BELSHAW'S QUARRY

A SPECIAL PLACE...

SITES OF BIOLOGICAL AND EARTH SCIENCE IMPORTANCE HAVE BEEN SURVEYED BY NORTHERN IRELAND ENVIRONMENT AGENCY TO ASSESS THEIR SCIENTIFIC INTEREST. THE BEST SITES ARE NOW BEING DECLARED AS AREAS OF SPECIAL SCIENTIFIC INTEREST (ASSIs). IN DOING SO WE AIM TO SAFEGUARD THESE IMPORTANT SITES FOR THE BENEFIT OF PRESENT AND FUTURE GENERATIONS

Belshaw's Quarry is a special place because of its earth science interest. The area provides access to an infrequently exposed deposit called the Clay-with-flints (CwF). This deposit is found between the Cretaceous white limestone below and the Palaeogene black basalt above, and spans a period of time of approximately 10 million years. Because of its location beneath the basalt, the CwF is usually only exposed at the edge of the Antrim Plateau.

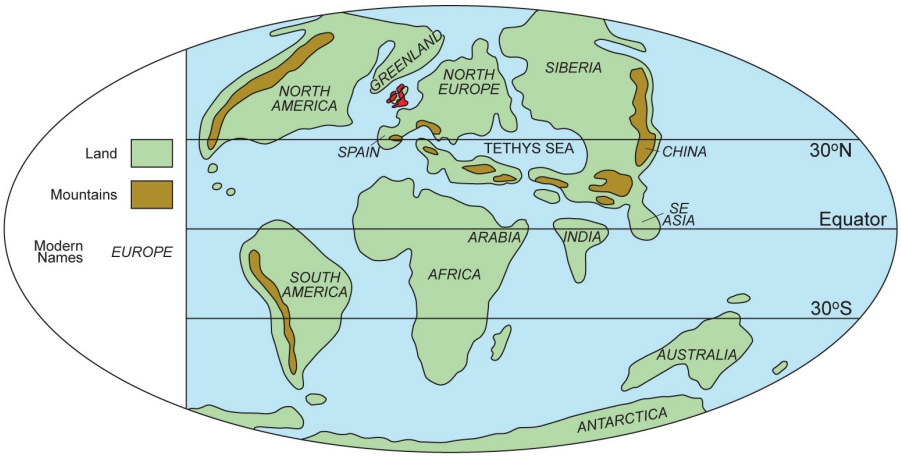
The Cretaceous white limestone formed on the bottom of a sea floor around 75 million years ago, during a time when the island of Ireland was completely covered by a warm, clear, shallow sea. As the sea level eventually dropped, the resulting limestone was exposed and it underwent a long period of weathering. This would have led to the development of a landscape similar to that of the Burren in Co. Clare, with abundant limestone pavement and associated hollows and caves. The Cretaceous limestone contains abundant nodules and layers of flint, a silica-rich material that does not dissolve in rainwater, unlike the limestone.

As weathering continued, it left behind the more robust flints that accumulated on the limestone landscape.

At the beginning of the Palaeogene period, about 65 million years ago, volcanic activity began as a result of stretching and thinning of the Earth's crust when the North American and European tectonic plates pulled apart. The resulting lava flows covered much of Northern Ireland and preserved the top surface of the Cretaceous limestone, covering the CwF.

As its name suggests, the CwF is made up of two main components, namely flints, held together to a greater or lesser degree by clay. The colour of the clay varies greatly, as does the thickness of the deposit and its unique location between the Cretaceous white limestone and the Palaeogene black basalt is what makes it most interesting.

The origin of the CwF has been a subject of great debate amongst geologists. It was initially thought to be a result of weathering at the surface to produce the flint,



A new ocean - the beginning of the Palaeogene period saw the opening of the North Atlantic Ocean and the onset of associated volcanic activity.

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combined with the residue left behind from the dissolution of the white limestone to produce the clay. Whilst this is correct in the case of the flint, the origins of the clay is much more doubtful. Another theory is that the clay component came from an explosive volcanic event that would have produced abundant volcanic material including ash. This would have occurred before the main basalts started forming. The most recent theory however indicates that the clay most likely came from localised mudflows that would have contained clays derived from the weathered basalts that would have been plentiful at the beginning of the Palaeogene period.

Exposure of the Clay-with-flints at the western end of Belshaw's Quarry

At Belshaw's Quarry the exposure of the CwF is found at the western end of the quarry just beside the top section of the steps leading down to the quarry floor. The Cretaceous white limestone can be clearly seen making up the lower half of the quarry with the Palaeogene basalt making up the upper part. The CwF is found between the two and is just over 80cm thick. There are two main divisions in the exposed section; the lower half has small to medium sized flints and a dark grey clay component, the upper half has much larger flints with a light grey component. These two distinct layers represent the flints that formed in-situ as a result of weathering of the white limestone (lower layer), followed by the deposition of clay by mudflows associated with volcanic activity (upper layer).

The clay at Belshaw's Quarry has yielded rare evidence regarding the timing of the events linked with the CwF. Analysis of some of the microscopic fossils found within the clay, specifically from a type of marine plankton known as dinoflagellates, indicates that a great deal of limestone that was exposed at the end of the Cretaceous period was weathered before the formation of the CwF. This would confirm the fact that the lower layer of the CwF is a direct result of in situ weathering of the Cretaceous white limestone, leaving behind insoluble flints.

For its size, Northern Ireland is one of the most geologically diverse areas on Earth. Designated sites of geological importance such as Belshaw's Quarry, collectively describe the full geological story of our part of the planet.

Continued sensitive management will ensure the survival of the site's important geology. The Northern Ireland Environment Agency is keen to work closely with landowners to maintain and enhance Belshaw's Quarry ASSI.

DEPARTMENT OF THE ENVIRONMENT

DECLARATION OF AREA OF SPECIAL SCIENTIFIC INTEREST AT BELSHAW'S QUARRY, COUNTY ANTRIM. ARTICLE 28 OF THE ENVIRONMENT (NORTHERN IRELAND) ORDER 2002.

The Department of the Environment (the Department), having consulted the Council for Nature Conservation and the Countryside and being satisfied that the area described and delineated on the attached map (the area) is of special scientific interest by reason of its geological features and accordingly needs to be specially protected, hereby declares the area to be an area of special scientific interest to be known as the 'Belshaw's Quarry Area of Special Scientific Interest.'

Belshaw's Quarry is of importance because of its geology. It is one of a series of sites that describes the Clay-with-flints (CwF), a unique deposit whose exposure is mostly confined to the margins of the Antrim Plateau. Stratigraphically, at most localities, the deposit occurs between older white chalk of the Late Cretaceous Ulster White Limestone Formation (83 to 72 million years old) below, and lava flows of younger black basalt of the early Palaeogene Antrim Lava Group (63 to 60 million years old) above. The period of time within which the CwF formed spans about 10 million years of the Late Cretaceous and Early Palaeogene.

Following the uplift of the former seabed and associated marine limestones (the Ulster White Limestone) the limestone surface underwent a prolonged period of weathering, including karstification. This dissolution of the limestone by acidic surface and ground water produced a topographically varied karstic surface on which the CwF horizon was developed. While the limestone could be easily weathered, the more robust flints accumulated, being very resistant to erosion.

The highly varied palaeotopography exhibited by the karstified land surface at sites exposing the CwF series, has provided evidence to inform the debate about the relative compaction and hardness of the Ulster White Limestone (UWL) when compared to similarly aged limestone in Britain. It was generally thought that the UWL owed its character from either thermal alteration and/or compaction resulting from the enormous thickness of the overlying Palaeogene Antrim Lava Group. No equivalent igneous rock series overlies the Cretaceous limestone in Britain. The nature of some of the karstic features found at these sites in Northern Ireland suggests that the limestone was already hardened and more compact prior to the development of the CwF series.

The origin of the CwF has been a subject of debate for generations of geologists both in Ireland with regard to the contemporaneous deposit in England. It was initially thought by most scientists that the origins of the CwF and its two main components, clay and flint nodules, were as a result of sub-aerial weathering and dissolution of the underlying chalk. With respect to the flint content of the deposit this is clearly correct. However, the origins of the clay component have been much more difficult to demonstrate conclusively.

There have been many proposals for the origins of the clay. These have included

being an autochthonous by-product of weathering of the chalk and originating from an external volcanic source, eruptions linked to the opening of the Atlantic Ocean, but preceding the main period of basaltic volcanism in the north of Ireland. Most recently, new evidence suggests that the origin of the clay may have been derived from the remobilisation of clays from volcanic deposits, by high-density mudflows at local and regional scale.

Chalk extraction took place at Belshaw's Quarry until about 1950, and in recent years the site was designated as a Nature Reserve. The main face of the quarry is clean and well exposed, but the CwF is obscured in most places except for a section at the western end of the quarry, just beside the top section of the steps leading to the bottom of the quarry.

At Belshaw's Quarry, the Late Cretaceous Ulster White Limestone Formation is just over 10m thick, and represents the Portrush and the Ballymagarry Chalk Members of the formation. The CwF series overlies the chalk, and is best exposed in the western end of the quarry. The upper part of the quarry comprises sub-horizontal Palaeogene basalt flows of the Lower Basalt Formation of the Antrim Lava Group. At the southwest end of the quarry a vertical Palaeogene dyke intrudes the basalt lava flows and continues to the SSE baking the chalk and the CwF.

The CwF section is just over 80cm thick and reveals three divisions. In the lowest 40cm of the bed, the clay matrix is a dark grey and contains scattered small to medium flints with no internal staining. In the succeeding 30cm the clay matrix is lighter grey in colour and large whole flints are present, which have developed internal purplish pink staining. The top 20cm is much darker grey, with small to medium sized flints that are still stained internally and are matrix supported.

Palynological examination of two samples of clay from the lower 40cm of the CwF at Belshaw's Quarry yielded abundant organic residues and palynofloras, especially dinoflagellate cysts. The overlapping age ranges of the dinoflagellate cysts *Alisocysta circumtabulata, Neoeurysphaeridium glabrum,* and *Odontochitina operculata* are indicative of an Early Maastrichtian age (*Belemnitella lanceolata* Zone). However, the youngest chalk at Belshaw's Quarry is latest Campanian in age and is therefore older than the dinoflagellate cysts. This seems to indicate that chalk of the *B. lanceolata* Zone, of Early Maastrichtian age was formerly present but was eroded in later Cretaceous times, prior to the formation of the CwF.

The two contrasting lower lithologies at Belshaw's Quarry support the concept that the CwF is the product of a two-stage process. The lower of these lithologies formed by in-situ accumulation of insoluble flint nodules during karstic weathering of the exposed chalk landscape and is confirmed by the presence of dinoflagellate cysts from now eroded chalk layers. The upper lithology is more difficult to interpret but field observations suggest that the clay was deposited by high density mudflows associated with contemporaneous volcanism.

SCHEDULE

The following operations and activities appear to the Department to be likely to damage the geological interest of the area:

1. Any activity or operation which involves the damage or disturbance by any means of the surface and subsurface of the land including reclamation and extraction of minerals, including rock and gravel.

2. The storage or dumping, spreading or discharge of any material.

3. Construction, removal or disturbance of any permanent or temporary structure including building, engineering or other operations.

4. Changes in tree or woodland management, including afforestation, planting, clearing, selective felling and coppicing.

5. Alteration of natural or man-made features, the clearance of boulders or stones and grading of rock faces.

6. The following activities undertaken in a manner likely to damage the interest of the area:

    i) educational activities;

    ii) research activities;

    iii) recreational activities.

7. Sampling of rocks, minerals, fossils or any other material forming a part of the site, undertaken in a manner likely to damage the scientific interest.

8. Use of vehicles or craft likely to damage the interest of the area.

FOOTNOTES

(a) Please note that consent by the Department to any of the operations or activities listed in the Schedule does not constitute planning permission. Where required, planning permission must be applied for in the usual manner to the council or the Department under Part 3 of the Planning Act (Northern Ireland) 2011. Operations or activities covered by planning permission are not normally covered in the list of Notifiable Operations.

(b) Also note that many of the operations and activities listed in the Schedule are capable of being carried out either on a large scale or in a very small way. While it is impossible to define exactly what is "large" and what is "small", the Department would intend to approach each case in a common sense and practical way. It is very unlikely that small scale operations would give rise for concern and if this was the case the Department would normally give consent, particularly if there is a long history of the operation being undertaken in that precise location.

BELSHAW'S QUARRY ASSI

Views About Management
The Environment (Northern Ireland) Order 2002 Article 28(2)

A statement of the Department's views about the management of Belshaw's Quarry Area of Special Scientific Interest ("the ASSI")

This statement represents the views of the Department about the management of the ASSI for nature conservation. This statement sets out, in principle, our views on how the area's special conservation interest can be conserved and enhanced. The Department has a duty to notify the owners and occupiers of the ASSI of its views about the management of the land.

Not all of the management principles will be equally appropriate to all parts of the ASSI and there may be other management activities, additional to our current views, which can be beneficial to the conservation and enhancement of the features of interest. It is also very important to recognise that management may need to change with time.

The management views set out below do not constitute consent for any operation or activity. The written consent of the Department is still required before carrying out any operation or activity likely to damage the features of special interest (see the Schedule on page 3 for a list of these operations and activities). The Department welcomes consultation with owners, occupiers and users of the ASSI to ensure that the management of this area maintains and enhances the features of interest, and to ensure that all necessary prior consents are obtained.

MANAGEMENT PRINCIPLES

The earth science interest at Belshaw's Quarry occurs as a small exposure at the western end of the quarry. The Department would encourage the maintenance of the ASSI and its earth science interest. The site is currently a NNR and although subject to vegetation growth it is regularly cleared. With minimal management this should not detract from its geological importance or adversely affect the ASSI.

The geological series

Provided no damaging activities, as set out in the Schedule, are undertaken without consent, the needs of owners, occupiers and the Department can be met. Earth science features such as those at Belshaw's Quarry may require occasional management intervention in order to maintain access to, and exposure of, the geology. This could include selective removal of vegetation or any major build up of loose rock.

Specific objectives include:

Maintain the geological series in an undamaged state.

Maintain access to the geological series.

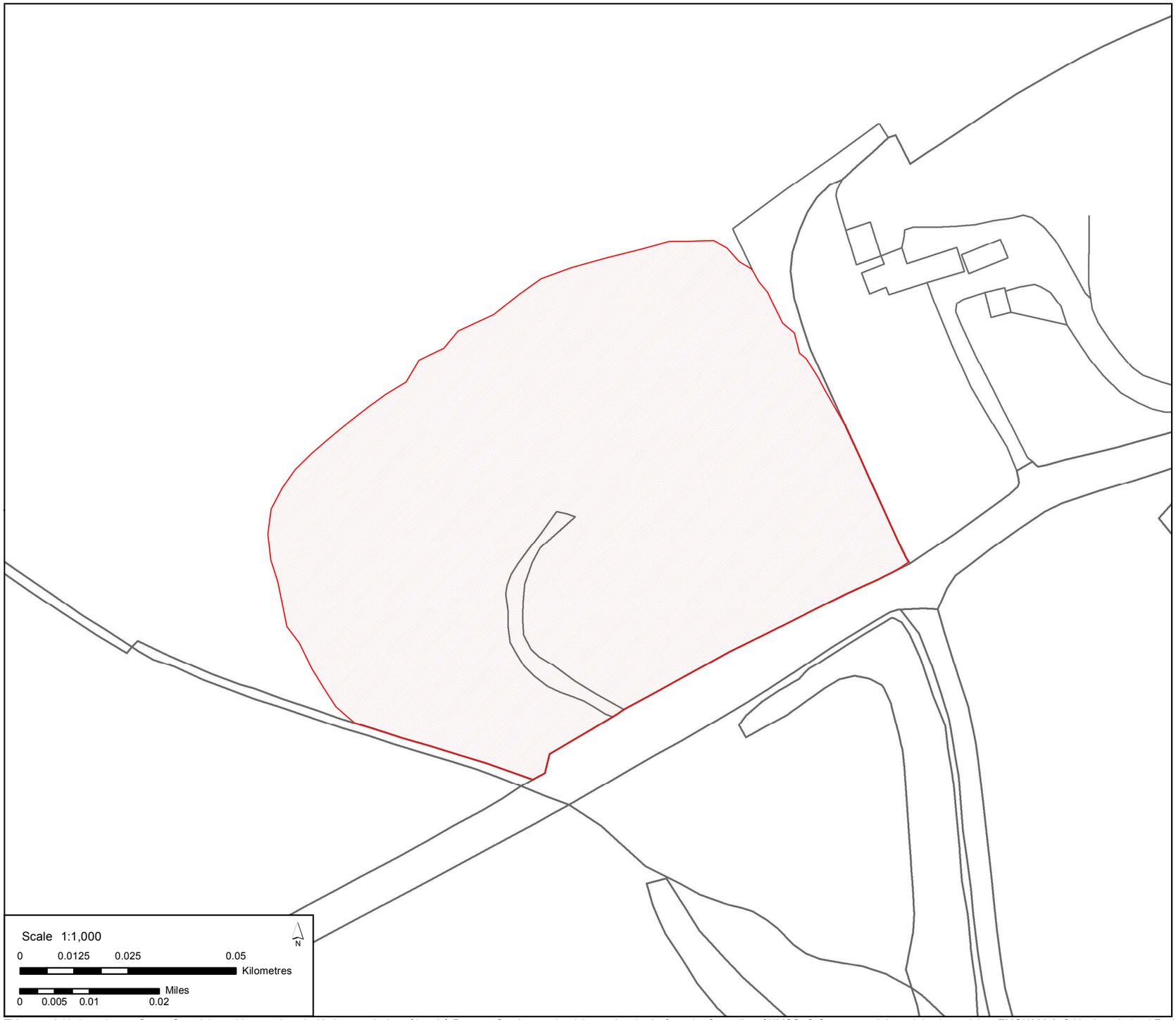
Sealed with the Official Seal of the
Department of the Environment
hereunto affixed is authenticated
by

[Signed by]

HELEN ANDERSON
Senior Officer of the
Department of the Environment

Dated the 31st of March 2016

BELSHAWS QUARRY



BELSHAWS QUARRY
AREA OF SPECIAL SCIENTIFIC INTEREST

Map referred to in the Declaration dated: 31st of March 2016

SITE BOUNDARY: The Area of Special Scientific Interest (ASSI) includes all the lands highlighted within the solid coloured line.

AREA OF SITE: 1.16 hectares

OS MAPS 1:50,000: Sheet No. 20
1:10,000: Sheet No. 165

IRISH GRID REFERENCE: IJ 228 670

COUNCIL AREA: LISBURN AND CASTLEREAGH CITY COUNCIL

COUNTY: ANTRIM

[Signed by]

HELEN ANDERSON
SENIOR OFFICER OF THE
DEPARTMENT OF THE ENVIRONMENT

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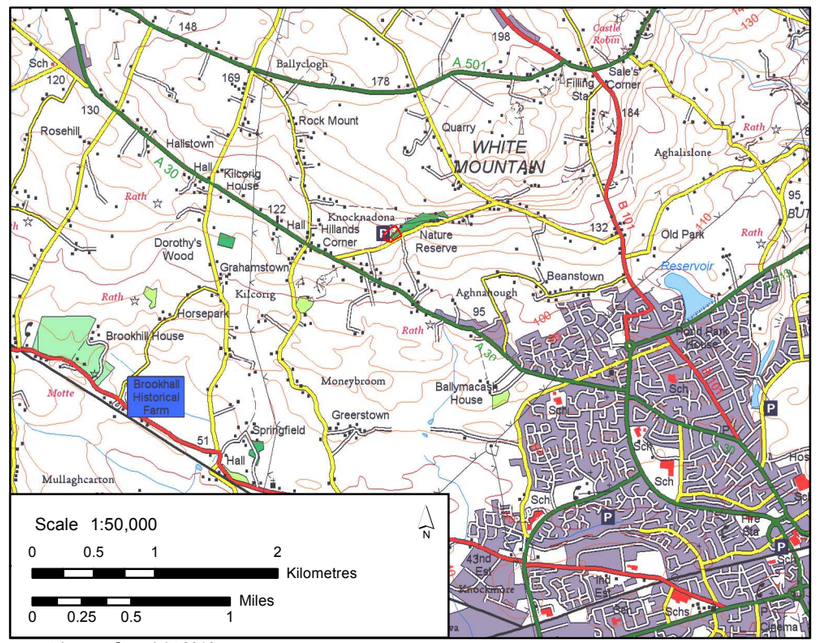

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