Namurian rocks

Namurian rocks were formed during the Namurian subdivision, or Epoch, of the Carboniferous Period known as the Namurian, between approximately 327 and 316 million years ago. The name Namurian is derived from the province of Namur in Belgium.

Currently protected sites of Dinantian rocks within the AONB SSSIs

SSSI Name/GCR Name Grid Ref

Botany Hill/Botany Hill [NY 955 204]

Grag Gill/Grag Gill [NZ 026 235]

Rogerley Quarry/Rogerley Quarry [NZ 019 375]

Sleightholm Beck Gorge 'The Troughs'/Sleightholm Beck Gorge 'the Troughs' [NY 965 116]

Namurian rocks are also exposed within a number of areas scheduled as SSSIs that are not specifically designated for Namurian rocks within the Geological Conservation Review.

RIGS

Bank's Gate, North Stainmore

Howhill Quarry, Alston

Nenthead, Alston Moor

Durham County geological sites

Chestergarth Quarry, Rookhope [NY 943 418]

Derwent River Gorge, [NZ 090 530]–[NZ 050 497]

Fine Burn, Bollihope [NZ 023 351]

Greenfield Quarry, Cowshill [NY 851 422]

Harehope Quarry, Frosterley [NZ 038 367]

Harthope Quarry, St John's Chapel [NY 863 352]

Harthope Head Quarries, St John's Chapel and Langdon Beck [NY 864 339]

Middlehope Burn, [NY 906 381]

Killhope Lead Mining Centre [NY 823 433]

Roundhill Quarry, Stanhope [NZ 011 383]

Stanhope Burn [NY 987 398]

Sedling Burn, Cowshill [NY 855 405]

Spurlswood Beck and Quarter Burn, Eggleston [NZ 022 268]

Stable Edge Quarry, Newbiggin [NY 919 282]

Teesdale Cave (Moking Hurth Cave) [NY 868 310]

Other representative sites in the area

River Nent, Nenthead Mines Visitor Centre [NY 785 431]–[NY 788 427]

River Allen gorge, Allenbanks [NY 800 592]–[NY 799 640]

River West Allen, Carrshield [NY 803 465]

Beldon Burn [NY 916 497]

Coal Crag, Nookton Burn [NY 923 472]

Croglin Water [NY 615 476]

Forest Head Quarries, Hallbankgate [NY 584 574]

Harthope Bank Quarry, Langdon Fell [NY 864 339]

Hartleyburn Common & Glendue Fell [NY 637 550]

Hudeshope Burn [NY 936 308]

Stanhope Burn, Stanhope [NY 956 442]

Namurian rocks in Great Britain

Within Great Britain almost all rocks of Namurian age are sedimentary. Over substantial areas of the central and southern Pennines and the Peak District, Namurian rocks mainly comprise thick successions of hard, coarse-grained sandstones to which the term 'Millstone Grit' is commonly applied, from the suitability of many of its sandstone beds for making grindstones. In the North Pennines and Cumbria, Namurian rocks typically comprise thick successions of shales, siltstones and sandstones with some, generally thin, beds of limestone and coals.

The broad pattern of 'troughs' and 'blocks'which was established during Dinantian, times persisted into the Namurian. The Namurian rocks of northern England reveal evidence of the transformation from the predominantly marine conditions of the Dinantian, to the almost exclusively fresh water deltaic environments of the Westphalian.

Namurian rocks in the AONB

Namurian rocks crop out over 124,583 hectares, or over 63%, of the AONB.

These rocks have extensive outcrops in the north, east and south of the area and form much of the higher ground of Alston Moor, Weardale and the northern side of Teesdale. Particularly conspicuous are the exposures of Great Limestone in the numerous large abandoned quarries in Weardale.

As discussed above, the classification of the Namurian rocks of the AONB, adopted in this document, is based on that used in currently available 1:50000 scale geological maps.

Stainmore Group

In the North Pennines, the lowest unit of Namurian age is the Great Limestone.

The Great Limestone, up to 22 metres thick in the Stanhope area, is one of the thickest limestones within the Carboniferous succession of the North Pennines. Like the majority of the underlying Dinantian limestones, the Great Limestone typically comprises a medium-grey, slightly bituminous limestone, in which small fragments of crinoids are usually common. However, it also contains a number of distinctive beds which can be traced throughout much of the AONB and beyond.

- The Chaetetes Band occurs commonly within 1–2 metres of the base of the limestone. It is a bed, in places up to around 1 metre thick, in which superbly preserved encrusting mats of the sponge Chaetetes depressus, accompanied by colonial corals and a variety of brachiopods, bivalves etc., are preserved in growth position. Although very conspicuous in many localities this bed is absent at others.
- The Brunton Band is a bed rich in microscopic algae which occurs locally around 5 metres above the base of the limestone.
- The Frosterley Band is widely present around 6 to 7.5 metres below the top of the limestone. It is rarely more than 0.5 metres thick and is distinguished by containing variable, but often abundant, concentrations of the solitary rugose coral Dibunophyllum bipartitum. The bed, which can locally be extracted in large slabs, takes a high polish. Under the name of Frosterley Marble it was commonly worked as an ornamental stone (see Frosterley Marble, below).
- The term 'Tumbler Beds' is applied to the beds which form the uppermost approximately 4.5 metres of the Great Limestone. These comprise well-marked 'posts' of limestone separated by beds of dark grey shale up to 0.6 metres thick and are named from their troublesome instability during mining or quarrying.

Apart from the Great Limestone at its base, the Stainmore Group comprises rhythmic alternations of mudstones, siltstones and sandstones with only a few thin limestones and some very thin coals. Mudstones and siltstones make up the greater proportion of the succession, though they are seldom well exposed. The sandstones exhibit the characteristics of typical Carboniferous sandstones described above; many provide clear evidence of erosive bases. The very large cast of a tree stump and associated root system, preserved today in Stanhope churchyard, is a particularly spectacular example of a plant fossil from a 'seat-earth' sandstone.

The Knucton and Rookhope Shell Beds are examples of Namurian sandstones which contain concentrations of marine shells and have been shown to have value as correlative horizons.

The limestones commonly exhibit a rather characteristic soft, brown, earthy weathering to which the term 'famp' is locally applied. Towards the top of the Namurian succession limestones become fewer and much more impure, locally becoming difficult to distinguish from calcareous sandstones or mudstones.

Although most of the coals are very thin, usually a few centimetres thick at most, and impersistent, the Little Limestone Coal is locally up to about 2 metres thick.

Ironstones, typical of the clay ironstones described above, occur at several horizons within the Namurian succession. More unusual ironstones, which seem not yet to have been described in the geological literature, include the distinctive oolitic Knuckton and Rookhope ironstones.

Impact on the landscape

These rocks are of fundamental importance in shaping the landscape and giving it its distinctiveness. The Great Limestone is well exposed in the sides of many of the valleys and along the North Pennine escarpment. It typically forms distinctive pale grey rocky scars or low crags, partially clothed in limestone grassland, which commonly contrasts strikingly with the more acid vegetation on the overlying rocks. In common with other limestones, the Great manifests a number of features characteristic of limestone country, collectively known as 'karst' (see Karst Features, below). The Great Limestone supports one of the AONB's few examples of a typical limestone pavement, near Brough. Prominent lines of 'sink' or 'shake' holes clearly mark the top of the Great Limestone along many hillsides. As one of the thickest of the area's limestones, the Great has been extensively quarried; abandoned quarries, which expose the limestone and its

overlying beds, are conspicuous features in the landscape of Weardale around Stanhope and Frosterley. The Great Limestone's role as a host for mineral veins has also impacted significantly on the area's landscape.

Above the Great Limestone, rocks of the Stainmore Group underlie much of the open moorland which typifies much of the AONB. Much of the outcrop of Namurian rocks is substantially free of any significant cover of superficial deposits, though spreads of hill peat are widespread in places. Weathering of the flat-lying, or very gently inclined, mainly shale/sandstone succession has produced extensive areas of rolling moorland with comparatively few natural exposures of rock, except in deeply incised streams. Differential weathering of the more resistant sandstones and intervening shales has produced prominent terraced hillsides on which sandstone (and locally thin limestone) outcrops, form steep-sided terrace features. In places where the rock is especially resistant, low grey-weathering sandstone crags occur. Some of the limestones locally give rise to low scarp features. Elsewhere the nature of the underlying rock is betrayed by scattered blocks in the soil, or in small pits and quarries opened to provide local sources of stone for the many miles of drystone walls which are such distinctive elements in the enclosed landscapes of these dales. The summits of Cross Fell and other peaks along the North Pennine escarpment and on Alston Moor are formed of characteristically flat cappings of Namurian sandstones. Sandstone beds give rise to the prominent crags which rim the summit of Cross Fell.

Impact on biodiversity

Much of the impact of the Namurian rocks is similar to that of the Dinantian rocks.

Small areas of limestone pavement, for example at Palliards near Brough, provide one of the AONB's finest examples of this internationally scarce habitat. Extensive quarrying of the Great Limestone has left a legacy of abandoned quarries which exhibit varying degrees of degradation and regeneration and are commonly hosts to a rich limestone flora. Although the other limestones within the Stainmore Group have much smaller outcrops than the Great, and have been much less frequently quarried, small exposures of these rocks locally provide habitats similar to those associated with the Great Limestone.

However, the bulk of the Stainmore Group comprises shales and sandstones which typically weather to a range of mainly acidic soil types. The wide outcrops of these rocks are distinguished by expanses of moorland vegetation, including some fine examples of heather moorland, though management and grazing regimes have resulted in the widespread development of pale coloured Nardus grassland.

Economic use

By far the most important economic product of the Namurian succession has been limestone. Almost certainly, every limestone unit within the AONB provided local supplies of limestone for the making of quicklime and hydrated lime as a soil improver, obtained from countless small quarries and associated kilns scattered across the area. However, limestone production assumed large-scale industrial proportions during the late 19th and 20th centuries when huge quarries in the Great Limestone of Weardale supplied limestone for use as a flux in the iron and steel plants at Consett and elsewhere in the adjoining Durham Coalfield. In addition, limestone from the

Great and other limestone formations became an important source of crushed rock aggregate, for building and road making. The demand for limestone flux ended some time ago and many of the area's limestone quarries have long been abandoned. However, the Great remains a major source of crushed limestone products from Broadwood and Heights quarries in Weardale.

The Frosterley Marble, a distinctive coral-rich bed within the Great Limestone, is known to have been worked as an ornamental stone for use in Durham Cathedral and elsewhere as early as the 14th Century and has been worked intermittently ever since (see Frosterley Marble below). However, the amounts produced over this long period of working are likely to have been very small.

The importance of the Great Limestone as a host for metalliferous and related mineral deposits is discussed elsewhere (see Mineral Veins, below).

Almost all of the sandstones within the Stainmore Group have found local use in drystone walls and farm buildings. Many have been worked for building, paving and roofing stones and for making setts. The names of some of these units give important clues to their properties and local uses. The Grindstone Sill provided material for grindstones, the Slate Sills commonly offered flaggy sandstones suitable for roofing slabs, the Firestone Sill was locally used as a source of hearth stones. At the time of writing (January 2010), small workings for building and paving stone are active at the following sites:

Baxton Law, Hunstanworth [NY 932 468]

Dead Friars, Stanhope [NY 969 453]

Flinty Fell, Nenthead [NY 771 417]

Leipsic, Alston [NY 735 504]

Mousegill Bridge, North Stainmore [NY 857 115]

Dodd Fell, Allenheads [NY 864 459]

Siliceous sandstone, or ganister, for making refractory products, has been worked from a number of the sandstones. The most extensive of these workings are in the sandstones considered to be part of the Coalcleugh Beds, at Harthope Quarries at Harhope Pass, Weardale.

Several of the Namurian coal seams have been worked, both for local domestic use and as an important fuel for lead smelting. The most extensive workings have been in the Little Limestone Coals, particularly at the Ayle, Blagill, Baraugh, Clargill and Flow Edge collieries near Alston. Conspicuous lines of spoil heaps mark the sites of abandoned workings along the outcrops of the Little Limestone Coals, particularly in the Nent and South Tyne valleys. Similar characteristic dark grey heaps of waste shale mark the sites of workings in the Coalcleugh Coal and in other more minor seams.

It is likely that some of the horizons of thin ironstone beds, or concentrations of nodules within the Stainmore Group, may have attracted small scale working in early centuries. Some of the scattered patches of bloomery slags recorded in the area may mark the sites at which such ores were smelted. There are no records of any substantial working, or exploration, for such sedimentary ironstones.

Wider importance

The North Pennines AONB includes some of the most extensive outcrops of Namurian rocks in the UK. Comparing and contrasting the detailed nature of individual rock units and the overall succession within the AONB with adjoining areas, is vital to understanding the complex history of the UK's evolution during Carboniferous times. The Great Limestone marks the last significant episode of limestone formation in the Carboniferous succession. It contains abundant evidence of the contemporary marine fauna and flora and in places, e.g. in the Frosterley and Chaetetes bands, exhibits striking examples of complete marine ecosystems fossilised in situ. Namurian sandstones in the AONB contrast both lithologically and in their environment of deposition, from the classic 'Millstone Grit' of the central and southern Pennines. They therefore provide important evidence of the varied environments prevailing in northern Britain during Namurian times.

Threats

Many of the exposures of the AONB's Namurian rocks and features associated with them, are robust elements in the landscape. However, suitable vigilance should be exercised to ensure that no operations or activities pose threats to these features. Numerous abandoned quarries expose important sections through parts of the Namurian succession. The progressive deterioration of long-abandoned quarry faces, together with the risk of quarries being filled, poses some long- term threats. The face at Greenfield Quarry, Weardale, has been damaged by fossil hunters and research workers.

Figures

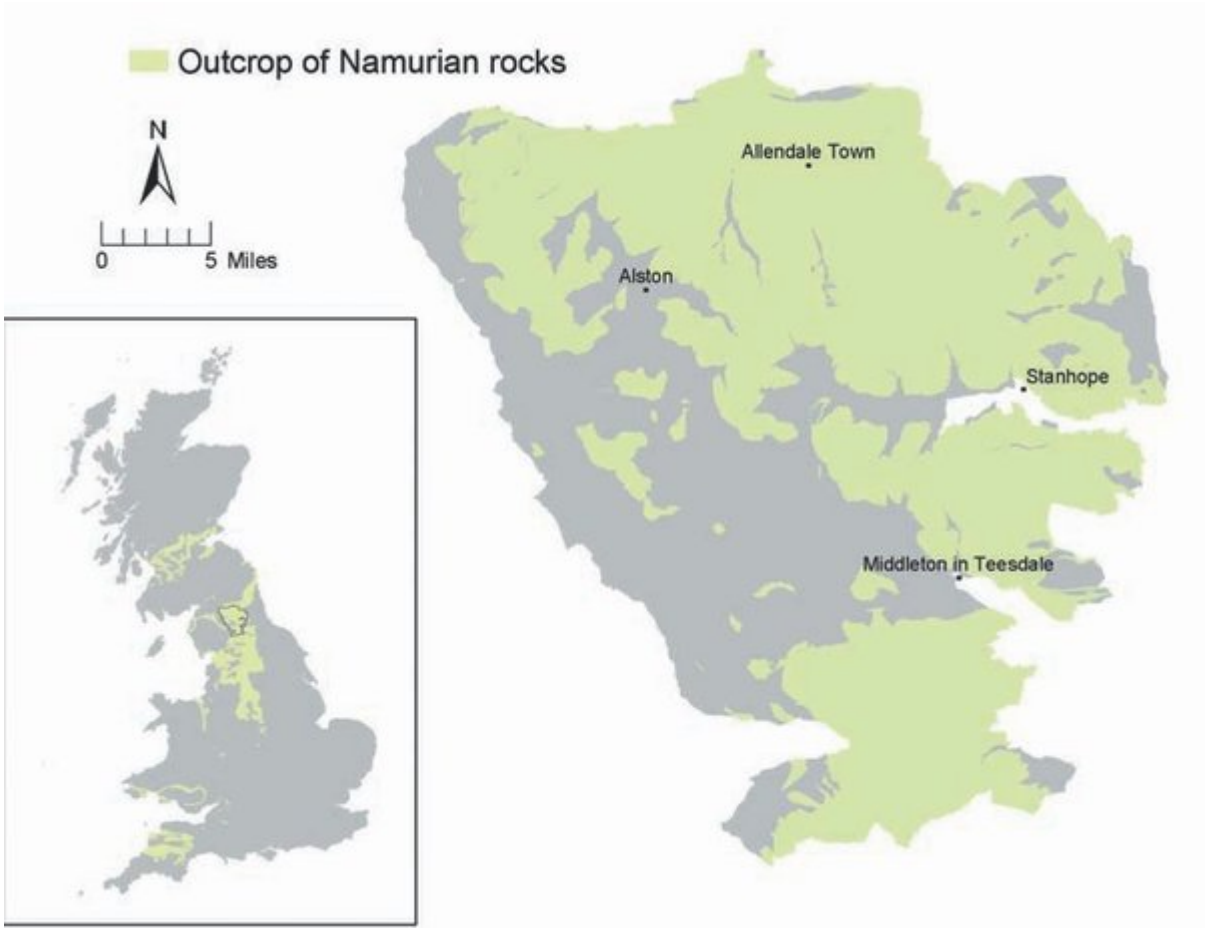
(Figure 20) Outcrop of Namurian rocks.

(Figure 21) Chaetetes Band, River Nent, Nenthead Mines. © D. Millward, BGS, NERC.

(Figure 22) Characteristic terraced hillside, Blagill, Nent Valley. S.Clarke © BGS, NERC.

(Figure 23) Middleton Common. Heather moorland on outcrop of Namurian Rocks. © Charlie Hedley, Countryside Agency.

Full references



Outcrop of Namurian rocks

Chaetetes Band, River Nent, Nenthead Mines. © D. Millward, BGS, NERC.

Characteristic terraced hillside, Blagill, Nent Valley. S.Clarke © BGS, NERC.

Middleton Common. Heather moorland on outcrop of Namurian Rocks. © Charlie Hedley, Countryside Agency.