British Geological Survey — Natural Environment Research Council

Department of the Environment — www.doeni.gov.uk

Department of Enterprise, Trade and Investment — www.detini.gov.uk

COUNTY ARMAGH

Mineral Resource Map of Northern Ireland

Mineral Resources

Scale 1:100 000

Compiled by: P.E.J. Pitfield, J.M. Markelow, M.R. Cooper, D.G. Cameron, P.A. Lusty, R.A. Shaw, and K.A. Linley
Project Leaders: J.M. Markelow (BGS) and M.R. Cooper (GSNI)
Digital Cartography: N.A. Spencer (BGS)

This map is one of a series of six maps comprising the Mineral Resource Map of Northern Ireland, commissioned by the Department of the Environment (Northern Ireland).

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Pitfield, P.E.J., Markelow, J.M., Cooper, M.R., Cameron, D.G., Lusty, P.A.J., Shaw, R.A. and Linley, K.A. CR/12/019

SAND AND GRAVEL

Superficial deposits

- Glaciofluvial and glacial deposits

SANDSTONE

- Sandstone with potential for high specification aggregate
- Other sandstone

CONGLOMERATE

- Conglomerate

IGNEOUS AND META-IGNEOUS ROCKS

- Other igneous and meta-igneous rocks (basalts, andesites, rhyolites, granites, volcanogenic and meta-volcanic rocks)

LIMESTONE

- High purity limestone (>97% $CaCO_3$) - Ulster White Limestone
- Limestone - Carboniferous
- Other limestone

DOLOMITE

- Dolomite

LIGNITE

- Lignite (coincident with Lough Neagh Clay)

CLAY

- Lough Neagh Clay (coincident with lignite)
- Brick clay

MINERAL WORKINGS (as at 23.03.12)

- Crosslieve (Sst) — Extent of valid (extant) planning permission (name, mineral commodity)
- Navan *(Lst)* — Extent of expired planning permission (name, mineral commodity)
- Building stone quarries (including historical)
- Wharf landing sand and gravel

Mineral commodity

Cla	Clay and shale	Ign	Igneous/meta-igneous rocks
Lst	Limestone	Pea	Peat
Sag	Sand and gravel	Slt	Slate
Sst	Sandstone		

METALLIC MINERAL OCCURRENCES

- Au — Symbol indicates elemental occurrence

Symbol	Element	Symbol	Element
Au	Gold	Ag	Silver
Ba	Baryte	Cu	Copper
Mn	Manganese	Pb	Lead
Zn	Zinc		

ENVIRONMENTAL DESIGNATIONS (as at 23.03.12)

- International nature conservation designations (SACs, SPAs and RAMSAR sites)
- National nature conservation designations (ASSIs and NNRs)
- Area of Outstanding Natural Beauty: Ring of Gullion
- \+ Scheduled Monument

MINERAL CONSTRAINT (as at 23.03.12)

- Area of Constraint on Mineral Developments

ADMINISTRATIVE AREAS

- Local Government District

WARNING: Please be aware that the printed colours may differ due to the settings of the plotter used.

MINERAL RESOURCES MAP OF NORTHERN IRELAND

A key aspect of sustainable development is the conservation and safeguarding of non-renewable resources, such as minerals. There is a need to ensure that these resources are not needlessly sterilised by other development thus leaving them unavailable for future generations. Mineral Resource maps are designed to show the location and distribution of those mineral resources which may be of current or potential economic interest. The maps are intended to assist strategic decision making in respect of mineral extraction and the protection of important mineral resources against sterilisation. They bring together a wide range of information, much of which is scattered and not always available in a convenient form. The maps have been produced by the collation and interpretation of mineral resource data principally held by the Geological Survey of Northern Ireland.

The Geological Survey of Northern Ireland and counterpart The British Geological Survey have produced the maps via a commission from the Department of the Environment. This map, along with one for each of the five other counties (including county boroughs), was completed in 2012 and a series of six digitally generated maps at a scale of 1:100 000 are available. The scale at which data depicted on these maps are also available in a digital format for use within a Geographical Information System (GIS).

Mineral resources

Mineral resources are natural concentrations of minerals which might now, or in the foreseeable future, be of economic value. The assessment of mineral resources is, therefore, a dynamic process which must take into account a range of factors. These include geological reinterpretation as additional data becomes available, as well as the continually evolving demand for minerals, or specific qualities of minerals, due to changing economic, technical and environmental factors. Consequently, the economic potential of mineral resources is not static, but changes with time.

Generally, a mineral resource is known to exist within the boundaries outlined by geological mapping, which may be supplemented by more in depth geological data. Mineral Resource data depicted on the map shows the inferred extent of a mineral resource. Inferred resources are those which are derived from available geological information and assumed but not verified geological continuity. They have neither been evaluated by drilling or other sampling methods, nor had their technical properties characterised, on any systematic basis.

Limitations

The mineral resource data presented are based on the best available information, but are not comprehensive and their quality is variable. The inferred boundaries shown are, therefore, approximate. Mineral resources defined on the map delineate the areas within which potentially workable minerals may occur. These areas are not of uniform potential and also take no account of planning constraints that may limit their working. Much of Northern Ireland is covered by thick superficial deposits which, although they may locally be of economic value, have not been mapped in detail. Such deposits are not shown to the working of many of the bedrock resources depicted. Peat, as a mineral resource, is included on an east map. Till is not considered to be a resource although it may contain small sand and gravel deposits. The economic potential of specific sites can only be proved by a detailed evaluation programme. Such an investigation is an essential precursor to submitting a planning application for mineral working. Areas are shown on the map as having no mineral resource potential, but some isolated mineral workings may occur. The presence of these operations generally reflect very local or specific situations.

The locations of extant or expired planning permissions for the extraction of mineral are shown. These have been supplied by the Planning Service, Department of the Environment. Information on planning permissions granted after this date was not available and, therefore, may not be shown on the map. In addition, building stone quarries are also shown. Information on the location of building stone quarries was taken from the Natural Stone Database of Northern Ireland, developed by the Corsaint Design Group and Queens University Belfast, supplemented by information from GSNI. Due to the historic nature of many building stone quarries, digital outlines of the planning permission are unavailable and, therefore, are not shown on the map. The boundaries shown on the map for the Natural Stone Database of Northern Ireland are digitised from the location of mines and quarries in a snapshot in time. Moving the extraction location as reserves become exhausted or a new extension starts production, and renaming of sites are regular occurrences, and in addition planning permission may cease to be extant.

The map is intended for general consideration of mineral issues and not as a source of detailed information on specific sites. The map should not be used to determine individual planning applications or in taking other decisions on the acquisition or use of a particular piece of land, although they may give useful background information which sets a specific proposal within context.

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CRUSHED ROCK AGGREGATES

Crushed rock aggregates are a key component of construction materials such as concrete and asphalt where aggregate adds low-cost reinforcement to these composite materials. Loose aggregates are also used as a stable foundation for road/rail base with predictable, uniform properties.

A wide variety of hard rocks are suitable for use as aggregates including igneous, sedimentary and their metamorphic equivalents (igneous or sedimentary rocks which have subsequently been altered by heat and/or pressure). Their technical suitability for different applications depends upon physical characteristics, such as crushing strength and resistance to impact and abrasion.

High specification aggregates (HSA) are needed to produce skid-resistant road surfacing. These materials must have a high resistance to polishing. This is expressed as a 'Polished Stone Value' (PSV) of 58 or higher. HSA must also meet strict specifications for resistance to abrasion, fragmentation and weathering, as well as compositional restrictions. For less demanding applications such as constructional fill and drainage media, a wider variety rocks with lower specifications are acceptable.

This text box describes resources of crushed rock aggregate in County Armagh derived from igneous rocks, sedimentary rocks and their metamorphic equivalents, and their metamorphic equivalents. Limestones, which are also a source of crushed rock aggregate in Co. Armagh, are described in a separate text box.

Igneous and meta-igneous rocks

Most igneous and igneous-derived rocks in Co. Armagh are suitable for general aggregate use. However, igneous rock resources suitable as HSA material for road surfacing applications are limited.

The basalt lavas and intrusions of the Antrim Lava Group have elevated PSV values that make them suitable for a wide range of applications. Basalt lava in the northern part of Co. Armagh is exploited for crushed rock aggregate and roadstone.

A felsite dyke and/or a crosscutting basalt sill, is worked at the Swan Rock quarries located to the east of Crossmaglen in the southernmost part of the county. Also in the south of the county, the Newry Igneous Complex and the adjacent contact metamorphosed meta-sedimentary rocks are worked for crushed rock aggregate.

Sedimentary and meta-sedimentary rocks

The extensive quartz-rich sandstones (or gritstones) underlying much of Co. Armagh constitute a major source of HSA material. Eleven quarries are currently active of which three produce in excess of 100 000 tonnes per year and several supply HSA to England. Average PSV values range from 57.5 to 66.0, with most quarries recording values in the interval 61-64.

Sandstones and siltstones, commonly with thick mudstone interbeds, in the southernmost parts of Co. Armagh, generally produce inferior aggregate material except in the vicinity of the Newry and Slieve Gullion igneous complexes where they have been thermally metamorphosed. HSA aggregates are exploited at various sites in the vicinity of these granitic complexes.

The Carboniferous-age limestone around Armagh is primarily used as a local source of crushed rock aggregate. The limestone, which was formerly for building stone (see text box on Building Stone), is currently worked at the Carganmuck, Annacramp and Tynan quarries near Armagh City.

CLAY

Brick clay

'Brick clay' is a term used to describe clay and shale used predominantly in the manufacture of bricks, and to a lesser extent, roof tiles and clay pipes. These clays may sometimes be used in cement manufacture, as a source of constructional fill and for lining and sealing landfill sites. The suitability of the raw material depends principally upon its behaviour during shaping, drying and firing. This dictates the properties of the fired brick such as strength and frost resistance and, importantly, architectural appearance.

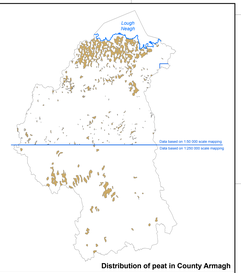
Most facing bricks, engineering bricks and related clay-based building products are manufactured in large automated factories. These represent a high capital investment and are increasingly dependent, therefore, on raw materials with consistent characteristics. Consequently, most companies own their own source of raw materials. Blending different clays to achieve improved durability and to provide a range of fired colours and textures is an increasingly common feature of the brick industry. Continuity of supply of consistent raw materials is of paramount importance.

Stone-free red plastic clays from the Triassic-age Mercia Mudstone Group, with later re-deposition, have been worked for brick manufacture at Portadown in Northern Ireland (e.g. the Tandragee area and Eagles Valley). The Mercia Mudstone Group occurs north-west of Portadown, in the north of County Armagh. There are no active sites working brick clay in Co. Armagh.

Lough Neagh Clay

The Lough Neagh clays extend over 500 km², of which 300 km² underlie the lough. The lignite-bearing clays form a belt that extends around the western, southern and eastern shores of Lough Neagh. Clays are interbedded with up to 400 metres thickness of flat lying or shallow dipping sands, silts and lignite within small fault-bounded basins (see also text box on Lignite). Clays from the Lough Neagh Group were used in the manufacture of sanitary pipes at Coalisland, Co. Tyrone, and on the east side of Lough Neagh near Portmore, Co. Antrim. The same Lough Neagh Group of rocks underlies superficial deposits in the north of Co. Armagh.

The Lough Neagh clays are of a similar age and character to the ball clay deposits found in the south-west of England. The principal exploitable properties of these ball clays are their plasticity, dry strength, white-firing character and vitrification behaviour. Unfortunately, the high iron content of the clays around Lough Neagh limits their use and no resources have been identified that would be acceptable to modern ceramic producers.



Distribution of peat in County Armagh

PEAT

Peat is an unconsolidated deposit formed by decaying organic matter which accumulates in a water-saturated environment over a long or more. Bogs occur in areas where it and are dependent on rainfall for supply of water or in sedimentary basins such as former lakes. Vegetation is characterised by acid tolerant plant communities of which the genus Sphagnum is dominant. The two main types of bog are (i) raised bogs, characteristic of flat underlying topography and found on plains and broad valley floors and (ii) blanket bogs, which occur mainly in upland areas where conditions are suitably cool and wet.

Although most widespread in the west and north of Northern Ireland, blanket bog also occurs in eastern upland areas. Peat depth is variable, with an average of 5.5-3 metres being fairly typical, but depths in excess of five metres are not unusual. Raised bogs occur across the province. These may be infilling former lagoons or glacial lakes behind other coastal deposits or older glaciogenic deposits respectively. Peat bogs in Northern Ireland are relatively small and were never developed on an industrial scale for power generation as they were in the Irish Midlands. Whilst peat is cut locally for fuel, its main usage is as a horticultural growing medium, although its potential as a carbon sink has been recognised.

There are widespread resources of peat in raised bogs overlying the Lough Neagh Clay Group and glacial tills in the northern part of County Armagh which are worked for horticultural use.

BUILDING STONES

A wide range of rock types are used as a source of building stone for masonry, field walling, roofing and flooring purposes, all of which give a specific character to an area. The stones can be used as coarsely dressed 'rubble walling', however, there is usually a need to dress the stone to produce flat beds, such as mullions and sills on such buildings. The suitability of particular rock types depends not only on aesthetic qualities such as colour and textural consistency but also factors such as strength and durability, as well as other commercial considerations.

A wide variety of hard rocks are suitable for use as building stone including igneous, sedimentary and their metamorphic equivalents. Limestones, which are also a source of crushed rock aggregate in Co. Armagh, are described in a separate text box. Building stone are also suitable for crushed rock aggregate (see text box on Crushed Rock Aggregates). Some units, notably the thicker sandstone formations, lend themselves to being used as a freestone or dimension stone as they can be worked in any direction without splitting or failing. A continuing supply of building stone is important for new build and conservation work.

Igneous and meta-igneous rocks

The Newry Granodiorite within County Armagh has been worked along its northern margin for building stone at Goraghwood Quarry near Jerrettspass, and at Drumalane Quarry near Newry. The granodiorite is a biuish-grey granitic rock that is an extremely hard and resistant building material. It has been used as facing stones on buildings and for kerbstones in Newry and Belfast. Stone from Goraghwood Quarry was used in the construction of the Craigmore railway viaduct. Drumalane Quarry is currently worked for crushed rock aggregates (see text box on Crushed Rock Aggregates).

The granitic rocks of Slieve Gullion Complex in the south of the county have been exploited for building stone at the Mullaghbawn Central, Slieve Gullion Forest and Camlough quarries. In the case of Camlough Quarry, thermally metamorphosed greywackes and shales are also present.

Sedimentary and meta-sedimentary

Armagh Limestone is probably the best recognised of Northern Ireland's limestones. It varies in colour from pale grey to dark grey and is commonly characterised by fossil debris. Historically, numerous quarries in Co. Armagh, Co. Down and Co. Antrim at the main stone quarries (e.g. Annacramp and Carganmuck) are still active, although largely used for aggregate. Rock Road and Benburb No 2 quarries have ceased working. Armagh Limestone shows little decay over time, with only mild weathering along stylolites (surfaces generated by pressure dissolution) and where fossils are present, and occasional mortar damage where cement pointing has been used.

The Meadown Limestone Formation was formerly exploited for building stone at Benburb No 1 Quarry. Some building stone is still extracted at the currently active Navan and Tynan quarries, although they are primarily worked for crushed rock aggregates.

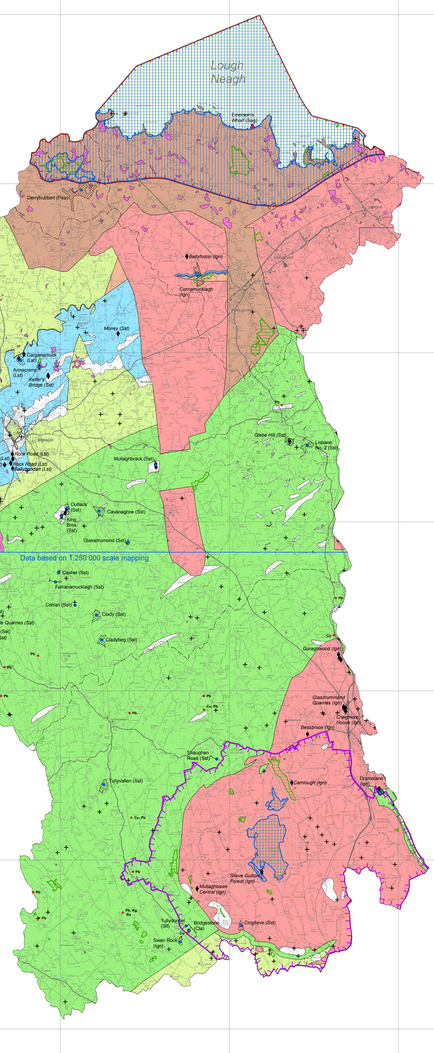
Well-bedded sandstones/gritstones, which underlie much of Co. Armagh, have been subject to very low grade metamorphism, making them good structural building stone as well as high specification aggregate. Gala Group greywackes have been exploited for building stone at Drumalane, Glebe Hill and Outlack quarries. Sandstones/gritstones within the Moffat Shale Group have been exploited for building stone at Killycapple (Outlack) and Mullaghbrack (Markethill) quarries.

SUPERFICIAL SAND AND GRAVEL

Sand and gravel are defined on the basis of particle size rather than composition. In current commercial practice, following the introduction of the European standards in 2004 (BS EN 12620), the term 'gravel' (or more correctly 'coarse aggregate') is used for general and concrete applications to define particles between 4 and 20 mm. The term 'sand' (or 'fine aggregate') is used for material that is finer than 4 mm, but coarser than 0.063 mm. For use in asphalt, 2 mm is the break point between coarse and fine aggregate. Most sand and gravel is composed of particles that are durable and rich in silica (quartz, quartzite and flint).

The principal uses of sand are as a fine aggregate in concrete, mortar and asphalt and the main use of gravel is as coarse aggregate in concrete. Substantial quantities of sand and gravel may also be used for constructional fill.

The variability of sand and gravel deposits together with their possible concealment within or beneath till (boulder clay), means that it is difficult to infer their location and the likely extent of potentially workable resources.

Most workable deposits of sand and gravel formed at the end of the last ice age. They lie on top of the bedrock geology and are generally concentrated in the river valleys. Superficial sand and gravel resources in County Armagh comprise proglacial fluvial deposits (sand and gravel deposited by meltwater flowing from the retreating ice margin). Small areas of glaciofluvial sand and gravels occur on the flanks of the valleys of the Callan River (8 kilometres south of Armagh City), Glore Water and the River Blackwater.

County Armagh is a relatively small producer of sand and gravel in Northern Ireland, accounting for about four per cent of output. The Lough Neagh Clay Group underlies much of the county and is overlain by sand and gravel, and at one time was worked for processing at Emerson's Wharf, near Lurgan. Whilst Lough Neagh is one of the main sources of sand and gravel, the reserves have not been estimated.