits in the fine-grained dolomitic limestones (cementstones) or pedogenic limestones (cornstones) were worked mainly for agricultural lime from the middle of the 18th century until the late 19th century. Near Dailly, the Hurlet Limestone was also formerly quarried. These are no longer considered to be economic because the beds are too thin.

PEAT

This unconsolidated deposit of water-saturated compressed plant remains usually forms a bog or moss. These form in areas where inputs of water (almost exclusively from precipitation) have a low nutrient content and where rainfall is sufficient to maintain the ground surface in a waterlogged condition. The vegetation is characterised by acid-tolerant plant communities of which the moss genus *Sphagnum* is dominant. The two main types of bog are (i) raised bogs, formed on plains or broad valley floors and (ii) blanket bogs which form mainly on upland hills where conditions are suitably cool and wet. The peat cover tends to be thinner over hill slopes; thicker water-logged deposits accumulated in lowland hollows.

Many lowland bogs are designated sites of international or national conservation areas.

In the past peat was used as fuel, but is now almost entirely dug for horticultural purposes, either as a growing medium or as a soil improver.

Peat covers some extensive areas in the north of North Ayrshire, but no peat is presently extracted from here. Most of it lies within the Clyde Muirsheil Regional Park. Several lowland raised peat mosses occur farther south including Cockinhead, Dykeneuk and Auchentiber Mosses. The northern part of the larger Shewalton Moss, which has a maximum recorded thickness of 9.0 m, is now a nature reserve.

In South Ayrshire raised peat is sparsely developed in poorly drained hollows, such as Red Moss, and tends to be intercalated with alluvial deposits. On some hillsides, such as Glenside Hill, and over many of the hills in the Southern Uplands, blanket peat cover is more extensive but little of it is over 1 m thick. Peat in these remote hilly areas is marginal as an economic resource.

Within East Ayrshire, Airds Moss which lies to the north of Cronberry, was investigated in the 1950s as a resource and it was estimated that peat 0.5 m to 8 m thick covered some 1066 ha. The peat volume was estimated as 28.4 million cubic metres. Airds Moss was assessed originally as a source of energy, but today it might be considered for horticultural use or for producing charcoal or activated carbon. Flow Moss is fairly extensive but it is unlikely that the deposit is more than 5 m thick. Other peat resources, such as Glaisnock Moss, Martyr's Moss and Headmark Moss lie between Cumnock and Dalmellington. Many of the peat deposits have been drained and several planted with trees. Peat blankets cover the more remote, upland parts of East Ayrshire but they are unlikely to be of economic interest. Some of these mosses are important widlife sites of European and National importance.

SECONDARY AGGREGATES

Secondary aggregates include the waste from collieries and other mineral extraction or processing operations as well as materia recycled from former man-made constructions. They are used as alternatives to primary aggregates.

Colliery tips (bings) that contain a high proportion of unburnt mudstone may provide suitable material for brick-making but their composition can be variable. Tips of inert burnt mudstone with siltstone and sandstone can be used as fill. Some tips may be polluted and their use may not be environmentally or economically desirable. Recently many of the coal bings around Dailly have been



