

The Geological Heritage of Clare

by Matthew Parkes, Claire McAteer and Scott Engering



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An audit of County Geological Sites in Clare

by **Matthew Parkes , Claire McAteer and Scott Engering**

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Section 2 - Site Reports

IGH 1 Karst

Site Name

Aillwee Hill
Ballykinnacorra North Mushroom Stone
Carran Enclosed Depression
Coad Mushroom Stones
Coolagh River Cave
Crossard Mushroom Stone
Doolin Cave
Doolin Green Holes
Elmvale Mushroom Stones
Fergus River Cave
Glencurran Cave
Gortlecka Mushroom Stone
Killinaboy Mushroom Stone
Mullaghmore/Slieveroe/Knockanes
Poulsallagh
Pol an Ionain
Rinnamona Mushroom Stones
Sraheen Mushroom Stone
St. Brendan's/Poulnagollum
Sheshymore
Tomeens
Tuamgraney
Turkenagh Mushroom Stones
Vigo Cave

IGH 2 Precambrian to Devonian Palaeontology

Site Name

Ballyvorgal South
Ballycar South

IGH 3 Carboniferous to Pliocene Palaeontology

Site name

Black Head
County Council Quarry
Doolin Cliffs [See Doolin to Hags Head site - IGH9
Doonaha
St. Brendan's Well

IGH 4 Cambrian-Silurian

Site name

Ballymalone
Caher Hill
Maghera TV road quarry
Ballycar South [see IGH2]

IGH 6 Mineralogy

Site Name

Kilbreckan
Roadford, Doolin
Maghera TV Road Quarry [see IGH4]

IGH 8 Lower Carboniferous

Site Name

Black Head [see IGH3]
Magowna
Rineanna Point, Shannon Estuary
St Brendans Well - Slieve Elva – Pollnagollum [See IGH1, IGH3]
Toonagh Quarry, Ennis

IGH 9 Upper Carboniferous and Permian

Site Name

Bridges of Ross
Doolin to Hags Head (Cliffs of Moher)
Foohagh Point
Gull Island, Tullig Point and Trusklieve section
Loop Head
Magowna [See IGH3]
Roadford [See IGH6]
Spanish Point
St. Brendans Well [See IGH3]

IGH 10 Devonian

Site Name

Ballycroum Hill

IGH 12 Mesozoic and Cenozoic

Site Name

Aillwee Hill [see IGH1]
Carran Enclosed Depression [see IGH1]
Fergus River Cave [see IGH1]

Pol an Ionain [see IGH1]

Vigo Cave [see IGH1]

IGH 13 Coastal Geomorphology

Site Name

Bridges of Ross [see IGH9]

Doolin to Hags Head [see IGH9]

IGH 15 Economic Geology

Kilbreckan [see IGH6]

Appendix 1

Full Geological References

Appendix 2

Caving References

Report Summary

County Clare is justly famous for its landscape and scenery, with an international reputation for the treasured landscapes such as the Burren and the Cliffs of Moher. The bedrock foundation, with hundreds of millions of years in the formation and shaping, and the more recent history of geomorphological processes such as coastal erosion and limestone solution are what has created that underlying geodiversity. Geological understanding and interpretation is best done on the ground at sites where the rocks and landforms are displayed. County Clare has a wealth of such natural and man-made sites.

This report documents what are currently understood to be the most important geological sites within Clare by the Irish Geological Heritage Programme of the Geological Survey of Ireland. It proposes them as County Geological Sites, for inclusion within the Clare County Development Plan. County Geological Sites do not receive statutory protection like Natural Heritage Areas (NHA) but receive an effective protection from their inclusion in the planning system. However, many of the sites described in this report are considered to be of national importance as best representative examples of particular geological formations or features. They either have been, or will be, formally proposed by the Geological Survey of Ireland, for designation as NHAs by the National Parks and Wildlife Service after due survey and consultation with landowners. However, many of these sites fall within existing NHAs and SACs where the ecological interest is founded upon the underlying geodiversity. It should be noted that a very small number of sites have been omitted for specific reasons, but may be added to the full list once particular issues have been resolved. The commission of this report, and adoption of the sites within the County Development Plan places Clare at the forefront of geological conservation in Ireland.

This report is written in non-technical language (with a glossary for unavoidable geological terminology) as a working document for use by the Heritage Officer and the Planning department of Clare County Council. It is not primarily intended for publication for the people of Clare as it stands. A chapter of the report includes recommendations on how to best present and promote the geological heritage of Clare to the people of Clare. However the preliminary sections, summary geological history and accompanying map, timescale and stratigraphical column may be used as they stand to preface a booklet or as website information in the development of this work and for information.

Clare in the context of Irish Geological Heritage

This report places Clare in the very forefront of geological heritage within Ireland, as it is only the third county to commission such an audit within the scope of the Heritage Plan. It will hopefully act as a model and an inspiration for other councils to follow. It represents a significant commitment on the part of the Local Authority to fulfil its obligations to incorporate geology into the spectrum of responsibilities under the Heritage Act 1995, the Planning and Development Act 2000, Planning and Development Regulations 2001, and the Wildlife (Amendment) Act, 2000 and the National Heritage Plan (2002). The Geological Survey of Ireland views partnerships with the local authorities, such as this report, as a very important element of its strategy on geological heritage.

The Irish Geological Heritage Programme (IGH) in the Geological Survey of Ireland (GSI) complements other nature conservation efforts of the last decade, by assessing Ireland's geodiversity, which is the foundation of the biodiversity addressed under European Directives on habitats and species by the designations of Special Areas of Conservation (SAC) and more recently on a national scale by the introduction of Natural Heritage Areas (NHA) as the national nature conservation method. As a targeted conservation measure to protect the very best of Irish geology and geomorphology it fills a void which has been there since the abandonment of the Areas of Scientific Interest scheme, listed by An Foras Forbartha in 1981.

The IGH Programme does this by identifying and selecting the most important geological sites nationally for designation as NHAs. It looks at the whole of Irish geology and geomorphology under 16 different themes. A fundamental approach is that only the minimum number of sites necessary to demonstrate the particular geological theme is selected. This means that our first criterion is to identify the best national representative example of each feature or major sequence, and secondly any unique or exceptional sites. The third criterion, of any sites of International importance, is nearly always covered by the other two.

IGH THEMES

1. Karst
2. Precambrian to Devonian Palaeontology
3. Carboniferous to Pliocene Palaeontology
4. Cambrian-Silurian
5. Precambrian
6. Mineralogy
7. Quaternary
8. Lower Carboniferous
9. Upper Carboniferous and Permian
10. Devonian
11. Igneous intrusions
12. Mesozoic and Cenozoic
13. Coastal geomorphology
14. Fluvial and lacustrine geomorphology
15. Economic geology
16. Hydrogeology

Designation of geological NHAs is by the partners in the Programme, the National Parks and Wildlife Service (NPWS – formerly a part of Dúchas) in the Department of Environment, Heritage and Local Government. Once designated any geological NHAs will be subject to normal statutory process within the Clare Planning Department and other relevant divisions. However, management issues for geological sites are generally less, and different from many ecological designations. A later chapter considers these issues.

As a result of extensive comparison of similar sites to establish which is the best, we have a good picture of many other sites, which are not the chosen best example, but may still be of National importance. Others may be of more local importance or of particular value as educational sites or as a public amenity. It is also these other sites that are proposed for CGS listing in the County Development Plan, along with the clear NHA selections.

At the time of writing this report, candidate sites have been established by Expert Panels for all the 16 themes, and for many themes the indicative site lists have been finalised. For three themes, the entire process has been essentially completed and detailed site reports and boundary surveys have been done along with a Theme Report. Because much of the geology of Clare happens to coincide with these three themes, many of the sites documented here are already selected and proposed for NHA designation, but due to various factors, they have not been formally designated yet. Members of the Expert Panels for each theme are too numerous to list here but the information is available in GSI's Annual Report for 2003 and on the Heritage Programme's pages on the website (www.gsi.ie).

The procedure for identifying and assessing sites has developed as the whole Irish Geological Heritage Programme has got established. Early thematic reports on Karst, Precambrian to Devonian Palaeontology and Carboniferous to Pliocene Palaeontology (IGH1, IGH2 and IGH3) were done in their entirety, with contractors or by Matthew Parkes. The Expert Panels met to decide which sites should be assessed and prioritised, with site reports and fieldwork being done following that to allow a basis for selection of the most important for NHA designation. However, due to lessons learnt in establishing the methodology, and because of urgent demands for information on sites from many quarters, the approach has evolved. All Expert Panels have almost concluded their preliminary selection of candidate sites so that we have a picture of the full range of sites to be examined nationally as candidate NHAs or County Geological Sites. This is also valuable because sites which have scientific importance under more than one theme can be properly defined in an integrated way. It is hoped that these candidate site lists and location maps will be available on the GSI website early in 2005.

Commissioned desk study site reports from members of the Expert Panels will then be followed by field site reporting by IGH Programme staff, including boundary surveys if the sites are suitable. After this stage the Expert Panels will then review sites to make the final selection for NHA status. Any suitable site may be promoted with a local authority as a County Geological Site,

whether or not it goes forward as an NHA at a later stage after full assessment.

The sites proposed here as County Geological Sites (CGS) have been visited and assessed specifically for this project, and represent our current state of knowledge. It does not exclude other sites being identified later, or directly promoted by the Council itself, or by local communities wishing to draw attention to important sites for amenity or education with an intrinsic geological interest. Although there are some additional areas that may merit inclusion, the state of work done by the Expert Panel for some themes is not sufficiently advanced to be clear on the importance of some sites for this report. Such sites are primarily landscapes exhibiting geomorphological processes, but which are often of a large scale unsuited to designation as a specific site. For example the Fluvial and Lacustrine Geomorphology Panel work has only recently commenced and it has not yet established its candidate list.

Geological conservation issues and site management

Since **geodiversity is the often forgotten foundation for much of the biodiversity** which has been identified for conservation through SAC or NHA designation it is unsurprising that many of the most important geological sites are actually the same areas. In these areas, the geological case enhances and cements the value of these sites for nature conservation, but requires no additional designation of actual land areas.

There tend to be two broad types of site identified by the IGH Programme. Most geological sites tend to be small and discrete. They may be old quarries, natural exposures on hilly ground, coastal cliff sections, or other natural exposures, such as Ballyvorgal, Ballycar South, Poulsallagh, Kilbreckan or the submerged caves at Doolin Point. They usually have a specific interest such as fossils, minerals or are a representative section of a particular stratigraphical sequence of rocks. **The other type of site tends to be larger areas that represent a geomorphological interest – landscapes that illustrate processes which formed them.** The Coastal Geomorphology theme, the Quaternary theme and the Karst theme include such sites. In Clare, many larger areas of the Burren such as Aillwee Mountain, the Carran Depression, the Pollnagollum – Pollelva cave system and Mullaghmore are characteristic of these larger sites for the IGH 1 Karst Theme. Long stretches of the coast of Clare are likewise characteristic of the Coastal Geomorphology theme sites.

It is also important from a geological conservation perspective that planners understand the landscape importance of geomorphological features which may not in themselves warrant any formal site designation, but which are an integral part of the character of Clare. A lack of awareness in the past, has led to the loss of important geological sites and local character, throughout the country. The **Landscape Characterisation** process, recently undertaken by Clare County Council with the support of the Heritage Council, includes these broad scale features and hopefully will provide a tool to help future planning decisions maintain the integrity of the County.

There are big contrasts in the management requirements for geological sites in contrast to biological sites. Most geology is actually quite robust and generally few restrictions are required in order to protect the scientific interest. In some cases, paradoxically, the geological interest may even be served better by a development exposing more rock. **The important thing is for the sites to be known about in the planning department, and more generally, so that consultation can take place if some development is proposed for a site.** In this way, geologists may get the opportunity to learn more about a site or area by recording and sample collection of temporary exposures, or influence the design so that access to exposures of rock is maintained for the future, or prevent completely inappropriate developments through a strong scientific case.

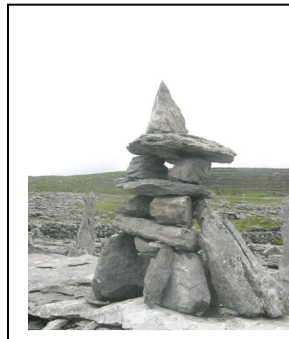
In Clare, as in some other counties, working quarries may be designated simply because they are the best representative sections available of entire

sequences, in areas where exposure is otherwise poor. No restriction would be sought on the legitimate operation of these quarries. However, maintenance of exposure after quarry closure would be sought with the operator and planning authority in such a case. One special case for attention is the occurrence of workings to extract Liscannor Flags, in the area between Doolin and Lahinch. It is important to ensure that good examples of this distinctive stone type are available for geological study in situ, but this does not mean sterilising the resource by a designation that prevents quarrying. Equally a quarry that has finished work would need regular maintenance to prevent overgrowth of vegetation obscuring the scientific interest. Fortunately the traditional pattern of small workings in fields along the outcrop of the rocks should ensure that examples are routinely available for geological study, as long as access is available. This is discussed further in the chapter on proposals and ideas for presenting the geological heritage of Clare.

Specific sites may require restrictions and a typical case might be at an important fossil locality or a rare mineral locality, where a permit system may be required for genuine research, but the general opportunity for collecting may need to be stopped. However, Clare's palaeontological and mineralogical sites are not likely to require such an approach.

Limestone pavement protection

A more serious problem in the Burren area is the high degree of **despoliation of limestone pavement** by uneducated visitors messing with the rocks. The turning of slabs and wedging of them as uprights in the expanded joints (grikes) of the pavement is a widespread problem, as is building of cairns of stones.





The attractiveness of water-worn limestone has long made it an attraction for gardeners. Pressure on Irish limestones such as in the Burren have probably increased since effective actions in Britain to protect their limestone pavement areas have taken effect, although the UK demand has probably reduced due to wide educational campaigns within the gardening community and including many TV gardening personalities. The designation of considerable areas of the Burren as SAC or NHA provides **a measure of protection against wholesale removal of limestone pavement**, but ironically outside of those areas, there are no ways of preventing large-scale destruction of other limestone pavement areas by farmers, in the name of 'agricultural improvement'. Worse still, when this occurs, the rock which could meet any demand for such stone that there is, is usually just bulldozed into piles at field edges. There are no means of preventing small-scale removal of water-worn limestone by individuals either.

The whole issue of limestone pavement protection and the trade in this stone, is addressed in a report commissioned for the Heritage Council, entitled *On Stony Ground*. It is perhaps outside the scope of this report to offer solutions or views on this issue, but it is certainly an area which demands sound educational efforts, and awareness campaigns, both within Clare and throughout the country as a whole, since the Burren is such a national landmark. It may also be addressed under the whole issue of land usage and management practices in the Burren, in order to prevent the spread of scrub over the pavement areas, and a loss of the identity of the stone landscape.

Waste dumping

A lesser problem, but one which still occurs, is the **dumping of rubbish in** the countryside, but especially in **closed depressions (dolines) or in**

sinkholes in karstic areas. Long tradition of out of sight out of mind, is unacceptable today, and requires attention wherever it occurs. One measure apart from clearing up of the rubbish is the groundwater protection scheme (such as the GSI develops in partnership with local authorities) but there is scope for educational efforts within the frame of geological heritage promotion. A good example of the kind of approach is the *Dump it : Drink it!* campaign run by the Speleological Union of Ireland in past years.



[See <http://www.cavingireland.org/News and Events/reports.htm>]

New exposures in development

One less obvious area where the Local Authority can play a key role in the promotion and protection of geology is in the case of new roadways. **Wherever new carriageways are built**, such as the Newmarket on Fergus bypass, or other major infrastructural work, it should be a policy within the Planning Department that **where new rock exposures are created, that they be left open and exposed** unless geotechnical safety issues occur (such as bedding dips prone to rock failure). The grading and grassing over of slopes in cuttings is largely a civil engineering convenience and a mindset which is hard to change. However, it leads to sterile and uninteresting roads which look the same throughout the country. By leaving rock exposures along the routeway, where they are intersected, it provides an improvement in character and interest, reflecting the geology and landscape of an area. Sympathetic tree or shrub planting can still be done, but leaving bare rocks, especially where they show interesting features, not only assists the geological profession, but creates new local landmarks, to replace those removed in the construction of the roadway. It can also potentially save money on the construction.



Geoparks

An extremely interesting development in geological heritage, not just in Europe, but internationally, has been the rapid recent growth and adoption of the Geopark concept. Initially it was largely a European network but has now been embraced in China and other countries, and is fully endorsed by UNESCO [*at time of writing, the UNESCO Earth Heritage Programme is under threat of abandonment*]. A **Geopark is a territory** with a well defined management structure in place (such as Local Authority support), **where the geological heritage is used to develop sustainable tourism opportunities**. A fundamental basis of the Geopark is that it is driven from the bottom up – the communities in the Geopark, are the drivers of the project and are the main beneficiaries. It therefore provides protection of the geological heritage resource so that the community can benefit from it.

In Ireland there are already two members of the European Geopark Network (the Copper Coast in Waterford and Cuilcagh-Marble Arch in Fermanagh), but there is **an active proposal in development for the Burren as a Geopark**. This is being led by Paddy Maher at the Burren Interpretive Centre at Kilfenora, and has been supported by the Council to date. Assuming that the appropriate management structure and umbrella support can be assured and also the community support on the ground, there is clearly a wide range of fantastic geology in the area, which this report helps to document, such that success in the application to the Network is likely. Applications usually need to demonstrate some existing promotion of geological heritage, and this project and the report may be useful in demonstrating the commitment.

World Heritage Site status

It is surprising that there has not been any popular campaign for the Burren as a World Heritage Site given its very high degree of popularity and fame both within Ireland and with foreign visitors. It is obviously a very strong candidate for consideration as an official nomination to be put forward by Ireland. Given that there are current changes in the criteria that now recognise cultural landscapes where human influences have modified a natural landscape, it may be easier to make a case for the Burren than with the previous criteria of either a natural site or a cultural site.

Proposals and ideas for promotion of geological heritage in Clare

The clear and significant inclusion of geological heritage in the Heritage Plan for County Clare is a most welcome and positive step, for a topic that is often undervalued and poorly known in the wider community.

B. Overall Aim - to inform public policy on heritage and promote the strategic and integrated management of heritage at a local level. Provide good quality advice for heritage policy development in the future and ensure a strategic, co-ordinated and integrated approach in heritage management

Objective 4 – To ensure protection and raise awareness of the geological sites in the county			
No	Action	Target	Partners
4.1	Continue to identify and publicise geological sites of local, national and international importance	4.1.1 – Examine criteria to assess geological sites of merit for protection in the planning process	GSI DOE CCC TLE SD RRD GP
4.2	Protect geological sites through the Development Plan process		
4.3	Support efforts to develop geological trails throughout the county	4.3.1 – Map out and publish brochures on geological trails in the county, both walking and driving routes.	

Of course, aside from the specific objective and actions relating to geological heritage, there are many other objectives and actions in the Plan, where geological heritage may feature as an integrated facet of the topic. More obvious areas include:

Objective B1 – geodiversity provides the habitats for much of the biodiversity which it is hoped to conserve.

Objective B2 – The Burren contains many of the key geological sites and is as much a geological and geomorphological landscape as it is a plant habitat, an archaeological treasure or an agricultural land-use management issue.

Objective B3 - the coastal zone management and seascape protection can only be addressed with proper understanding of the geomorphological processes operating on the bedrock and on the unconsolidated sediments. Also the majority of geological heritage sites outside of the Burren are situated on the coast.

Objective B5 – Landscape Character Assessment is a tool which fundamentally defines differences in geology as the basis for land-use and cultural modifications, and the resultant landscapes. Implementing the objective must by necessity recognise this geological foundation.

Objective B6 – If the Council do own any of the geological heritage sites included here it will be easier to achieve positive results for both protection and promotion of those sites, and this may provide a basis for prioritising future actions.

Objective B7 – There is an opportunity for Clare to set national standards in policy guidelines for best practice in geological heritage management. Given the Irish Geological Heritage Programme’s experience in this respect, with the most up to date knowledge of international best practice, it would be able to operate as a partner in achieving this target.

Objective B8 – This is a key objective where an expansion of available geotourism resources may significantly help in achieving this objective. Again, the GSI’s IGH Programme is best placed to review existing resources and develop new ones. Specific ideas are discussed below.

Objective B10 – In general, walking enthusiasts are interested in most aspects of the landscapes and places they visit. It is important to ensure where appropriate, an accessible explanation of geological features and landforms is part of guidebooks and interpretation for new or existing walking routes.

Objective B12 – In ensuring reasonable and responsible access to heritage sites the GSI is able to advise on best practice and codes of conduct for geological fieldwork to facilitate where appropriate.

Objective B13 – GSI is involved in a range of actions alone, and with partners such as ES2k and through the Geosciences Committee of the Royal Irish Academy, to develop education, awareness and training opportunities in the geological area. Whilst these are mostly national efforts, they will inevitably feed into County based actions and initiatives such as are envisaged in this objective.

Objective B14 – As a Museum Professional as well as a Geologist, Matthew Parkes (Irish Geological Heritage Programme) is especially keen to advance museum services in Clare. Specific actions that could be achieved are discussed below.

Objective B15 – As a repository of the National Archives, the GSI holds extensive records relating to County Clare’s geology. Efforts to publicise archives in Clare may need to report such external archives too.

Objective C5 – The karstic geological heritage sites related to the River Fergus (Carran Enclosed Depression, Fergus River Cave and Springs) must be part of the management plans developed in the context of the Water Framework Directive

Specific ideas for projects

Guides

There are a few existing guidebooks to the geology of the Clare, but only a few are aimed at a general audience (e.g. Simms, 2001. *Exploring the limestone landscapes of the Burren and Gort Lowlands*; GSI 1998. *An East Clare Landscape Adventure*). There are several others in production (e.g. Geoscapes guides to Cliffs of Moher, and to the Liscannor Stone story, in conjunction with the Rock Shop in Liscannor), but there is scope for others, and for guides at different levels of detail and accessibility to non-specialists. A wide range of leaflets, booklets, books and other media are all feasible, but the research and production of appropriate text and images is a difficult task to do well without appropriate experience, and adequate time and resources.

Signboards

Simple explanatory or interpretive signboards may be advisable at key geological heritage locations, but if these are considered, their locations and individual siting should be very selective, since a proliferation of different interest groups may provoke a 'rash' of panels all over the county. The Planning Section should clearly have a controlling input, in conjunction with the Heritage Office. The subject of panels, the text and graphics are a fine art to do successfully, and the IGH Programme can offer input if signs are planned for key visitor localities.

Museum exhibitions

As a result of the work to produce this report, the material for a panel based exhibition has been largely compiled. With some extra research covering human dependence on geology and resources an interesting exhibition can be put together for display in the Museum, Council offices, Libraries etc etc. A good model is that produced for Carlow or for Dun Laoghaire Rathdown. Images of these can be seen on the geological heritage section of the GSI website (www.gsi.ie). Whilst the work on this may be possible within the scope of the IGH Programme, the cost of materials (colour plots and mounting boards) would need to be met by a contribution or sponsorship.

Geoparks

Continued support should be given to the potential application to the European Geoparks Network for the Burren, led by Paddy Maher of the Burren Co-operative, Kilfenora.

World Heritage Site bid

Due consideration should be given to promotion of an application for World Heritage Site status for the Burren. It is understood that the National Parks and Wildlife Service and the Department of Environment, Heritage and Local Government are the recognised body for such a bid. It should first be established if they have any current assessment or plans in this respect.

TV programmes

With sufficient resources consideration could be given to making a specific programme or even a series on the geological heritage of Clare. The IGH Programme and the GSI could advise on the development of this idea. Existing programme concepts in development and fundraising stages are national in scope, but would definitely include Clare. The making of a specific programme or series would need to be led from the county.

Oil industry linkages

Many hundreds of visitors to west Clare each year come from industrial and academic research units related to the oil industry. This is because the rocks displayed on the coast are comparable to what geologists and geophysicists are attempting to interpret from drilling exploratory wells in the seas around the world. Preserving the sections for such purposes and developing solid links with the petroleum industry could be developed and be advantageous for all concerned.

A summary of the Geology of Clare

The scenic landscapes in the Clare area formed over hundreds of millions of years by various geological processes, each one leaving its mark in the rock record. Careful examination of the rocks in the region can help unravel the mysteries surrounding their formation and thus shed light on the evolution of the Clare landscape.

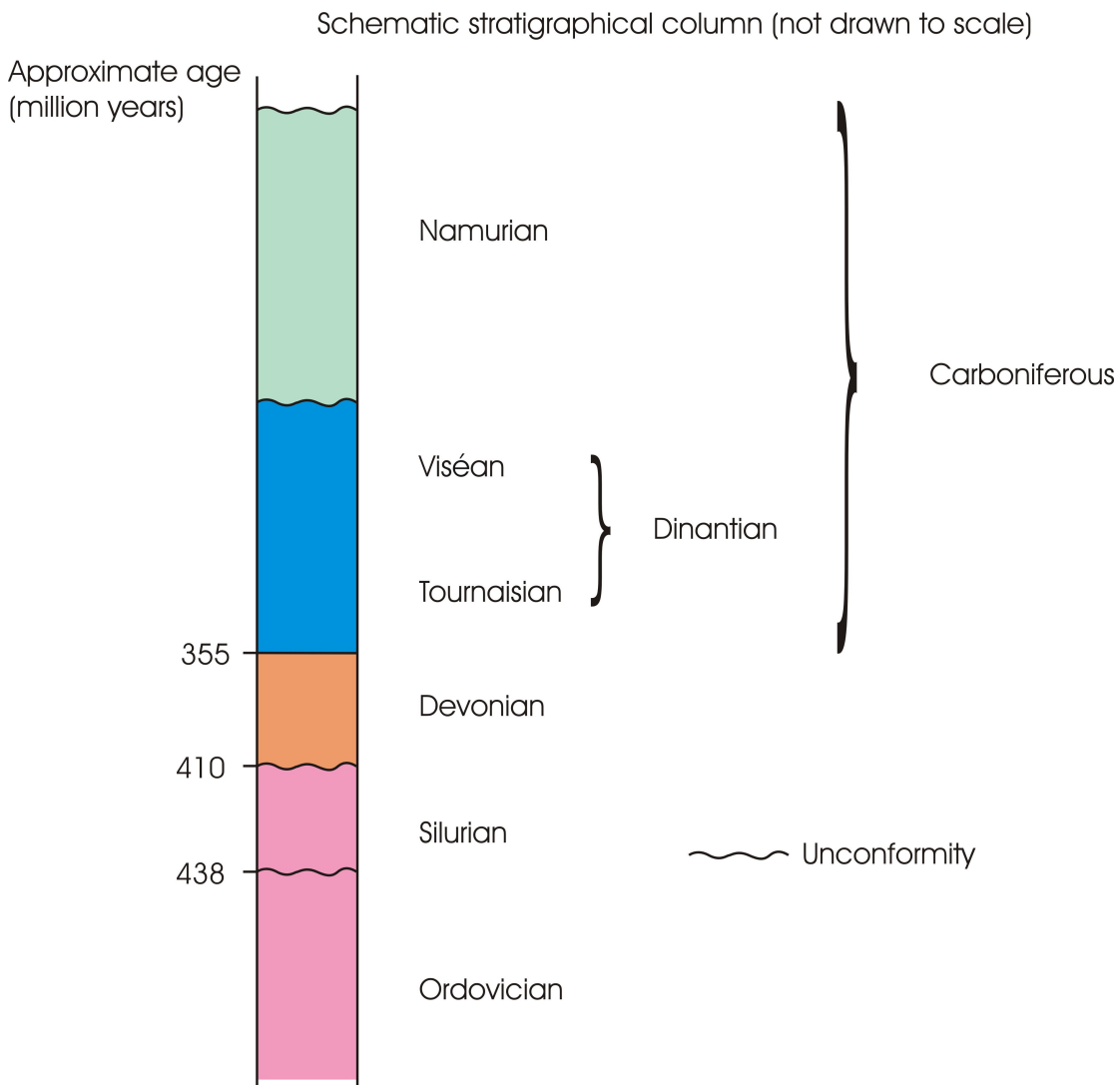
Rocks can be divided into three main groups, sedimentary, igneous and metamorphic. Sedimentary rocks are laid down as particles of material such as sand or mud and then hardened by compaction and [lithification](#) into sandstones, siltstones, mudstones and limestones. Fossils, often preserved in these rocks, can give us an idea of when the rock formed and what the climate and environment were like at that time. Igneous rocks crystallise from magma originating deep beneath the Earth's surface and may be [extrusive](#) (i.e. lava flows at the Earth's surface) or [intrusive](#) (emplaced within the Earth's crust, below the surface). Metamorphic rocks are sedimentary or igneous rocks that have been altered by changes in temperature and/or pressure. New minerals grow in response to these changes and their composition depends on the composition of the original rock, and the temperatures and pressures that affect it.

The predominant rock types in the Clare area are sedimentary rocks, limestone and sandstone and shales in particular. There are also some minor igneous rocks. These rocks have only been mildly affected by folding and metamorphism and as such retain many of their original sedimentary and depositional structures. The most common metamorphic rocks in Clare are Slates. Slates, originally shales, are a relatively low-grade metamorphic rock, meaning that they form at relatively low temperatures and pressures and are only slightly deformed from their original appearance.

At any one locality there is usually more than one rock type, or lithology and they are generally inter-layered. Ranges of lithologies over a small area are largely consistent and sequences of rock often share common characteristics allowing them to be grouped together as packages or geological units. The most important of these 'units' is the [formation](#), which is defined as a sequence of related rock types differing significantly from adjacent sequences. It is a recognisable consistent rock type that a geologist can map in the field over an area.

These formations are mapped as a sequence or succession of units in a stratigraphical order, with younger rocks overlying older rocks unless they have been strongly faulted and folded. By compiling the formations into a column with oldest at the bottom and youngest at the top we can represent the geological history of an area, with international names for the time periods. The following description of the main events and the rocks they formed in Clare should be read with reference to the map, stratigraphical column and geological timescale. The simplified map of Clare's geology outlines the main units by age. For more detail of the individual formations

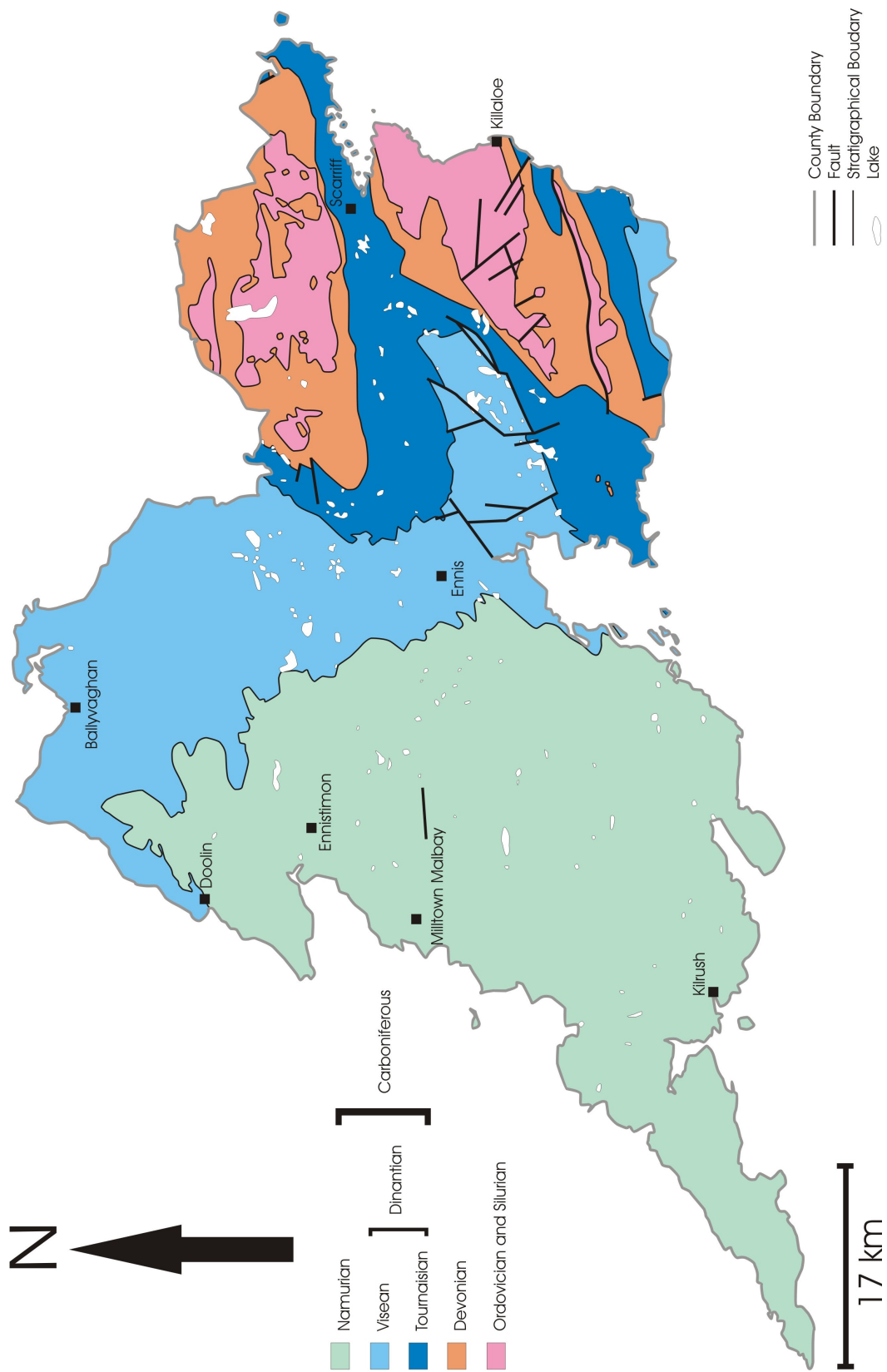
described it would be necessary to examine the GSI's 1:100,000 scale maps of the area – Sheet 14 and Sheet 17 and parts of Sheet 18.



The older rocks in Clare are exposed in the hilly regions in the east of the county. The oldest of these are the black [graptolitic](#), [pyrite](#)-rich shales of the Ballymalone Formation. These can be seen in forest roads, small quarries and farm pits at various places, but one very good example is at Ballymalone Td, near Raheen Bridge, east of Tuamgraney. These rocks were deposited during Ordovician times when most of what is now central Ireland lay on the deep ocean floor of a long vanished ocean called the Iapetus Ocean. This vast ocean separated northwest and southeast Ireland from approximately 600 million years ago until the end of the Silurian, approximately 410 million years ago. The axis of the Iapetus Ocean ran along a roughly southwest-northeast trending line through central Ireland from the Shannon Estuary to Clogher Head in Co. Louth. The Ordovician and Silurian rocks in the Clare area were deposited on the northwestern side of Iapetus in deep waters.

The next oldest rocks exposed in Clare belong to the Cornagroe Formation. These rocks, which represent the earliest Silurian deposits in Clare, are approximately 10 million years younger than the Ballymalone Formation. The contact between the two formations is tectonic, that is, bounded by [faults](#). The

Simplified Geology of Clare



AGE (Million Years)	ERA	PERIOD		Events Relating to the Clare Area
1.6	Cenozoic	Quaternary		A series of ice ages followed by spread of vegetation, growth of bogs and the arrival of man. Karst features develop.
65		Tertiary		Erosion. Opening of the North Atlantic ocean. Volcanoes in NE Ireland.
135	Mesozoic	Cretaceous		Erosion. Probable incursion of the sea. Chalk deposition preserved today in northern Ireland.
205		Jurassic		Uplift and erosion. Sediments deposited in offshore sea basins.
250		Triassic		Erosion and deposition under desert conditions.
290	Palaeozoic	Upper	Permian	
355			Carboniferous	Land progressively submerged. Coastal plain and nearshore deposits followed by limestone deposition in shallow tropical seas. Subsequent building out of the land, deltaic sands and muds deposited often under swampy conditions. Variscan mountain building event (affecting southwest Ireland) towards the end of the Carboniferous.
410			Devonian	Continued mountain building, rapid erosion and deposition under semi-desert conditions.
438		Lower	Silurian	Closure of Iapetus Ocean, continental collision and Caledonian mountain building.
510			Ordovician	Deep-sea mudstone deposition on the floor of the Iapetus Ocean.
544			Cambrian	Opening of the Iapetus Ocean between northwest and southeast Ireland.
2500	Pre-cambrian	Proterozoic		Oldest rocks in Ireland.
4000		Archaean		Oldest known rocks on Earth.
Formation of the Solar System approximately 4600 million years ago				

Geological Timescale

green siltstone, mudstone and graptolitic shales of the Cornagnoe Formation were deposited at a time when the Iapetus Ocean had contracted significantly since the deposition of the Ballymalone Formation. Graptolites found within the Ballymalone and Cornagnoe Formations have been used to date the rocks of these formations. Graptolites, extinct pelagic organisms spanning middle Cambrian to Carboniferous times, often accumulate to form crowded layers within these formations. They are good zonal fossils, i.e. they can be used to ascertain the age of rocks, due to the abundance of species with relatively short life spans and their wide geographical distribution. A deep water fauna of very small trilobites and brachiopods is also known from a very obscure outcrop at Ballyvorgal South in the western part of these Ordovician rocks.

Mid-Silurian rocks are the most extensive Lower Palaeozoic rocks in the Clare area. They represent a time when enormous quantities of sediment were deposited onto the floor of the contracting Iapetus Ocean. These sediments are represented in the geological record by the greywackes, graptolitic shales and conglomerates of the Broadford Formation, the slaty banded siltstones and fine-grained to coarser, conglomeratic greywackes of the Slieve Bernagh Formation and the grey/green siltstones, with occasional calcareous horizons of the Cratloes Formation. At sites such as Ballycar South in the Cratloes, pebbly deposits of submarine channels have provided a diverse shelly fauna to palaeontologists.

The slates found within the Slieve Bernagh Formation and the Broadford Formation originated as mud and silt on the floor of Iapetus but as earth movements brought the northwestern and southeastern margins of Iapetus together, closing the once immense ocean, increased temperature and pressure altered the mudstones and siltstones to slates, developing a sheet like cleavage (preferential planes of splitting). This period of mountain building which took place during late Silurian, early Devonian times is known as the Caledonian orogeny. The slates were worked in the past around Broadford, for roofing purposes.

The closure of the Iapetus Ocean saw the amalgamation of two landmasses to form the Old Red Sandstone Continent, during the Devonian. Ireland's position within this landmass, which covered most of northwest Europe, had a latitude and as such, climate, similar to that of the Sahara desert today. Marine processes were not a major factor as most of the land lay above sea level. Instead terrestrial processes, such as wind and fluvial systems dominated. The Old Red Sandstone Continent remained throughout the Devonian from about 410 to 360 million years ago. In the Clare area evidence for this period is found in the mountainous regions in the east of the county, namely the Cratloe Hills, the Broadford Mountains, Slieve Bernagh and Slieve Aughty. The Old Red Sandstone deposits in these areas rest unconformably on the Lower Palaeozoic rocks and have been gently folded. The deposits consist of yellow/brown, coarse-grained sandstone, pebbly sandstone and conglomerate and are fluvial in origin. An excellent place to see this relationship clearly is at the top of Ballycroum Hill, near Feakle.

At the beginning of the Carboniferous sea level began to rise. The shoreline moved northwards from Cork flooding the land as it passed. During this time Ireland had a latitude of 10° and experienced a tropical climate much like that of the modern day Bahamas. This gradual marine [transgression](#) is recorded in the Upper Devonian and Lower Carboniferous rocks in the Clare area.

Sandstones and mudstones of the early Carboniferous Lower Limestone Shales record shallow water conditions and the onset of the Carboniferous transgression. The overlying muddy limestone and calcareous shales of the Ballymartin Formation reflect slightly deeper water conditions. As sea level continued to flood the land less clay was available for deposition and the cleaner, [crinoid](#)-rich limestones of the Ballysteen Formation were deposited.

The growth of Waulsortian carbonate mud-mounds succeeded the Ballysteen Formation and covered much of central Ireland, although they are not common in Clare. These mud-mounds, often called reefs but quite unlike modern day coral reefs, formed as individual mounds on the sea-floor at depths of at least 200m. They contained an abundance of life including bryozoans and crinoids. Muddier limestone, similar in type to the Ballysteen Formation surrounded these individual mounds.

Younger, Viséan limestones record a transition from shallow-water shelf limestones to deeper water limestones that were deposited in a basin called the Shannon Trough. Some of these limestones contain [ooids](#), which reflect shallow, agitated conditions. Occasional clay horizons within this group of rocks indicates intermittent exposure above sea level. Places like Tuamgraney in East Clare demonstrate the Carboniferous limestone as well as the main Burren, and sites such as Toolin's Quarry near Ennis.

The Upper Carboniferous Namurian rocks succeeding the Viséan limestones were deposited in the Shannon Trough. Deep-water marine shales (the Clare Shales) define the base of the Namurian and they are overlain by [turbidites](#) which frequently cut into the underlying shales and form submarine fans. There are many features (including the presence of turbidites, slumped horizons and dewatering structures such as sand volcanoes) within this succession that suggest high rates of basin subsidence as well as high sedimentation rates. Siltstones and sandstones of slumped continental slope and shelf origin were the next sequence to infill the basin and overlie the turbidites.

By latest Namurian times the rate of deposition was greater than the rate of basin subsidence and deltaic depositional environments ensued, much like that of the modern day Mississippi. These deltaic conditions are recorded by rootlet horizons and coal seams. Intermittent rises in sea-level saw the deposition of marine shales often containing [goniatites](#) which can be used to correlate horizons across the basin as well as providing a means to date the age of the rocks. The fluctuating sea level is attributed to a Carboniferous glaciation.

A period of mountain building at the end of the Carboniferous deformed rocks across Ireland and Europe. The rocks in the Clare area were uplifted, gently folded and faulted during this orogeny, known as the Variscan orogeny. For much of the following 300 million years Ireland was mostly a land area dominated by erosion rather than sedimentation. Eroded sediment was carried offshore and deposited in ocean basins. During Cretaceous times, approximately 135 million years ago, it is believed that most of Ireland was covered by a chalk sea, remnants of which can be seen today in northern Ireland.

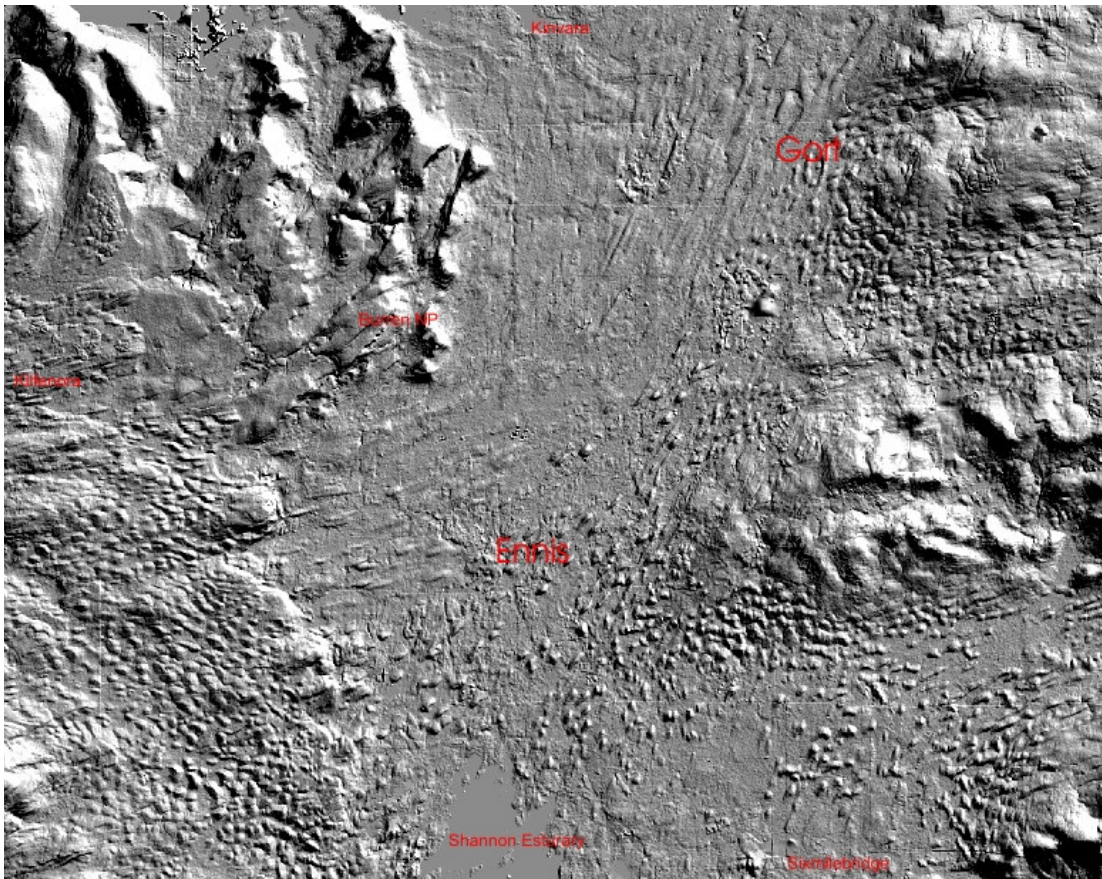
There is little direct evidence of deposition between post-Namurian and Quaternary times in the Clare area. Some researchers believe that the high grade of the Namurian coal seams in the region is consistent with burial beneath a significant thickness of younger rock (approximately 3km). Others believe that migrating hot fluids were responsible for the thermal maturation levels of the coal seams. Whatever the case if any rocks were deposited during this time the process of erosion has removed the evidence.

The last 1.6 million years of Earth history is known as the Quaternary Period. The Quaternary can be further subdivided into two epochs, the Pleistocene (or Ice Age), which ended approximately 10,000 years ago, and the Holocene (10,000 years ago to present day).

During Pleistocene times Ireland's climate oscillated between arctic and temperate conditions. During the colder stages huge sheets of ice covered much of Ireland. The sediments and associated landscapes that we see today were formed largely during the last Ice Age. In the Clare area, however, there is evidence to suggest that at least two glaciations have affected the region, the latter event leaving more of a mark on the land. Glacial deposits are generally thinner in areas of higher ground and thicker in lower lying regions.

The huge sheets of ice present during the colder stages of the Pleistocene scoured the landscape as they moved often leaving 'scratches' or striations on the rocks, which, where preserved, can still be seen today. These striations can give us an idea of the direction in which the ice was moving. Boulders or [erratics](#) transported far from their source area by glacial ice are often seen strewn about the landscape (e.g. the Rock Forest).

The scale and effect of glaciation is sometimes better appreciated by viewing the landscape with remote sensing techniques. The following image is a digital elevation model of the central Clare area, illuminated from the north east. It clearly shows drumlin fields to the south of the Burren in the bottom left portion of the image. These are oriented east north east to west south west in direction, reflecting the ice flow at its maximum to the south west. These drumlins have accumulated to form what is known as ribbed moraine, which gives a north west to south west trend to the drumlin features, when seen at this scale. In the centre of the image linear south south west directed features reflect a tongue of ice during deglaciation which was still flowing from Gort towards Ennis. Unoriented drumlins in the south east of the image may reflect the free drainage under ice sheets on limestone north of Sixmilebridge.



In areas where thick glacial deposits overlie the limestone, limestone pavement has not developed. This would suggest that most of the karst features in the Clare area formed after the last glaciation. However, there are many larger karst systems (e.g. Poulnagollum and the Carran Depression) that are too deep and extensive to have formed in the last thousand years. These systems must have started to form well before the last glaciation, possibly even before the glacial period began, some possibly having origins in the Tertiary period. The pattern of high ground in the Burren and the lowland karst nearer Gort is related to what time the overlying shale cap was removed and its protective effect withdrawn. The High Burren only lost its Namurian shales during the last glaciation event, whereas the lowlands were exposed to erosion and weathering of the limestone itself much earlier.

In Ireland karstification takes place on limestone. Rainwater, which is slightly acidic, from carbon dioxide dissolved from the air, can dissolve limestone on contact until it becomes saturated with bicarbonate ions. If the rainwater falls on rocks other than limestone, and flows as a stream or percolates through soils it may become much more acidic and much more aggressive in its solution of the limestone rock. This dissolution of limestone is what creates a host of distinctive landforms in karstic areas.

In areas such as the Mullaghmore National Park, or at Sheshymore where bare limestone rock was left exposed after the last glaciation, water soaking away into joints and fractures has enlarged them to create the classic

limestone pavement, with upstanding blocks called clints separated by enlarged joints called grikes, which provide the microclimates which host certain plants which characterise the Burren. The surface solution forms a wide range of karren features – the flutings and runnels on surfaces, and the kamenitza, crinkly edged bowls on flat surfaces. A classic measure of the rate of limestone solution is found where an erratic rock such as Galway Granite or sandstone is left on the limestone by glaciation. Acting as an umbrella, the limestone underneath does not get dissolved and the erratic may be found on a pedestal of limestone today, showing how much the limestone surface has been lowered by solution in about ten thousand years.

In other areas where streams accumulate on other rock types and then meet with limestone they often form caves and potholes, as the acidic water is focused in its attack on the limestone. The classic place for cavers to seek new caves is along the margin of the shale deposits overlying the limestone. By following this scarp, many caves have been located and most of the Burren caves are formed in the last ten thousand years by streams passing off the shale onto the limestone. The classic place for this pattern is the Pollnagollum – Pollelva system, where numerous streams flowing off the Namurian sandstones and shales of Slieve Elva contribute to Ireland's longest cave system.

Karst is characterised by underground drainage, with sinking streams and springs, often connected by cave passages. Enclosed depressions from small dolines to the major sites like the Carran depression are also typical, plus a wealth of other distinctive landforms. Most of the turloughs of the Gort Kinvara lowlands lie in Galway, but the Burren includes these seasonal lakes where high water table in winter leads to a lake which is dry in the summer. Immediately to south of the exposed limestone in the Burren are many classic landforms where karst is seen as windows through then shale deposits. Other landforms in the Burren reflect former positions of the shale margin, but which have been modified by the last glaciation.

Rivers too have played a big part in shaping the landscape, although it is much harder to interpret the history of these across landscapes so modified by glaciation. The Shannon Estuary represents a very large ria, or flooded estuary, as sea level rose after the Ice Age. The gorge of the Shannon River at Killaloe at the south end of Lough Derg have long been a matter for debate as to why the river does not drain westward at Scarriff, with superimposed drainage and river capture models put forward as explanations.

Glossary

Amygdaloidal

holes in lava flows (formed by escaping gas) which have since been filled low temperature minerals, usually calcite or quartz.

Basic Rocks

rocks which contain a relatively low percentage of silica, e.g. basalt.

Breccia

volcanic or sedimentary rock comprising of large angular fragments within finer grained material.

Bryozoa

invertebrate animals, often found as net-like or stick-like fossils.

Calcareous

containing calcium carbonate.

Chert

a sedimentary rock comprising of very fine-grained quartz.

Cleavage

finely spaced planar parting caused by compressive deformation of rocks.

Clints

tabular block of limestone in a limestone pavement.

Clitter

broken-up rocks.

Crinoids

echinoids (sea urchins) with long stems usually anchored to the sea floor.

Conglomerate

coarse-grained sedimentary rock with more than 50% rounded clasts greater than 2mm in size.

Cyclothem

a sequence of beds deposited in a single cycle of sedimentation.

Dendritic

branching.

Dolines

a surface depression entirely enclosed by higher ground found in karst terrane.

Dry Oxbow

caving term, where the river takes a more direct route through a cave and abandoning part of the stream, leaving it dry (see also stream oxbow).

Enclave

blob of magma of different composition to the igneous rock enclosing it.

En echelon

an arrangement of parallel lines displaced obliquely from one another in a consistent sense.

Extrusive

an igneous body emplaced at the Earth's surface as lava.

Erratics

boulders or small pieces of rock transported from their original location by glacial ice.

Fault

a fracture in rocks across which there has been some displacement or movement.

Fluvial

pertaining to a river or stream.

Formation

a sequence of related rock types differing significantly from adjacent sequences.

Fossiliferous

rich in fossils.

Glacial striae

markings left on the surface of pebbles/boulders/bedrock by moving ice sheets.

Goniatites

ammonoid, common fossil of Devonian and Carboniferous rocks.

Graptolite

extinct colonial pelagic organism, particularly important in dating Ordovician and Silurian rocks.

Greywacke	dark grey, poorly sorted sandstone with more than 15% clay content.
Grike	a solutionally widened vertical fracture separating clints on a limestone pavement.
Intrusive	an igneous rock emplaced within the Earth's crust, not extruded like lava.
Joints	vertical fractures in rocks caused by earth movements but along which there has been no movement of the rocks on either side.
Karren	minor solutional features developed on carbonate rocks.
Karst	general term used for landscapes formed by weathering of soluble rocks.
Lapilli	pyroclastic fragments between 2mm and 64mm in size.
Lithification	the process of rock formation from unconsolidated sediment.
Marl	calcareous mud.
Micaceous	rich in mica (shiny, flaky silicate minerals).
Ooid	generally a carbonate covered, spherical, sand-sized particle with a shelly fragment or sand-grain defining the nucleus. Formed in agitated waters where the grains are washed back and forth on carbonate sandbanks.
Orogeny	the creation of a mountain belt as a result of tectonic activity.
Orthoclase	a feldspar mineral.
Pelagic	descriptive of a deep-sea environment.
Phenocryst	a large mineral grain within a finer-grained igneous rock.
Photokarren	light oriented phytokarst pinnacles.
Phreatic	below the water table.
Phytokarst	karst resulting from biological action, generally small-scale and common in coastal settings.
Polje	a large, often flat-floored, closed depression in a karst area.
Pyrite	iron sulphide, pale yellow/gold coloured mineral, commonly occurring as cubes and often called 'fool's gold'.
Pyroclastic	fragmented rock material formed by a volcanic explosion.
Scallops	asymmetrical, scoop-shaped solutional hollows formed by water flowing over the rocks. Can be used to determine the direction of water flow.
Sink	or swallow hole, the point where a stream passes underground.
Spring	the point where an underground stream reaches the surface.
Stream oxbow	caving term, similar to an oxbow lake at the surface where the river/stream takes a more direct

	route and cuts off a meander loop. A stream
	Oxbow occurs in caves where the river is flowing
	through the new direct route as well as the original
	meander loop.
Till	unconsolidated, unsorted glacial deposits.
Turlough	seasonal lake.
Tuff	rock formed of pyroclastic material.
Trachyte	volcanic rock, often with a distinctive flow
	alignment of feldspar minerals.
Transgression	an incursion of the sea over land area.
Trilobites	extinct arthropods.
Turbidite	deposit of a turbidity current .
Turbidity current	
Unconformity	erosional surface representing a break in
	deposition.
Uvalas	term used for large and complex dolines .
Zonal (index) fossils	fossils used to date rocks.

Data sources on the geology of County Clare

This section is a brief summary of relevant GSI datasets, to assist any enquiry concerning geology to target possible information easily. The GSI has very many datasets, accumulated since it began mapping Ireland's geology in 1845. A recent project has established a Document Management System into which about half a million documents and maps have been scanned. This means that any user can visit the GSI Customer Centre themselves and search on screen for data of relevance to them. High quality colour and black and white prints can be made or data supplied on CD, for small charges.

Key datasets include:

1:100,000 Map Report Series

All historical, modern and other mapping has been compiled into very useful maps and reports that describe the geology of the entire country. Sheets 14 and 17, plus parts of Sheet 18 cover Clare.

19th century 6 inch to the mile fieldsheets

These provide an important historical and current resource, with very detailed observations of the geology of the entire country.

19th century one inch maps and Memoirs

Information from the detailed 19th century mapping was distilled into one inch to the mile maps, of which Sheets 114, 115, 122-125, 131-134, 140-144 cover County Clare. Each sheet or several sheets were accompanied by a Memoir which described the geology in some detail. These still provide valuable records of observations even though interpretations may have changed with better geological understanding.

Open File Data

Each Mineral Prospecting Licence issued by the Exploration and Mining Division of the Department of Communications, Marine and Natural Resources (currently) carries an obligation on the exploration company to lodge records of the work undertaken, for the common good. These records are held by the Geological Survey and are available as Open File Data, once a period of time has expired. They may include geological interpretations, borehole logs, geophysical and geochemical surveys and so on.

MinLocs Data

The MinLocs Database records all known mineral occurrences, however small, from GSI records, such as 19th century fieldsheets and Open File data.

Historic Mine Records

Abandonment plans and varied other material exists for the various mining ventures in the county, at places like Kilbricken, Milltown, Carahin and the phosphate mining at Roadford and Noughaval.

Quaternary Mapping

Since a Groundwater Protection Scheme has been done for County Clare by GSI, a modern very thorough mapping of the Quaternary sediments exists as well as bedrock mapping. This provides a significant resource in general terms as well as for groundwater protection. Customised output is possible.

Shortlist of Key Geological References

This reference list includes a few key papers, books and articles on the geology and geomorphology of Clare that are recommended as access points to Clare's fabulous geological heritage. A full reference list of papers relating to the geology of County Clare follows, plus a list of caving references which are kept separate due to their large number.

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Full Geological references

See Appendix 1 for the full reference list of all papers, books, articles and some unpublished reports etc relating to the geology and geomorphology of Clare that could be traced.

Caving References

The references in Appendix 2 relate significantly to caves and caving within the Clare area. They may only be brief reports or newsletter items. They are generally available within the Speleological Union of Ireland Library which is housed in the Geological Survey of Ireland.

Further sources of information and contacts

The Geological Survey of Ireland, and the Irish Geological Heritage Geologist, Matthew Parkes can be contacted in relation to any aspect of this report. Congella Maguire, the Heritage Officer of Clare County Council, or Graham Webb, Senior Planner in the County Council are the primary local contacts for further information in relation to this report. Other contacts are the Conservation Rangers of the National Parks and Wildlife Service, of the Department of Environment, Heritage and Local Government. The names and phone numbers of current staff may be found in the phone book, or at: Conservation Ranger, Burren National Park, 2 Riverview, Corofin, Co. Clare Tel: 065 6837166. The Curator of Clare County Museum is John Rattigan and he may be contacted at the Clare County Museum in Ennis. A further contact is Paddy Maher, Manager of the Burren Centre, Kilfenora, County Clare, who is also a geologist and an important local contact.

Web sites of interest

www.gsi.ie - for general geological resources
<http://www.ucd.ie/pepweb/research/abstracts/mushroomstones/> - for further information on mushroom stones
<http://www.habitas.org.uk/es2k/index.html> - for general geological information of wide interest
<http://www.tcd.ie/Geography/IQUA/Index.htm> - for information, fieldtrips, lectures etc in relation to Ireland's Ice Age history
<http://www.cavingireland.org/> - for information on caves and safe caving
<http://www.sgu.se/hotell/progeo/index.html> - for information about ProGEO the European Association for the Conservation of Geological Heritage

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Site reports – general points

The following site reports are brief non-technical summaries of the proposed County Geological Sites for County Clare. These have been specially prepared for this Report in order to make the information accessible to planners and others without geological training. For most sites more detailed reports and information files are held in the IGH Section in the Geological Survey of Ireland. These are available for consultation if required. Further sites may become relevant as IGH Programme work develops.

Each site report has primary location information, a mention of the main rock types and their age, and a short description of the key aspects of scientific interest. A section outlining any particular management or other issues specific to the site is included, along with one or two low resolution photographs exemplifying the site. **A CD accompanying this report will include further pictures of most sites at higher resolution, should they be required for a glossy booklet or leaflet for the general public.** Grid references are given normally for a central point in the site, or two extreme points at opposite ends of the site. They are only indicative of the location, but the site extent is best shown on a map.

A map is provided with an outline of the site boundary. It is important to note that no legal or definitive basis should be based on these boundaries. They are indicative only of the limits of exposure or of geological interest, and not based on detailed field surveys, which were outside the scope of this contract.

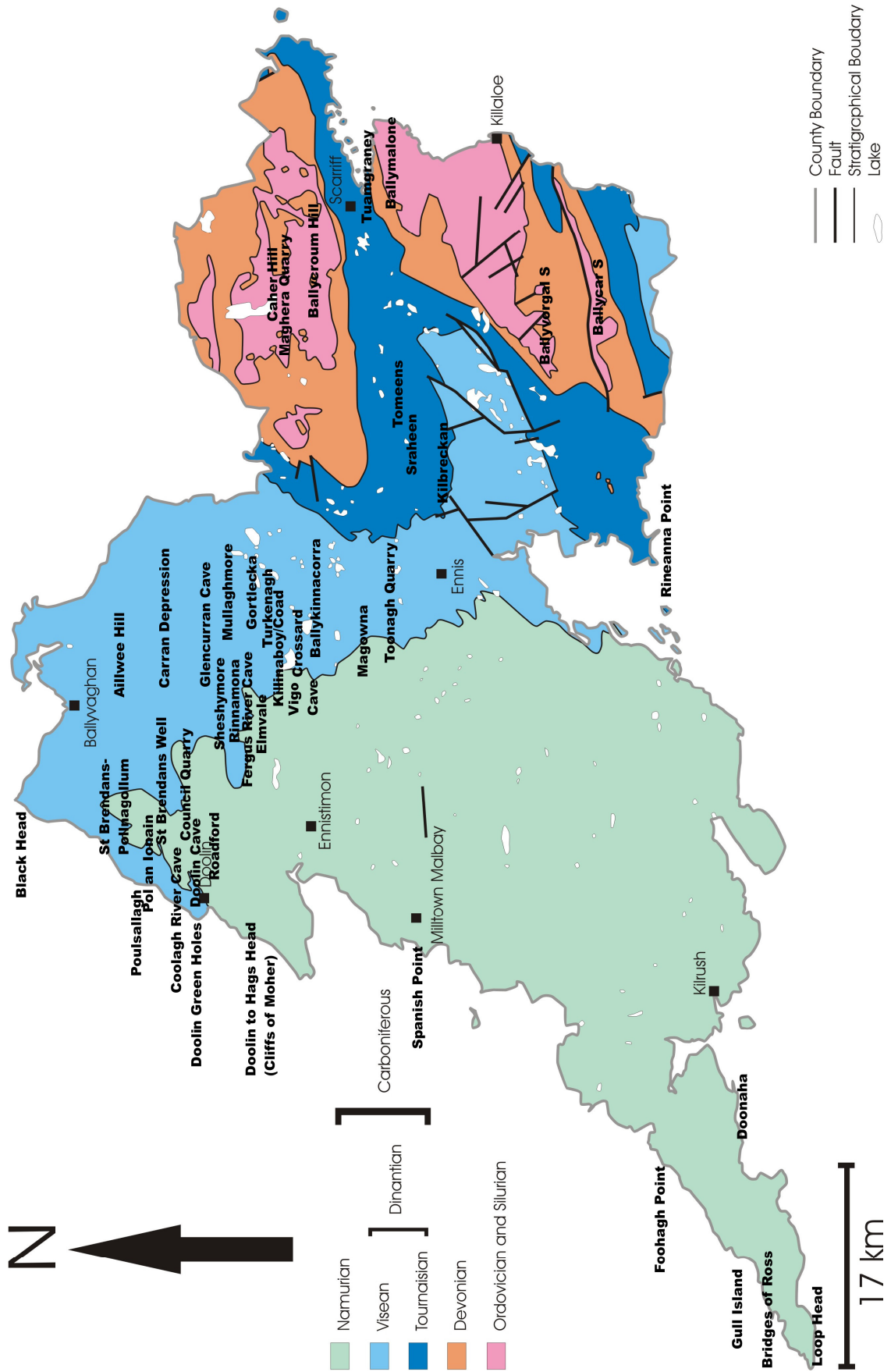
For sites that have been proposed or will be proposed for NHA designation detailed site boundary maps will become available to the Local Authority, through NPWS as the designation process is undertaken. Some areas of the Burren for example will already be available as they are proposed NHAs (pNHA), preceding the Wildlife (Amendment) Act 2000. Areas which have been designated as Special Areas of Conservation (SAC) under European Habitats Directives will also have statutory boundaries already determined. The geological interest may be included within the wider area of nature conservation.

In terms of any geological heritage site designation as NHA, due process of site reporting, boundary survey and very importantly, consultation with landowners where they can be readily identified, will take place before GSI makes recommendations to NPWS on the most important sites to be designated. Any landowner within areas or sites identified in this report with concerns over any aspect of this project is encouraged to contact Matthew Parkes at the Irish Geological Heritage Programme, in the Geological Survey of Ireland, Beggars Bush, Haddington Road, Dublin 4.

Phone 01-6782858. Email: matthewparkes@gsi.ie

Simplified Geological Map of Clare with site locations indicated

Simplified Geology of Clare



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Aillwee Hill

Other names used for site

TOWNLAND(S)

Ballycahill, Lisgoogan. Aillwee, Ballyalaban, Gleninsheen, Glensleade, Berneens, Garracloon, Poulgorm.

NEAREST TOWN

Ballyvaughan

SIX INCH MAP NUMBER

5, 9

NATIONAL GRID REFERENCE

125700 204800 (Centre Of Major Doline) = M 25700 04800

1:50,000 O.S. SHEET NUMBER

51 **1/2 inch Sheet No. 14**

Outline Site Description

Plateau karst with a wide variety of landforms. Area of dolines, uvalas, dry valleys, gorges, limestone pavement, springs, sinks, fossil caves.

Geological System/Age and Primary Rock Type

Middle and Upper Brigantian (Carboniferous) Limestones.

Main Geological or Geomorphological Interest

This site, located on the dip slope of Aillwee Hill in the north-central part of the Burren, contains the densest concentration and best examples of classical karst features in Ireland. These features, including springs, sinks, fossil caves, dry valleys and various enclosed depressions or dolines may have developed since the Pliocene by runoff from the former shale cover which was impermeable and insoluble. Later glacial and periglacial activity further modified these features (Drew 1973). The majority of the features have developed in Middle and Upper Brigantian limestones but the floor of the largest enclosed depressions are in the uppermost beds of the underlying Burren Limestones (Aillwee Member).

A series of discontinuous dry valleys, 20-50m wide and 5-20m deep, dissect the summit and flank areas of Aillwee Hill. The most complete valley is located at Ballymihil. These dry valleys have a general orientation towards the large and deep Glensleade doline (with a floor area of 1.5km²) and record the disintegration of a fluvial drainage system into a doline-oriented karstic drainage system. South of the Glensleade doline is the Kilcorney depression, one of three polje features in the central Burren region. Its origin is uncertain. Kilcorney may be genetically connected with the Aillwee landforms and is therefore considered a part of this larger site.

A large complex doline or uvala (smaller depressions within a larger enclosing contour) is situated at the summit of Aillwee Hill. This is the largest and most spectacular such diagnostic karst feature in Ireland. Numerous smaller dolines occur on the summit plateau and several small springs and sinks occur in the valleys and depressions.

Other karstic features in the area include fossil cave systems. The best developed are Maze Holes, a linear network of passages that honeycomb a limestone spur in the summit uvala. These caves, formed when the watertable was some 250m higher than at present, must be of great antiquity. The caves contain a partial fill of sediment. Similar ancient caves are present in the Kilcorney depression and seem to predate the formation of that depression.

Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme. The site is largely within the SAC54 Moneen Mountain.

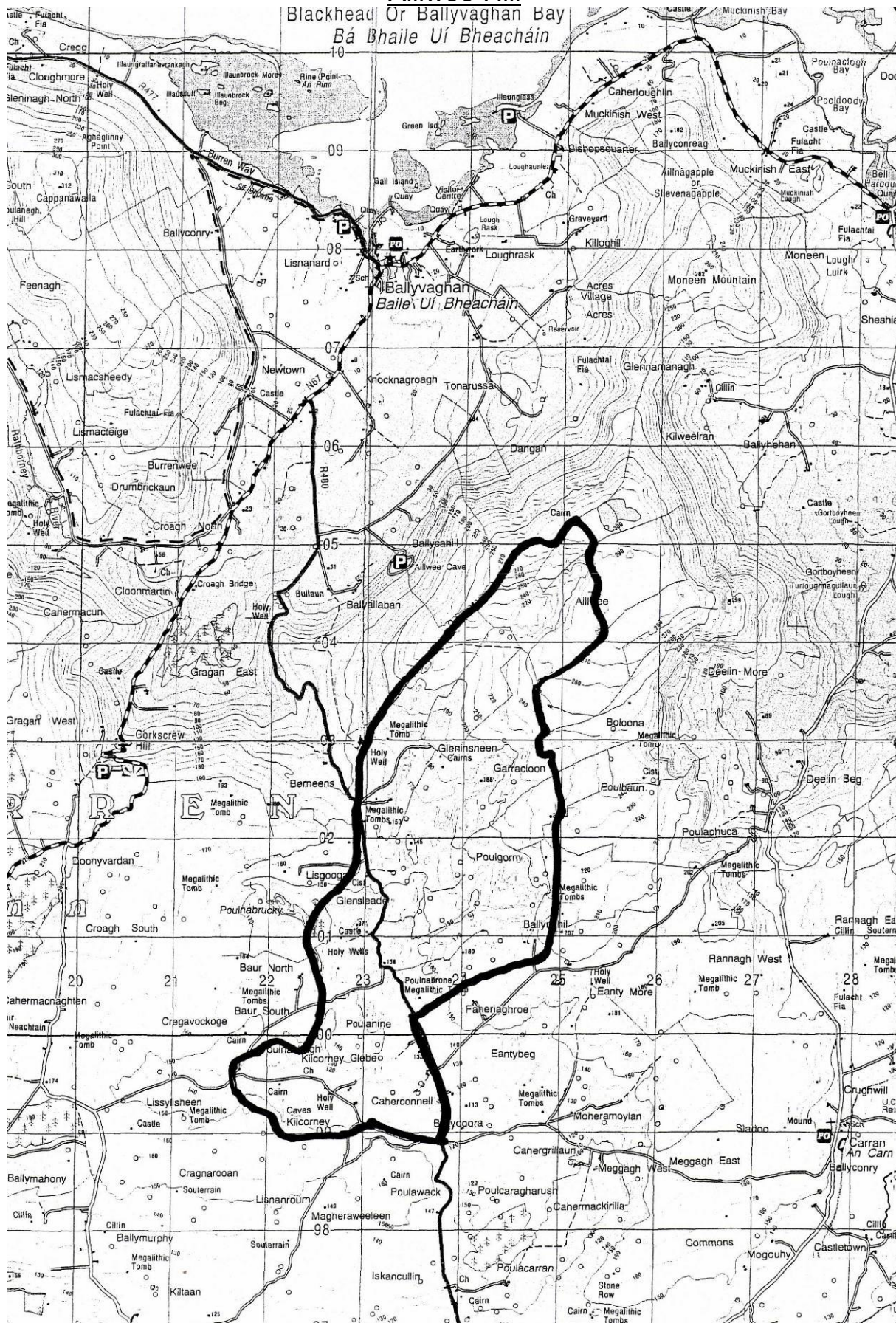
Management/promotion issues

Land reclaimed, new access roads, agricultural buildings on plateau in recent years.

The large enclosed
doline on the summit
of Aillwee Hill (D.
Drew).



Blackhead Or Ballyvaghan Bay
Bá Bhaile Uí Bheacháin



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**Ballycar South**

Other names used for site

TOWNLAND(S)

Ballycar South

NEAREST TOWN

Limerick

SIX INCH MAP NUMBER

Clare 53

NATIONAL GRID REFERENCE

156450 164100 = R56450 64100

1:50,000 O.S. SHEET NUMBER

58 1/2 inch Sheet No. 17

Outline Site Description

Agricultural grassland.

Geological System/Age and Primary Rock Type

Silurian (Wenlock) diverse shallow marine shelly fauna within conglomeratic Ballycar Member of the Cratloes Formation.

Main Geological or Geomorphological Interest

Ballycar South is an important site as the rocks here, which are presently not exposed at the surface, have yielded a very diverse assemblage of brachiopods (more than 200 different species have been identified), corals, gastropods, trilobites and bryozoans of Silurian age. These rocks were deposited by a debris flow (the rapid downslope movement of debris, in this case sand and pebbles, which became unstable and moved downslope under its own weight). Tectonic movements are thought to have been the triggering factor to this rapid flow (Weir 1975). The debris was transported from a shallow sea floor setting into a deeper marine basin, taking with it and preserving much of the inhabitants of the environment at the time.

The shelly fauna at this site are critical in the interpretation of the palaeogeography of the region during the Silurian. Although presently no rock is exposed the site has potential for further investigation as the nature of this type of deposit means that it could yield very new and different species. Such debris flows of this age are rare in Ireland but Ballycar is the best studied and has the richest fauna.

Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 2 Precambrian to Devonian Palaeontology theme and the IGH 4 Cambrian-Silurian Stratigraphy theme of the GSI's IGH Programme.

Management/promotion issues

The only obvious threat is the southerly extension of a large working quarry in the slate of the Cratloes Formation to the northwest, working into the higher ground of the Cratloe Hills ridge crest. Casual enquiry of one of the quarry plant operators indicated they would not be working in that direction. However, it requires verification as the quarry has significantly expanded towards Ballycar South during the last 10 years. Another potential threat is that of domestic building. The road up to Ballycar out of Limerick is a ribbon development of dwellings, which may become an issue.



View from roadside knoll about 100m north of the site, looking southward at the eastern end of the sub-surface rock ridge.

This is a detailed historical map of the Ballycannon area in County Wick, Ireland. The map shows various townships including Ballycannon East, Ballycannon West, Ballycannon, Ballyfinnee, and Ballycannon South. A prominent black outline highlights a specific area within Ballycannon South. The map includes numerous place names, such as 'Children's Burial Ground', and various numerical identifiers like 'R 9', 'P 23', 'A 318', and 'R 2'. It also features topographical details like 'Rises' and 'Rivers'.

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Ballycroum Hill

Other names used for site

TOWNLAND(S)

Ballycroum

NEAREST TOWN

Feakle

SIX INCH MAP NUMBER

19

NATIONAL GRID REFERENCE

154150 188650

1:50,000 O.S. SHEET NUMBER

58

1/2 inch Sheet No. 14

Outline Site Description

Short cliff rock exposure on hill

Geological System/Age and Primary Rock Type

The site has Devonian sandstones and conglomerates overlying Silurian siltstones.

Main Geological or Geomorphological Interest

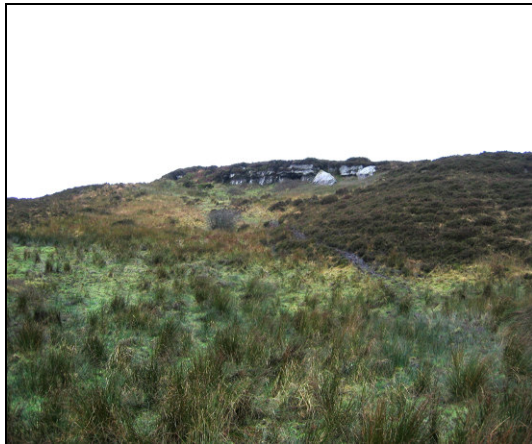
The site is an excellent example of an unconformity. Flat lying conglomerate beds are seen overlying the truncated ends of nearly vertical beds of Silurian slaty rocks. The time gap represented is approximately 30 million years, when the Silurian rocks below were transformed from their original oceanic sediments into hard rock, and then folded and tilted to their upright position. They were then subjected to erosion over an extended period, planing off the land surface. The Devonian conglomerates lying above this planed surface are deposits of rivers which occasionally flowed within a largely arid environment of the period.

Site Importance

The site is a County Geological Site for its general interest and visible clear relationships of a fundamental geological phenomenon.

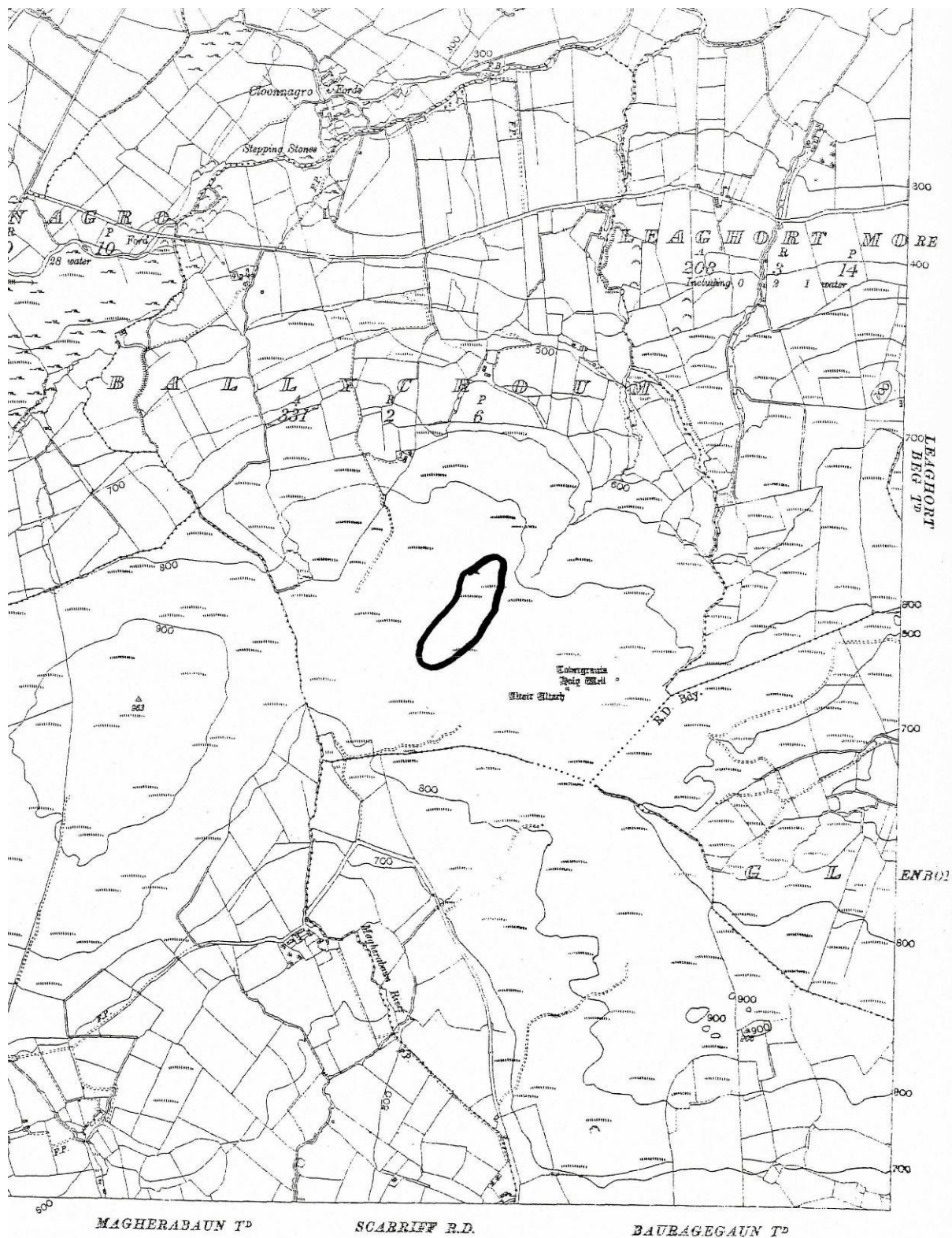
Management/promotion issues

As the site is on commonage hilltop with little activity other than cattle grazing it is not particularly at risk. As it is alongside the East Clare Way, it is easily accessible, by a muddy path across moorland. However, forestry is a threat and if any application is made to afforest the area, an unplanted barrier should be left around the site for people to access and appreciate the site from a moderate distance as well as close up.

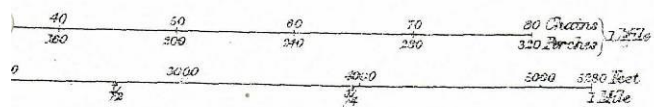


Left: an overview of the cliff. Right: a closer view showing the horizontal massive Devonian conglomerates overlying vertical Silurian rocks. The block nearest has fallen down as it became unsupported by erosion of the rocks below.

Ballycroum Hill



Scale: 1 inch = 330 Feet or 1 Mile



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Ballykinnacorra North

Other names used for site

TOWNLAND(S)

Ballykinnacorra North

NEAREST TOWN

Corofin

SIX INCH MAP NUMBER

17

NATIONAL GRID REFERENCE

128650 188480 = R2865 8848

128740 188060 = R2874 8806

1:50,000 O.S. SHEET NUMBER

57 1/2 inch Sheet No. 14

Outline Site Description

Mushroom rocks – isolated wave worn stones in grazing fields

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The stone in question is an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones such as at Ballykinnacorra North, this has created an scalloped lower surface with smooth surfaces, whilst in more extreme cases a mushroom shape develops with a cap on a pedestal. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes probably had a wider extent such as in the River Fergus floodplain, but in others the lake has entirely disappeared. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made, but this seems unlikely for Ballykinnacorra North.

Site Importance

The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. It is one of only about 63 mushroom stones known in the country as a whole. Fieldwork for this report has identified a further wave worn stone at R2874 8806, in the field to the south, near the petrol station. The site should include both obvious stones.

Management/promotion issues

The subtlety of the wave worn features means that the stone is vulnerable to field clearance, agricultural 'improvement' or road widening as well as the use of the field as a building site for a new domestic dwelling, although the main stone is large enough to command attention.



Far Left
Ballykinnacorra 1

Left
Ballykinnacorra 2

This is a detailed historical map of the Corrofin area in County Kerry, Ireland. The map shows the town of Corrofin at its center, with various landmarks and features labeled. The surrounding parishes are Anneville to the north, Lachy to the northeast, Linnacora to the southwest, and Annagh to the southeast. Key locations include Corrofin Bridge, Corrofin School, St. Catherine's Church, St. John's Church, St. Mary's Church, and the Union Workhouse. The map also shows the River Corrofin and several lakes, including Lake Vico. Numerous numerical data points are scattered across the map, likely representing population or land area statistics for different areas. The map is oriented with North at the top.

Parishes and Towns:
 ANNEVILLE
 LACHY
 CORROFIN
 LINNACORA
 ANNAGH

Landmarks and Features:
 Corrofin Bridge
 Corrofin School
 St. Catherine's Church
 St. John's Church
 St. Mary's Church
 Union Workhouse
 Fever Hospital
 Chapel
 The Glebe
 Bannkyle House
 Gallops Hill
 Longhouse
 Pail Green
 Richmond House
 Lake Vico
 Linnacora Drough

Map Details:
 The map includes numerous numerical data points, such as 270, 36, 169, 240, 69, 146, 97, 16, 3, 17, 21, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100. These numbers are often accompanied by small letters (A, R, P) and words like 'Including' and 'water'. The map also shows various roads and boundaries.

Scale and Orientation:
 The map includes a scale bar at the bottom left, indicating a distance of 1 mile. The orientation is North at the top.

Source:
 The map is a reproduction of a historical document, likely a census or land survey map, and is oriented with North at the top.

Map Title:
 KILLEN T^o
 (E. D. Corrofin)

KILLEEN T^D
(E. D. Corrofin)

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Ballymalone

Other names used for site

Raheen Bridge

TOWNLAND(S)

Ballymalone

NEAREST TOWN

Tuamgraney

SIX INCH MAP NUMBER

29

NATIONAL GRID REFERENCE

164800 181300 = R 648 813

1:50,000 O.S. SHEET NUMBER

58

1/2 inch Sheet No. 18

Outline Site Description

Small quarry

Geological System/Age and Primary Rock Type

Late Ordovician (Caradoc) graptolitic shales and cherts.

Main Geological or Geomorphological Interest

The Ordovician rocks of the Ballymalone Formation have been dated by graptolite fossils to be of Caradoc age. The site provides the only representative section of these rocks in the northeastern part of the Slieve Bernagh inlier, and complements the Ballyvorgal South site. The fossils were collected from the streambed, adjacent to the quarry (Rickards and Archer 1969), in difficult collecting circumstances so the availability of fresh, good exposures in the quarry offers great potential for more detailed research on the graptolite fauna.

Site Importance

The site is of County Geological Site importance under the IGH 4 Cambrian - Silurian theme of the GSI's IGH Programme.

Management/promotion issues

Largely of academic interest as a good place to see reasonably fresh exposure of the Ordovician Ballymalone Formation. Black shales have previously yielded graptolite fossils in the locality, but not potentially as easy to find. Landowner is not known and no access problems known, but probably not suitable for general promotion.



[illegible]

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Ballyvorgal South

Other names used for site

TOWNLAND(S)

Ballyvorgal South, Ballyvorgal Beg and Cloghoolia

NEAREST TOWN

Sixmilebridge

SIX INCH MAP NUMBER

Clare 43

NATIONAL GRID REFERENCE

151350 168600 = R51350 68600

1:50,000 O.S. SHEET NUMBER

58 **1/2 inch Sheet No. 17**

Outline Site Description

Streambank exposures.

Geological System/Age and Primary Rock Type

Late Ordovician [fossiliferous](#) mudstone of the Ballymalone Formation.

Main Geological or Geomorphological Interest

The Ballyvorgal site is an unusual Irish occurrence of an assemblage of deep-water fossils now found all over the world in rocks of Upper Ordovician age. The fauna has been well described and contains a characteristic mix of very small [trilobites](#) and tiny brachiopod shells. The type of assemblage at Ballyvorgal is also found in the Grangegeeth terrane (Oriel Brook) and the Northwestern Terrane (Pomeroy) and in Scotland (Whitehouse Group of Girvan) and other sites. The fauna exemplifies the breakdown of faunal provinciality (where species are restricted to certain regions) in the Iapetus Ocean during the Upper Ordovician.

As well as providing information on biogeographical patterns of migration, Ballyvorgal is an important site for understanding and dating the rocks of the Slieve Bernagh [Inlier](#). This site is the type locality for five species of trilobite.

Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 2 Precambrian to Devonian Palaeontology theme of the GSI's IGH Programme.

Management/promotion issues

The gorse, bramble and other vegetation overgrowing the stream banks means there are currently only three small exposures of the brown mudstones, and no clear section of the trilobite bed. Whilst it would be necessary for some clearance to take place for any future study, if the landowner was to undertake any drainage work in the immediate vicinity of the stream, then a geological investigation should be made at the same time. Equally any major forestry work (felling/gripping/planting) in the adjacent western bank of the stream (not included within the site boundary) should be notified so that investigation may also occur of fresh exposures.

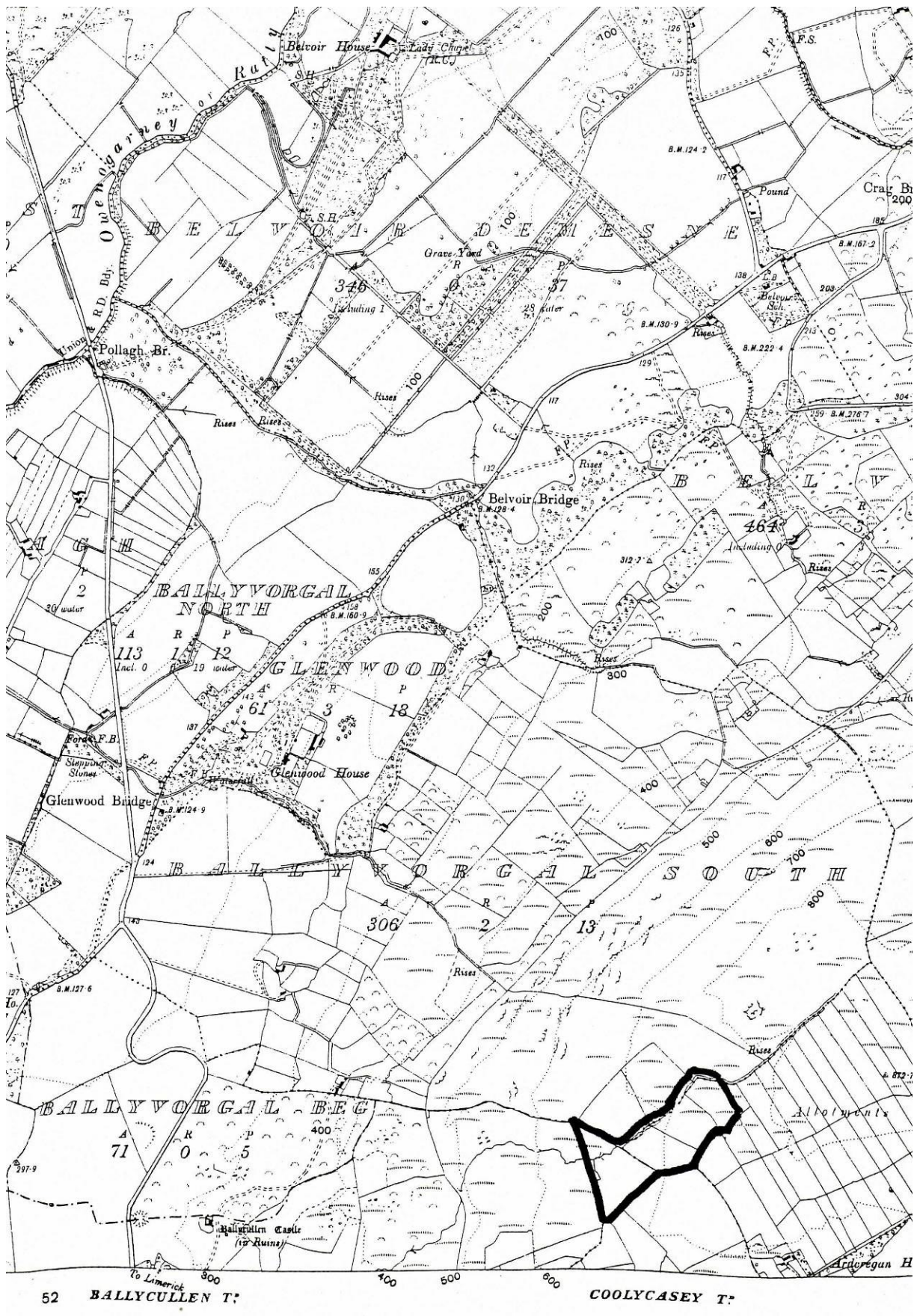


Left: A view over the site in the stream at the edge of the forestry, looking southwest from the northwest end of the site.

Right: Access to the main exposure in stream bank, excavated by earlier workers and overhung by trees.



Ballyvorgal South



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**Black Head**

Other names used for site

Ceann Boirne

TOWNLAND(S)

Murrooghtoohy North

NEAREST TOWN

Ballyvaughan

SIX INCH MAP NUMBER

1

NATIONAL GRID REFERENCE

115400 212300 = M154 123

1:50,000 O.S. SHEET NUMBER51 **1/2 inch Sheet No. 14****Outline Site Description**

Coastal cliffs and roadside pavement exposure.

Geological System/Age and Primary Rock Type

Carboniferous (Viséan) corals.

Main Geological or Geomorphological Interest

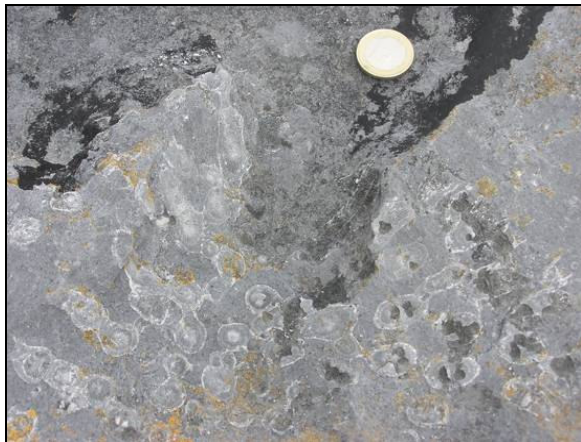
Limestone pavement with well-developed karst features. A good place to see the transition in Carboniferous corals from *Siphonodendron* to cerioid *Lithostrotion* through semi-cerioid forms. The Finavarra Member with dolomite bands, of the Tubber Formation is overlain by the Black Head Member, the basal unit of the Burren Formation. The first cerioid colonial rugose corals occur above the dolomite south of the road.

Site Importance

The site is of County Geological Site importance and may be proposed for NHA designation under the IGH 3 Carboniferous-Pliocene Palaeontology theme and the IGH 8 Lower Carboniferous theme of the GSI's IGH Programme.

Management/promotion issues

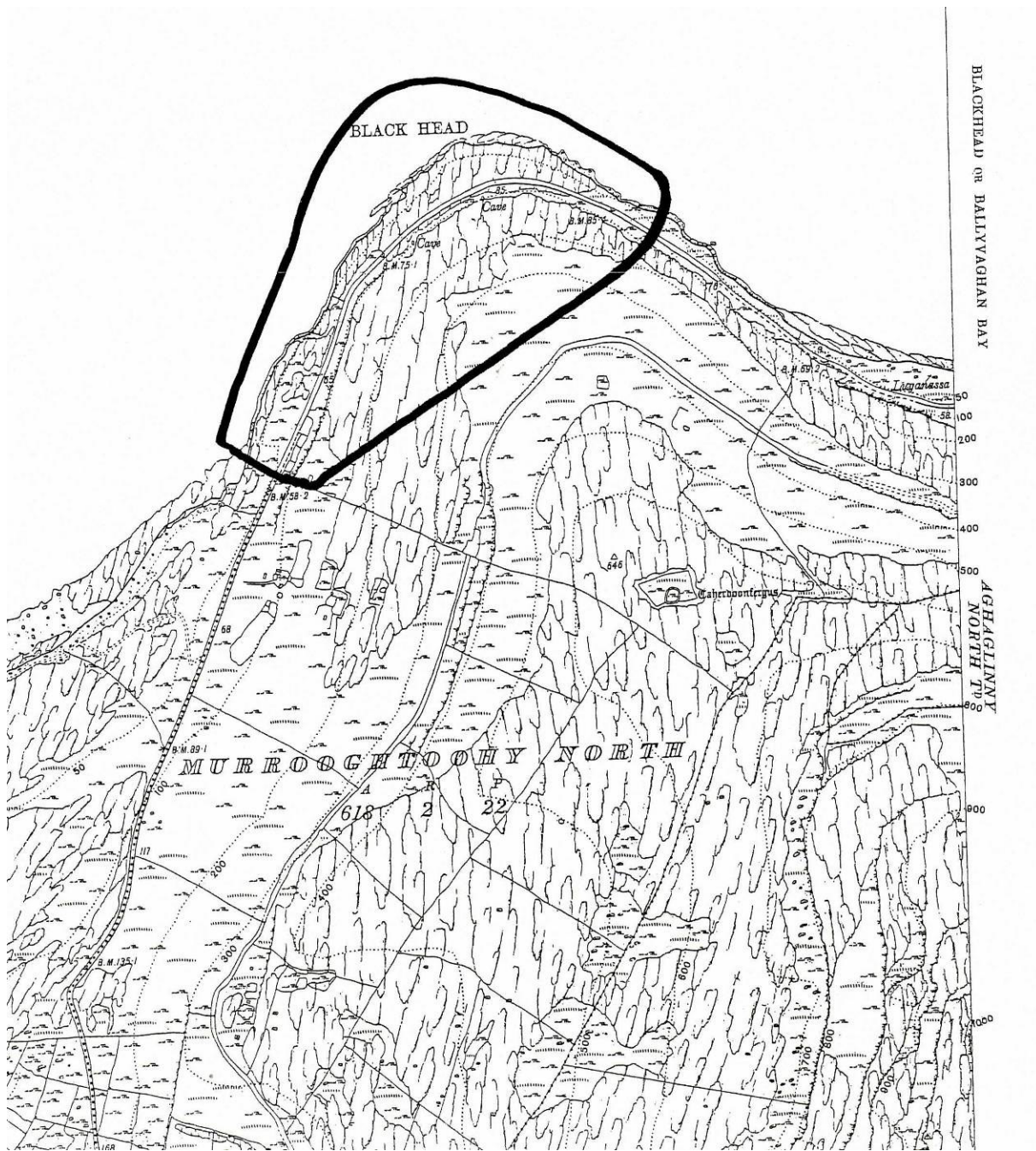
Poor parking at this landmark point on the coast road. Difficult geological features to promote so may not be suitable for on site information.



Above: an example of the corals seen at Black Head

Right: The lighthouse and limestone pavement at Black Head.

Black Head



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Bridges of Ross

Other names used for site

TOWNLAND(S)

Ross

NEAREST TOWN

Kilbaha

SIX INCH MAP NUMBER**NATIONAL GRID REFERENCE**

073300 150600 = QQ733 506

1:50,000 O.S. SHEET NUMBER

63

1/2 inch Sheet No.

Outline Site Description

Coastal cliffs section.

Geological System/Age and Primary Rock Type

Upper Carboniferous (Namurian) sandstone, siltstone and shale. Rock arches and blowholes

Main Geological or Geomorphological Interest

The Ross sandstone Formation consists of [turbiditic](#) sheet sandstone, siltstone and thinly bedded black shales. Slumping is common at many horizons throughout the formation, the most spectacular of which, the Ross Slide occurs at the Bridges of Ross. Slumping is the term used to describe a type of sediment slide where the material moves downslope as a single unit resulting in highly deformed structures within the sediment. The Ross Slide consists of several metres of siltstone and overlying sandstone displaying a range of deformational features including recumbent folds (folds with horizontal hinge lines). Sand volcanoes are present on the upper surface of the overlying sandstone unit. These impressive features formed by the extrusion of fine-grained sediment suspended in water as the sediments were compacted. Also of interest at this site are fold structures which formed during the Variscan Orogeny and a sea bridge which has developed as a result of erosion by the sea.

Site Importance

This site is of National Importance and may be proposed as an NHA under the IGH 9 Upper Carboniferous and Permian theme of the IGH programme.

Management/promotion issues

Sand volcanoes require protection. Public access seems to exist, but signs or panels to explain what can be seen would be worthwhile.



This is a detailed black and white topographical map of a coastal area. The map shows a coastline with several coves and rivers. A prominent feature is a large, irregularly shaped area outlined in thick black, which appears to be a large body of water or a specific land parcel. The map includes various labels such as 'River', 'Cove', 'Rocks', 'Bridge', and '517'. There are also numerical markers like '100', '50', and '39'. The map is oriented with North at the top.

MOYARTA Bİ

*the base of Poolbeg Lighthouse.
to surface levels.*

	10	20	30	40	50	60	70
10 Chains 5	0						
40 Acres 20	0						
1000 Feet	0	1000	2000	3000	4000	5000	6000
1 Furlong	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Caher Hill

Other names used for site

TOWNLAND(S)

Caher

NEAREST TOWN

Scarriff, Lough Graney

SIX INCH MAP NUMBER

19, 20

NATIONAL GRID REFERENCE

154750 190650 = R 5475 9065

1:50,000 O.S. SHEET NUMBER

52

1/2 inch Sheet No. 14

Outline Site Description

Hill exposures.

Geological System/Age and Primary Rock Type

Late Ordovician (Caradoc) volcanics, graptolitic shales and [cherts](#).

Main Geological or Geomorphological Interest

Caher Hill is the type locality for the Caher Hill Formation. Yellow, cream and pink-coloured [amygdaloidal trachytes](#) occur here. The yellow trachytes host [enclaves](#) up to 10cm in diameter of [basic](#) composition. The pink trachytes contain abundant [orthoclase phenocrysts](#). The trachytes overlie a succession of black shales and cherts, basic [lapilli tuffs](#) and a sequence of basic tuffs, lavas and [breccias](#). These rocks provide a record of sedimentation and volcanic eruptions within the contracting Iapetus Ocean. Graptolites found within the black shales have yielded a late Ordovician, Caradoc age for the rocks. The Caher Hill Formation is also exposed south and west of Lough Graney and near Lough Ea. Spillitic lavas occur at the latter locality.

Site Importance

The site is of County Geological Site importance and may be proposed for NHA designation under the IGH 4 Cambrian - Silurian theme of the GSI's IGH Programme.

Management/promotion issues

On private land, and not especially well exposed, so of scientific interest more than suitable for general promotion.

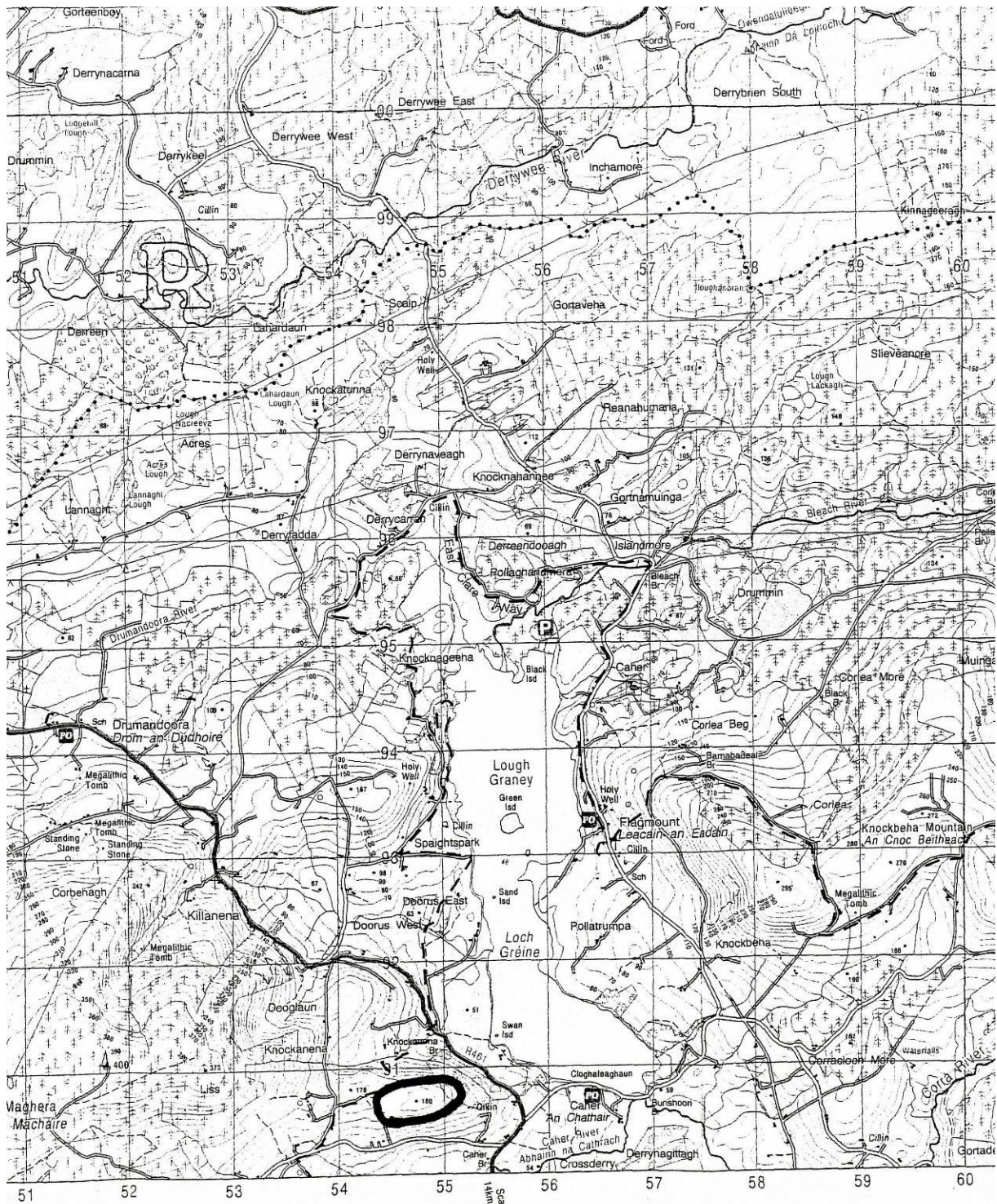


Caher Hill looking east (above left)

Caher Hill looking west towards Maghera
(above right)

Typical exposures on Caher Hill (left)

Caher Hill



Co. CLARE
Co. an Chláir

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Carran enclosed depression

Other names used for site

TOWNLAND(S)

Castletown, Ballyconry

NEAREST TOWN

Corofin/Ballyvaghan

SIX INCH MAP NUMBER

6, 10

NATIONAL GRID REFERENCE

128000 198000 (sink) = R28000 98000

1:50,000 O.S. SHEET NUMBER

51 1/2 inch Sheet No. 14

Outline Site Description

Large enclosed depression

Geological System/Age and Primary Rock Type

Large internally draining basin with inlet [springs](#) and outlet via a swallow hole (or [sink](#)) developed within Carboniferous limestone.

Main Geological or Geomorphological Interest

The Carran depression is the largest karstic enclosed depression in Ireland and Britain. It is approximately 4.5km² in area and 40m deep, implying a considerable length of time for development. The depression is divided into sub-enclosed basins and is ringed by moderate to steep slopes. Water enters the hollow via springs and exits via the Castletown sink in the south. The waters re-emerge at the Fergus River Cave and other Fergus valley springs. Under wet conditions much of the floor of the depression becomes flooded even though the 'watertable' is some 120m below the floor of the feature. The structure and hydrology of this depression resembles both an [uvala](#) (large and complex [dolines](#)) and a [polje](#) (closed depression in a karst area).

Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

None apparent, but the site deserves some explanation in the form of an interpretive panel by the pub in Carran, which provides a good viewpoint.

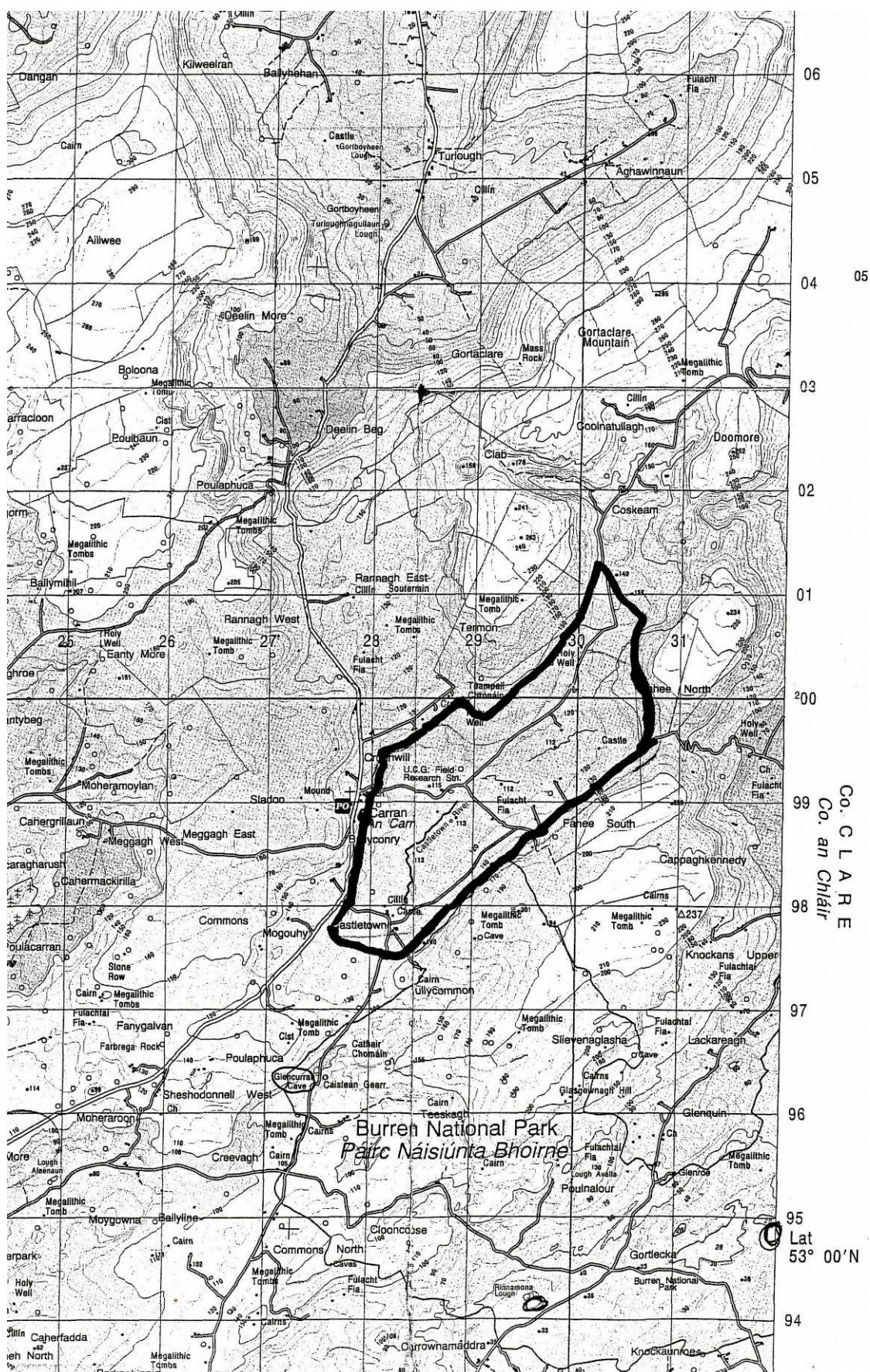


The Carran depression at the Castletown River sinks in autumn, looking east



The Carran depression in winter looking northeast

Carran enclosed depression



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Coad
Other names used for site	
TOWNLAND(S)	Coad
NEAREST TOWN	Corofin
SIX INCH MAP NUMBER	17
NATIONAL GRID REFERENCE	127250 191390 = R2725 9139
1:50,000 O.S. SHEET NUMBER	51 1/2 inch Sheet No. 14

Outline Site Description

Mushroom rocks – isolated wave worn stones in grazing fields

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The at least eight stones in question are an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones such as at Coad, this has created a marked smooth surface below a lip, whilst in more extreme cases a mushroom shape develops with a cap on a pedestal. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes probably had a wider extent such as in the River Fergus floodplain, but in others the lake has entirely disappeared. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made, but this seems unlikely for Coad.

Site Importance

The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. The stones at Coad comprise a large share of only about 63 mushroom stones known in the country as a whole. The adjacent stone in Killinaboy Townland on the other side of the adjacent road should be included in one site.

Management/promotion issues

The subtlety of the wave worn features means that the stones are vulnerable to field clearance, agricultural 'improvement' or road widening as well as the use of the field as a building site for a new domestic dwelling although the situation in the Fergus floodplain makes this unlikely.



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Coolagh River Cave

Other names used for site

TOWNLAND(S)

Ballynahown, Knockauns Mountain, Blakes Mountain,
Cloghaun, Poulmagun
Lisdoonvarna

NEAREST TOWN**SIX INCH MAP NUMBER**

4, 8

NATIONAL GRID REFERENCE

112400 201400 = M12400 01400

1:50,000 O.S. SHEET NUMBER

51

1/2 inch Sheet No. 14

Outline Site Description

Mature cave system with many subterranean and subaerial karst features.

Geological System/Age and Primary Rock Type

Carboniferous limestones host a Pleistocene and Holocene cave system

Main Geological or Geomorphological Interest

Dendritic Cave System with several stream sinks / swallow holes, Blind Valley, Active Uvala Coolagh River South B8 / Poulclabagh B10, Doline B11b Poulmagun.

The Coolagh River Cave is a mature cave system with many subterranean and subaerial karst features. It is a dendritic cave system with several stream sinks / swallow holes. The Coolagh River sink is at a karst window, at the end of a blind valley (B7). The Coolagh River Valley, which continues southwards as a normally dry valley within the site, is also one of the major surface features of the Burren. To the south it enters an irregular depression in the limestone. This has active and inactive sinks at several points (B9, B10-Poulclabagh), and is a compound sink, or uvala, distinguished from the karst window in being open to the main limestone outcrop at its southwest end. A classic collapse doline (B11b – Poulmagun) intercepts the Coolagh River stream. The drainage is proven to resurge at Poulisallagh (IGH1-6) on the coast to the west.

Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

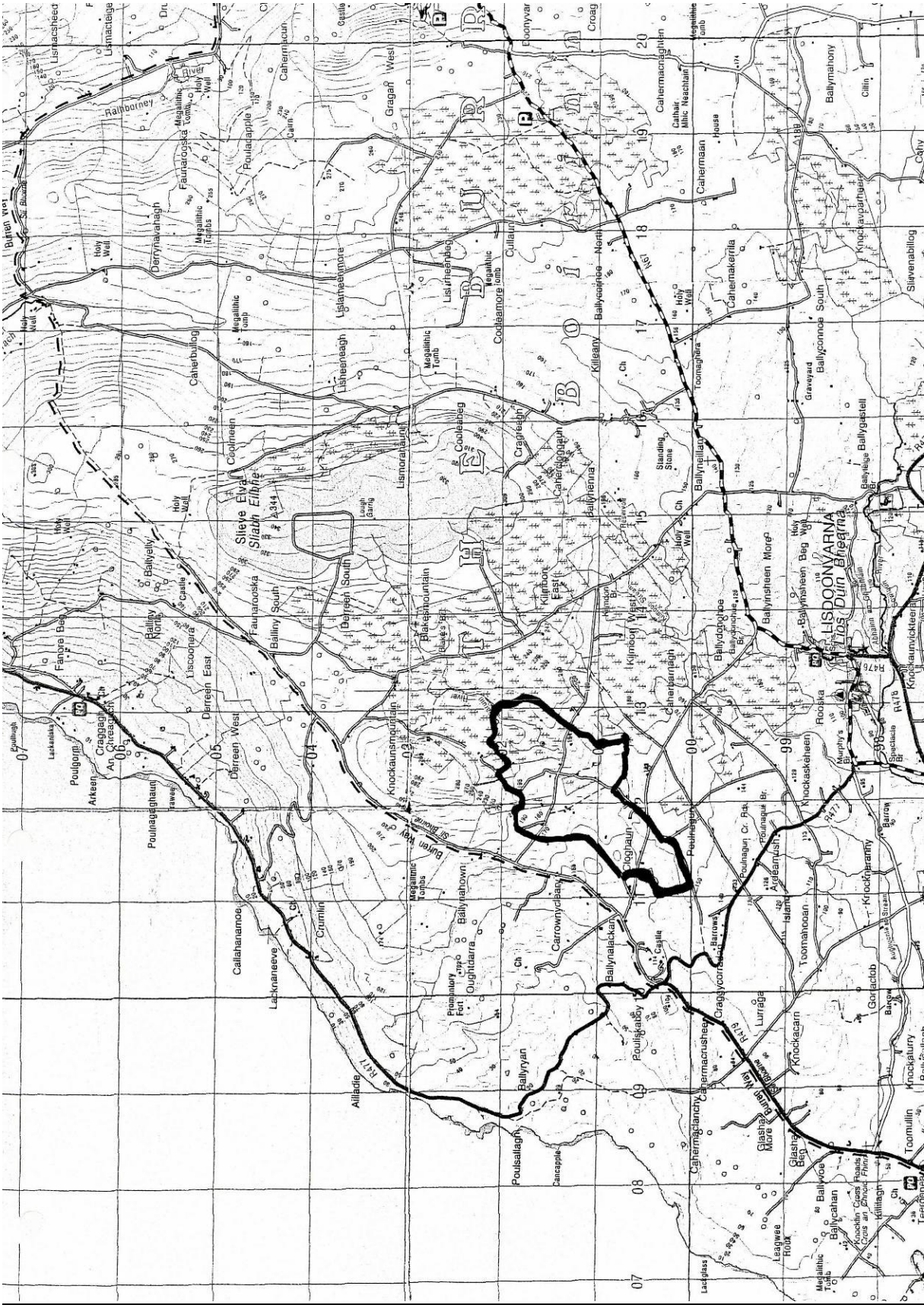
Management/promotion issues

Extensive forestry at B7 Polldonough. B10 Pollclabber entrance has been kept blocked by the farmer in the past



Polldonough. Blind valley and Coolagh River sink, with old and new forestry encroaching (G. LI. Jones).

Coolagh River Cave



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	County Council Quarry		
Other names used for site	Lisdoonvarna Quarry		
TOWNLAND(S)	Ballyinsheen More		
NEAREST TOWN	Lisdoonvarna		
SIX INCH MAP NUMBER	Clare 8		
NATIONAL GRID REFERENCE	115000 199500 = R 150 995		
1:50,000 O.S. SHEET NUMBER	51	1/2 inch Sheet No.	14

Outline Site Description

Quarry exposing well - bedded, fossiliferous limestones.

Geological System/Age and Primary Rock Type

Viséan Limestones and Namurian Shales.

Main Geological or Geomorphological Interest

Upper Viséan, Carboniferous limestones are exposed at the County Council Quarry, located 1.7km outside Lisdoonvarna. These well-bedded, dark grey limestones are rich in fossils. Fossils found at this site include [crinoids](#), [bryozoans](#) and corals. These corals, in particular, the coral *Orionastraea rete*, correlate with specimens found outside Ireland and indicate a Brigantian age (uppermost stage of the Viséan) for these limestones. Basal Namurian Clare Shales overlay these Viséan limestones.

Site Importance

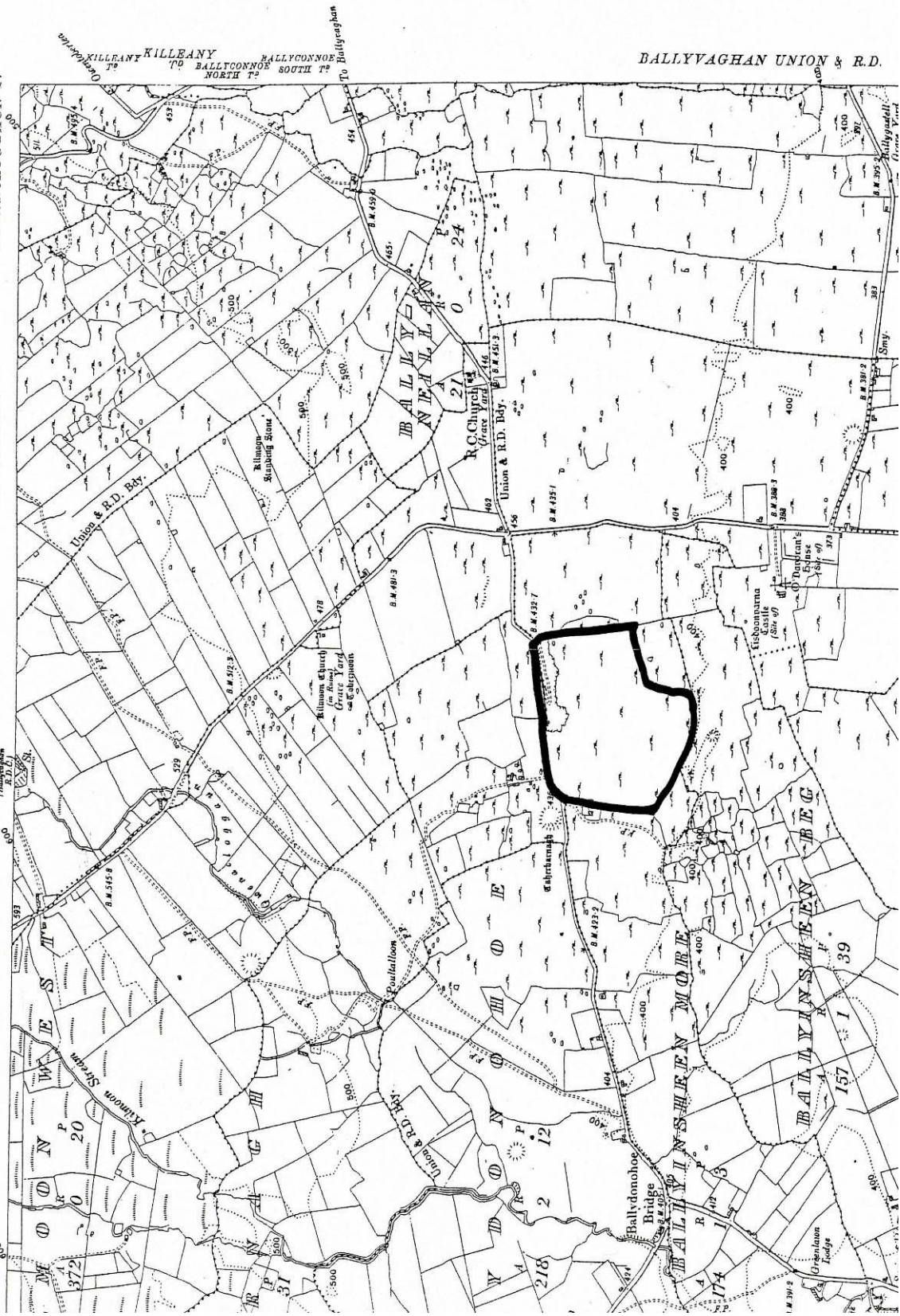
The site is of National importance and may be proposed for NHA designation under the IGH 3 Carboniferous-Pliocene Palaeontology theme of the GSI's IGH Programme.

Management/promotion issues

The quarry is not generally active, other than as a store for materials so no major issues arise.



KILMOON EAST T^D
Kilmoon
Reservoir
Hallycrossham



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**Crossard**

Other names used for site

TOWNLAND(S)

Crossard

NEAREST TOWN

Corofin

SIX INCH MAP NUMBER

17

NATIONAL GRID REFERENCE

126880 190750 = R2688 9075

1:50,000 O.S. SHEET NUMBER51 **1/2 inch Sheet No.** 14**Outline Site Description**

Mushroom rocks – isolated wave worn stone in grazing fields

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The stone in question is an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones such as at Crossard, this has created a marked bulbous mushroom shape develops with a cap on a pedestal, although other may only have lips on surfaces. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes, such as Inchiquin, probably had a wider extent in the River Fergus floodplain, but in others the lake has entirely disappeared. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made, but this seems unlikely for Crossard.

Site Importance

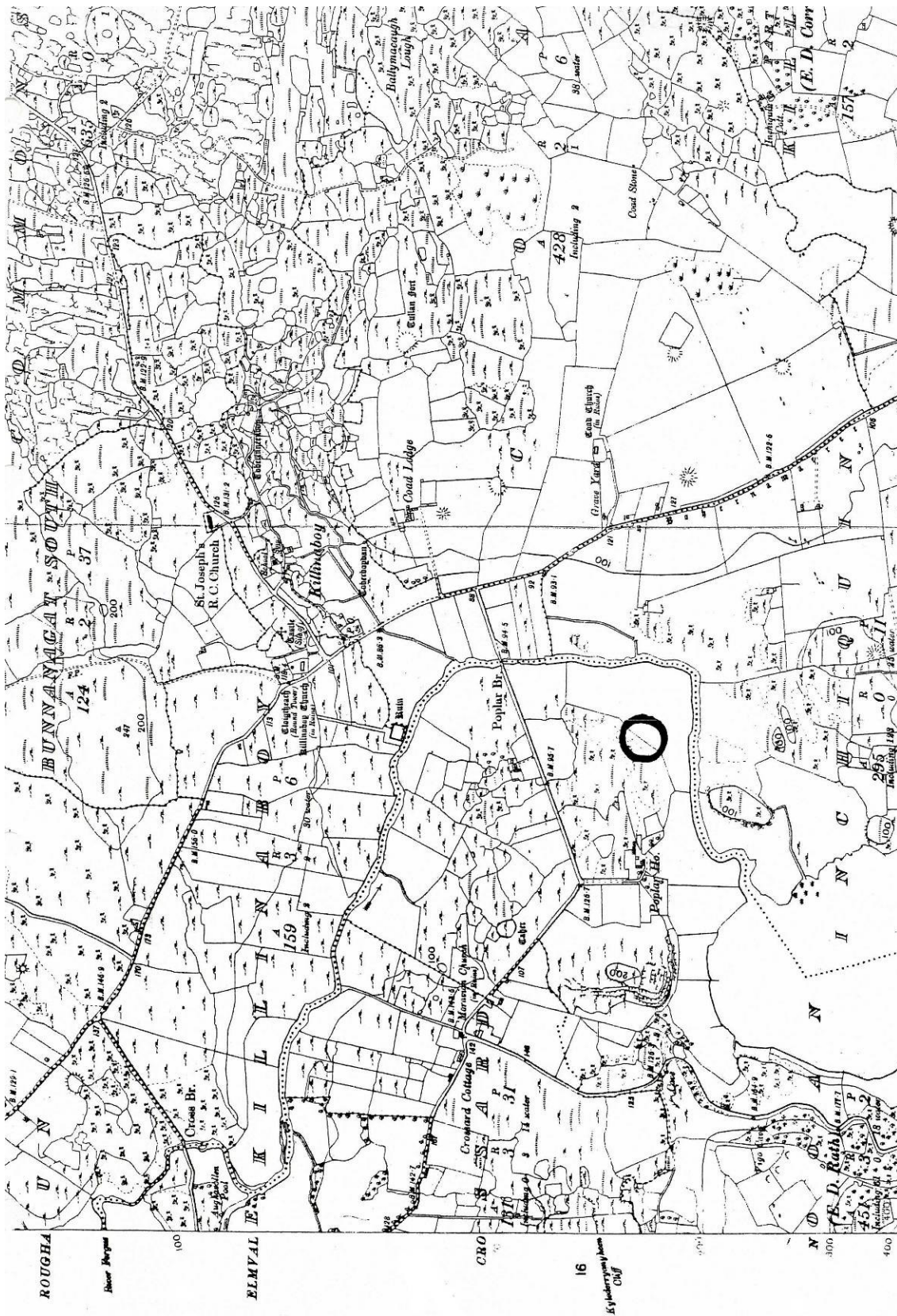
The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. It is one of only about 63 mushroom stones known in the country as a whole.

Management/promotion issues

The subtlety of the wave worn features means that the stone is vulnerable to field clearance, agricultural 'improvement' or road widening as well as the use of the field as a building site for a new domestic dwelling.



Crossard



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Doolin Cave

Other names used for site

TOWNLAND(S)

Doolin

NEAREST TOWN

Lisdoonvarna

SIX INCH MAP NUMBER

Clare 8

NATIONAL GRID REFERENCE

107500 197100 = R07500 97100

1:50,000 O.S. SHEET NUMBER

51 1/2 inch Sheet No. 14

Outline Site Description

Extensive [dendritic](#) stream cave system.

Geological System/Age and Primary Rock Type

Dendritic cave system within Carboniferous Limestone.

Main Geological or Geomorphological Interest

Doolin Cave, a dendritic network of stream passages, is an active cave system, which has preserved various stages of cave development. The cave system developed as parts of the surface Aille River system formed underground routes that unite in a large master conduit. The entire Aille River sinks into the cave in its lower part in low water conditions. Access to the lower reaches is by Fisherstreet Pot in between Doolin and Roadford.

Site Importance

The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

Expansion of tourism?

Ongoing pollution problems with domestic sewage, mainly on the Aran View Swallet branch.

NO PICTURE AVAILABLE

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Other names used for site

TOWNLAND(S)**NEAREST TOWN****SIX INCH MAP NUMBER****NATIONAL GRID REFERENCE****1:50,000 O.S. SHEET NUMBER****Doolin Green Holes**

Hell Complex/Mermaid's Hole

Doolin

Doolin

8, 14 & 8A

105600 197600 = R05600 97600

51 1/2 inch Sheet No. 14

Outline Site Description

Karst caves inundated by post-glacial sea level rise.

Geological System/Age and Primary Rock Type

Karst caves in Carboniferous Limestone.

Main Geological or Geomorphological Interest

The Doolin Green Holes, the best-documented karst caves in Ireland, consist of a series of cave passages that formed at a lower sea level than today when the water was trapped in huge ice sheets. Since their formation the caves have been inundated by post-glacial sea-level rises and have preserved much evidence of this. Other submarine karst springs have been identified along the northwest Clare coastline between Doolin and Black Head, and near Ballyvaughan but no open cave passage has been explored at these sites. Also of interest here are the [photokarren](#) and [phytokarst](#), which were examined by Simms (1990). These erosional features, which are absent in the darkest parts of the cave, are the first of their kind to be recorded outside of the tropics. They are produced by the boring and solutational activity of algae, which has proved to be the main factor in coastal limestone erosion rather than chemical solution dominant in freshwater or subaerial settings. A geophysical study conducted by Convery (1991) has demonstrated how VLF (Very Low Frequency) measurements can be used to locate salt-water passages within the cave. This study also highlighted the possibility of further passages north of Mermaid's Hole that may warrant additional investigation.

Site Importance

This site is of National importance and may be proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

The site is a popular place for visitors generally to stroll to the Point and would benefit from explanatory material at Doolin Pier, campsite or in guidebooks locally.

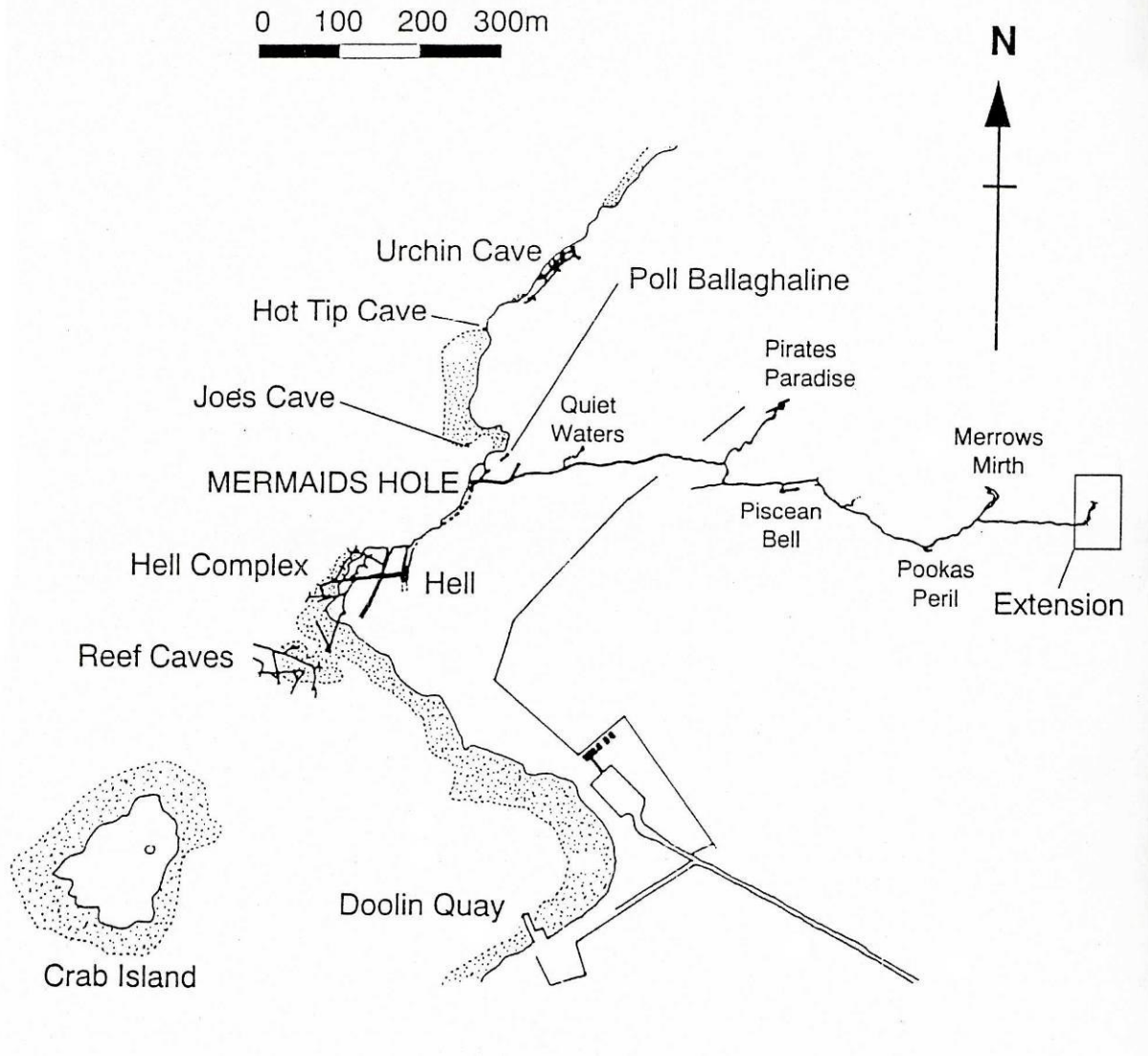


Far left: a view of the point from the pier area. Left: detail of an exposed karstic drainage channel from between beds of limestone, now exposed, showing cave formation in action.

The Green Holes of Doolin

After CDG Newsletter 101 with additions by Brian Judd, 1993.

See also UBSS Cave Notes, Co. Clare 1991 Vol 19(1)



Doolin Green Holes



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**Doolin to Hags Head (Cliffs of Moher)**

Other names used for site

TOWNLAND(S)

Doonnagore, Luogh North, Luogh South, Lislorkan North, Slievenageeragh, Shingaunagh North etc

NEAREST TOWN

Doolin, Liscannor

SIX INCH MAP NUMBER

8, 8A, 14

NATIONAL GRID REFERENCE

106500 196000 to 101300 189200

1:50,000 O.S. SHEET NUMBER51, 57 **1/2 inch Sheet No.** 14**Outline Site Description**

Coastal cliffs section.

Geological System/Age and Primary Rock Type

Upper Carboniferous sedimentary rocks.

Main Geological or Geomorphological Interest**IGH9**

A coastal section with a remarkable development of sand volcanoes in Carboniferous beds over-lying slumped shales and sandstones. The 'Fisherstreet Slide' is a distinctive sheet, 30 metres thick, extending over some kilometres of the section. The entire sheet moved as a sedimentary slide, and now contains a wealth of soft sediment deformation features. It is part of the Gull Island Formation from Doolin southwards until the Central Clare Group comprises the bulk of the cliffs from O'Brien's Tower southward. The cliffs also illustrate cyclothems I and II (Tullig Cyclothem and Kilkee Cyclothem) of the five in the Central Clare Group. These cyclothems are repeated sequences of mudstone, siltstone and sandstone, formed by normal processes in the deltaic environment that created these rocks. They are normally separated by thin marine bands with distinctive *goniatite* fossils, allowing correlation of rocks and events across a wide area. They comprise a basin fill sequence with the greater depth and development of the basin in south west and central Clare. Accessible ledges of the sandstones also contain a wealth of trace fossils, apart from the very well known Liscannor Flags, which has the burrow *Olivellites* in abundance. The vertical sea cliffs in Upper Carboniferous shales and flagstones are of iconic status as a tourist attraction - this area is of considerable amenity value.

IGH3

The cliffs at Doolin that extend towards the southwest expose the uppermost part of the Clare Shale Formation. These rocks have yielded a rare *neopteran pterygote* insect, which possessed wings that could be folded over the insect's body (Monaghan, 1995). These wings were a major evolutionary advancement allowing the insect to access confined spaces in plants and rocks for food and shelter. This is the earliest such example of this type of insect in the British Isles. The section has also yielded goniatites, important in dating their host rocks. Further investigation of the area may reveal better examples of the fossilized insect.

Site Importance

The site is of International importance and may be proposed for NHA designation under the IGH 9 Upper Carboniferous and Permian theme and the IGH 3 Carboniferous - Pliocene Palaeontology theme.

Management/promotion issues

The Cliffs of Moher are possibly the most visited geological site in Ireland, after the Giant's Causeway in Antrim. Aside from the spectacular nature of the cliffs, the average visitor has no concept of the geological or geomorphological interest of the cliffs. The proposed visitor centre at the Cliffs must include accessible explanations of the geology. Parts of the cliffs are

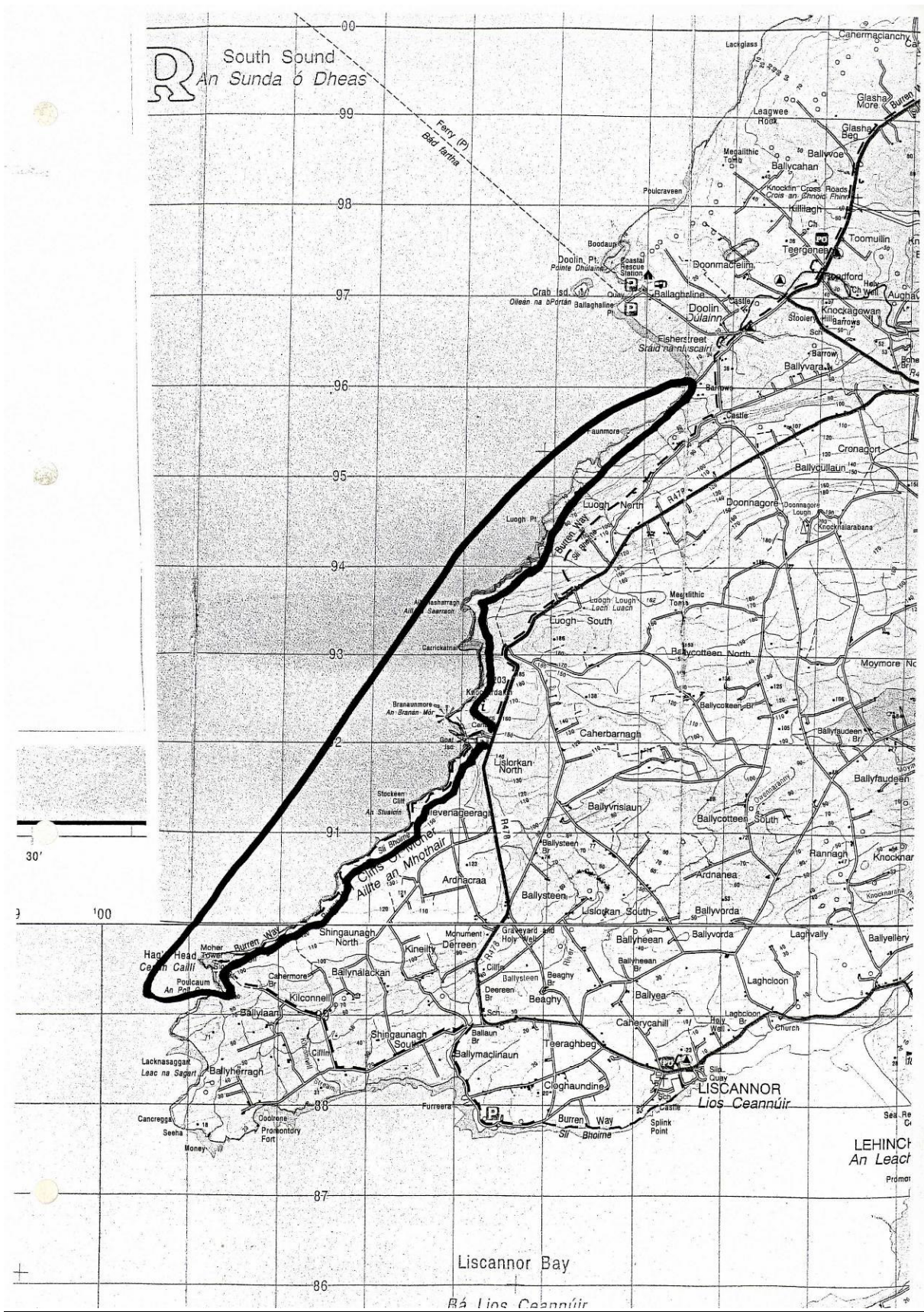
accessible as The Burren Way, but the northern part near Doolin is not. The access issues should be dealt with as constructively as possible to make public access to the whole length of the cliffs available. The Council is probably best placed to provide leadership in this matter.



Left: Hag's Head
Below: Three images
of the Cliffs of Moher



Doolin to Hags Head (Cliffs of Moher)



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Doonaha

Other names used for site

TOWNLAND(S)

Loop Head

NEAREST TOWN

Doonaha

SIX INCH MAP NUMBER

Clare 66

NATIONAL GRID REFERENCE

088000 152800 = Q 880 528

1:50,000 O.S. SHEET NUMBER

63

1/2 inch Sheet No.

17

Outline Site Description

Coastal exposures along about 3km of coast.

Geological System/Age and Primary Rock Type

Namurian sandstones, siltstones and shales of the Gull Island Formation.

Main Geological or Geomorphological Interest

The succession comprises micaceous sandstones, siltstones and shales. Of importance at this site are the trace fossils preserved in the Upper Carboniferous, Namurian rocks. These starfish traces represent the only Namurian starfish traces in Ireland. Two specimens are known and are preserved on the upper surface of a slab of micaceous siltstone, in which the impressions of the lower surface of the overlying slab are preserved. They are the only fossils found in this otherwise barren sequence of sandstones and siltstones.

The rocks are part of the Gull Island Formation, which includes the Fisherstreet Slide at its base. The presence of sand volcanoes at Doonaha indicates similar evidence of sedimentary instability. However, there are many other sedimentary and structural features of interest easily visible in the exposures.

Site Importance

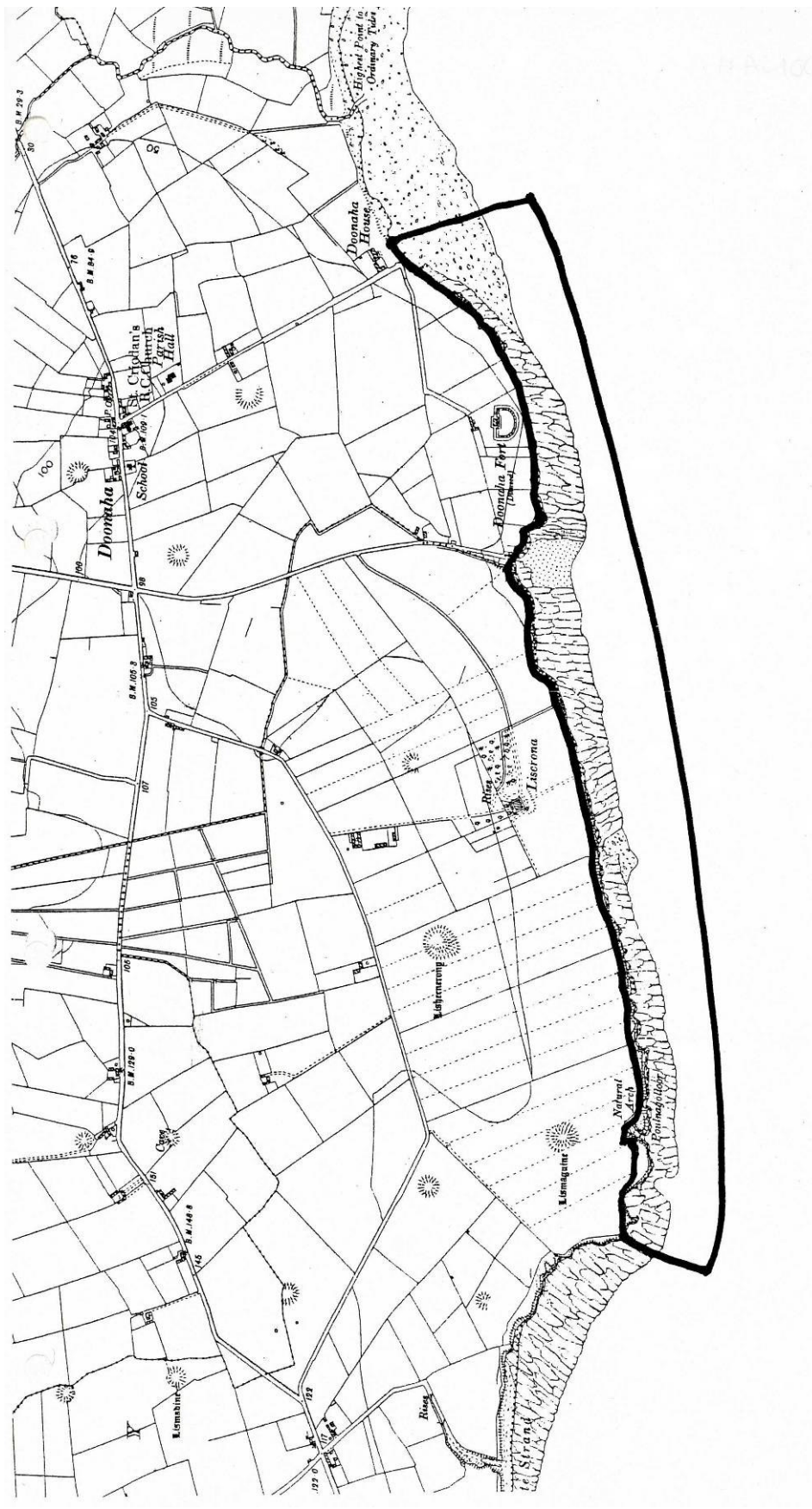
The site is of County Geological Site importance and may be proposed for NHA designation under the IGH 3 Carboniferous-Pliocene Palaeontology theme of the GSI's IGH Programme or under IGH9 Upper Carboniferous and Permian theme.

Management/promotion issues

Access to the rocks is easy with parking for the small beaches. Some explanatory material such as panel would be useful for public understanding.



Doonaha



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Elmvale

Other names used for site

TOWNLAND(S)

Elmvale

NEAREST TOWN

Corofin

SIX INCH MAP NUMBER

17

NATIONAL GRID REFERENCE

Elmvale 1: 125850 191700 = R2585 9170

Elmvale 2: 125860 191600 = R2586 9160

1:50,000 O.S. SHEET NUMBER

51 **1/2 inch Sheet No.** 14

Outline Site Description

Mushroom rocks – isolated wave worn stones in grazing fields

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The stones in question are an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones this has created a marked mushroom shape with a cap on a pedestal, although others may only have lips on surfaces. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes probably had a wider extent in the River Fergus floodplain, but in others the lake has entirely disappeared. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made.

Site Importance

The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. It has two of only about 63 mushroom stones known in the country.

Management/promotion issues

The subtlety of the wave worn features means that the stones are vulnerable to field clearance, agricultural 'improvement' or road widening as well as the use of the field as a building site for a new domestic dwelling, although the situation in the Fergus floodplain makes the latter unlikely.



[illegible]

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Fergus River Cave

Other names used for site

TOWNLAND(S)

Roughan

NEAREST TOWN

Corofin

SIX INCH MAP NUMBER

Clare 16

NATIONAL GRID REFERENCE

125200 192300 = R25200 92300

1:50,000 O.S. SHEET NUMBER

51

1/2 inch Sheet No. 14

Outline Site Description

Very old cave (>350,000years old) with excellent depositional and decay features. One of the oldest dated in Ireland.

Geological System/Age and Primary Rock Type

Ancient cave within Carboniferous limestone.

Main Geological or Geomorphological Interest

The Fergus River Cave is one of the oldest known in Ireland, with calcite deposits dated at greater than 350,000 years old. It contains more than 3km of largely abandoned streamway which floods in very wet conditions. The water is derived in part from the sink in the Carran enclosed depression. The cave is an abandoned rising for the Fergus River, although it can flood in very wet conditions. It is notable also for mud stalagmites and for glacially derived sediments. The latter were probably from Connemara, since the lithologies include a migmatitic granite and a variety of metamorphic clasts. A similar derivation by glaciers from Connemara has been suggested for quartz sediments in a small cave at Poulsallagh, 20km away.

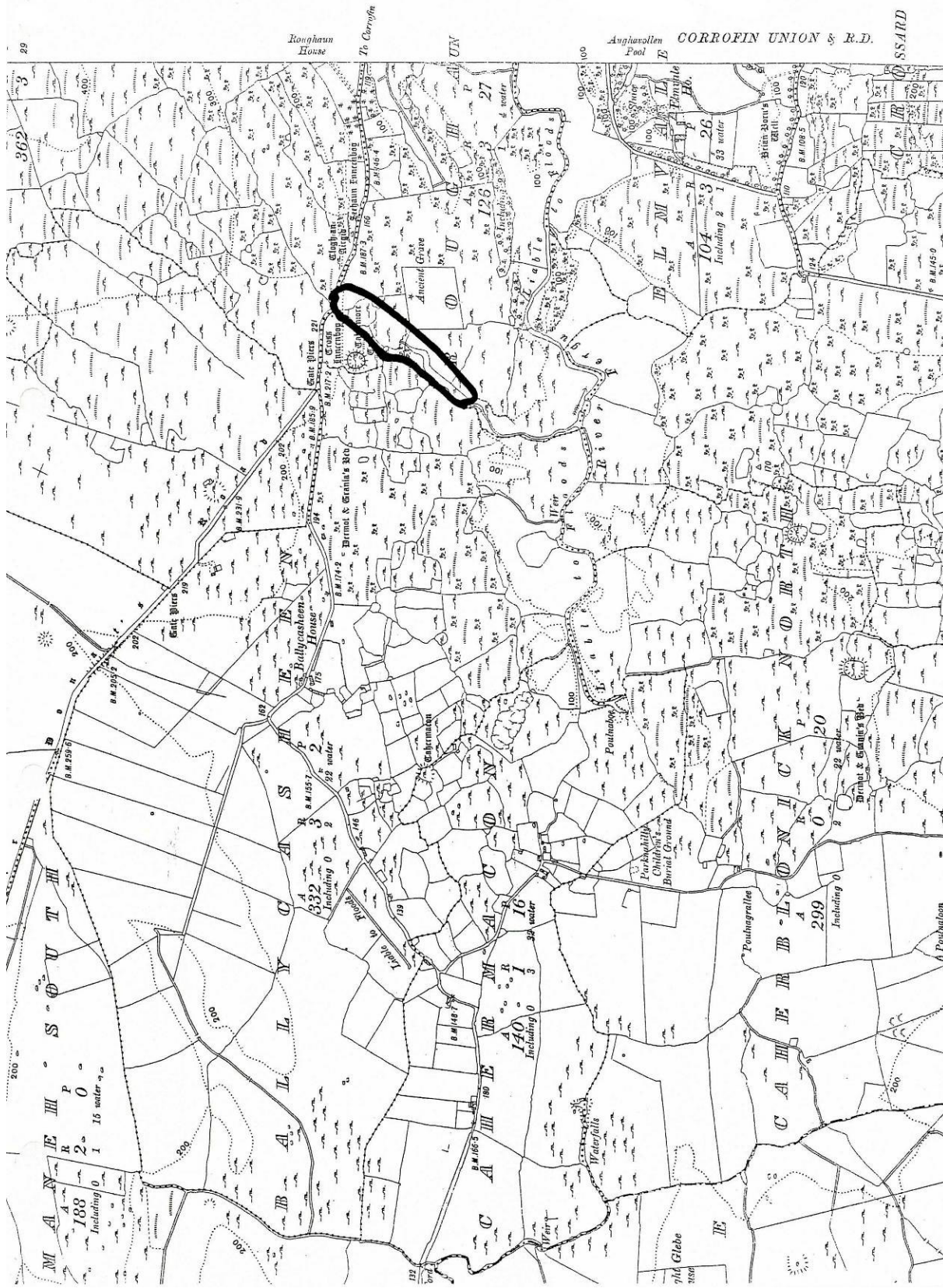
Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

The cave is unsuitable for any general promotion, and is dangerous even for experienced cavers in flood conditions, or after heavy rainfall. It is on private land and also difficult to locate.



To Corrofin

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Foohagh Point

Other names used for site

TOWNLAND(S)

Foohagh

NEAREST TOWN

Kilkee

SIX INCH MAP NUMBER

55

NATIONAL GRID REFERENCE

085300 159000 = Q853 590

1:50,000 O.S. SHEET NUMBER

63

1/2 inch Sheet No.

Outline Site Description

Cliff section.

Geological System/Age and Primary Rock Type

Growth fault within the Upper Carboniferous (Namurian) sandstone, siltstone and mudstone of the Central Clare Group.

Main Geological or Geomorphological Interest

A spectacular growth fault can be seen in the cliff face at Foohagh Point. A growth fault is a fault that moves at the same time as sediment is being deposited causing the sediment to thicken towards the fault. The growth fault at Foohagh Point displaces sandstones, siltstones and mudstones within the fourth [cyclothem](#) sequence of the Upper Carboniferous (Namurian) Central Clare Group. The pale coloured sandstones of this formation display clear thickening towards the fault.

Site Importance

This site is of National Importance and may be proposed as an NHA under the IGH 9 Upper Carboniferous and Permian theme of the GSI's IGH programme.

Management/promotion issues

None.



This is a detailed topographic map of the Kilkee area in County Clare, Ireland. The map shows the coastline, including Carrowmore Bay, Carrowbough Bay, and Fanny Bay. Key locations marked include Kilkee, Lisroe, Lisburne, and various smaller settlements and farms. The map also shows the railway line, roads, and numerous small features like wells, graves, and ruins. A prominent black line highlights a specific route or boundary through the area.

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Glencurran Cave

Other names used for site

TOWNLAND(S)

Poulaphuca

NEAREST TOWN

Kilfenora

SIX INCH MAP NUMBER

10

NATIONAL GRID REFERENCE

127380 196330 = R2738 9633

1:50,000 O.S. SHEET NUMBER

51 1/2 inch Sheet No. 14

Outline Site Description

An ancient cave system in the side of a wooded dry valley

Geological System/Age and Primary Rock Type

Glencurran Cave is a truncated and largely sediment filled cave, making it potentially an older system than the postglacial origins of many Burren stream caves. No published dating has been done to confirm the age, but some results are awaited from recent work.

Main Geological or Geomorphological Interest

Glencurran Cave is a significant cave with a diversity of interest. It is a challenging cave for recreational speleology, since most of it has been dug to gain access to 700m of passage. It is largely earth filled wide phreatic passage, with short sections of active stream cave. It has considerable geological and spelological potential as the most likely intersection to an undiscovered master cave between Castletown River Sinks in the Carran Enclosed Depression and the risings at Fergus River Cave. The cave entrance is on the side of the Glencurran dry valley which has truncated the cave. Of particular importance is the recently explored archaeological significance (not yet published) with multi period usage of the large entrance passage. It is also reported to be a bat roost.

Site Importance

The site is of County Geological Site status under the IGH 1 Karst theme of the GSI's IGH Programme. It also has considerable archaeological importance, with recent excavations showing episodes of activity in the cave from Neolithic to late Medieval times (Marion Dowd – pers. comm., January 2005). It is listed as RMP CL010-054.

Management/promotion issues

The cave is well hidden and difficult to find without specialist caving guidebooks or personal knowledge. It is unlikely to be suitable for general public promotion as beyond the walking sized entrance passage it is very restricted and unappealing to a casual visitor.



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Gortlecka

Other names used for site

TOWNLAND(S)

Gortlecka

NEAREST TOWN

Corofin

SIX INCH MAP NUMBER

10

NATIONAL GRID REFERENCE

Gortlecka 1,2: 132020 194990 = R3202 9499

1:50,000 O.S. SHEET NUMBER

51 1/2 inch Sheet No. 14

Outline Site Description

Mushroom rocks – isolated wave worn stones in limestone pavement area, adjacent to turlough

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The two stones in question are an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones such as at Gortlecka, this has created a marked smooth surface below a lip, whilst in more extreme cases a mushroom shape develops with a cap on a pedestal. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes probably had a wider extent, but in others the lake has entirely disappeared. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made, but this seems unlikely for Gortlecka.

Site Importance

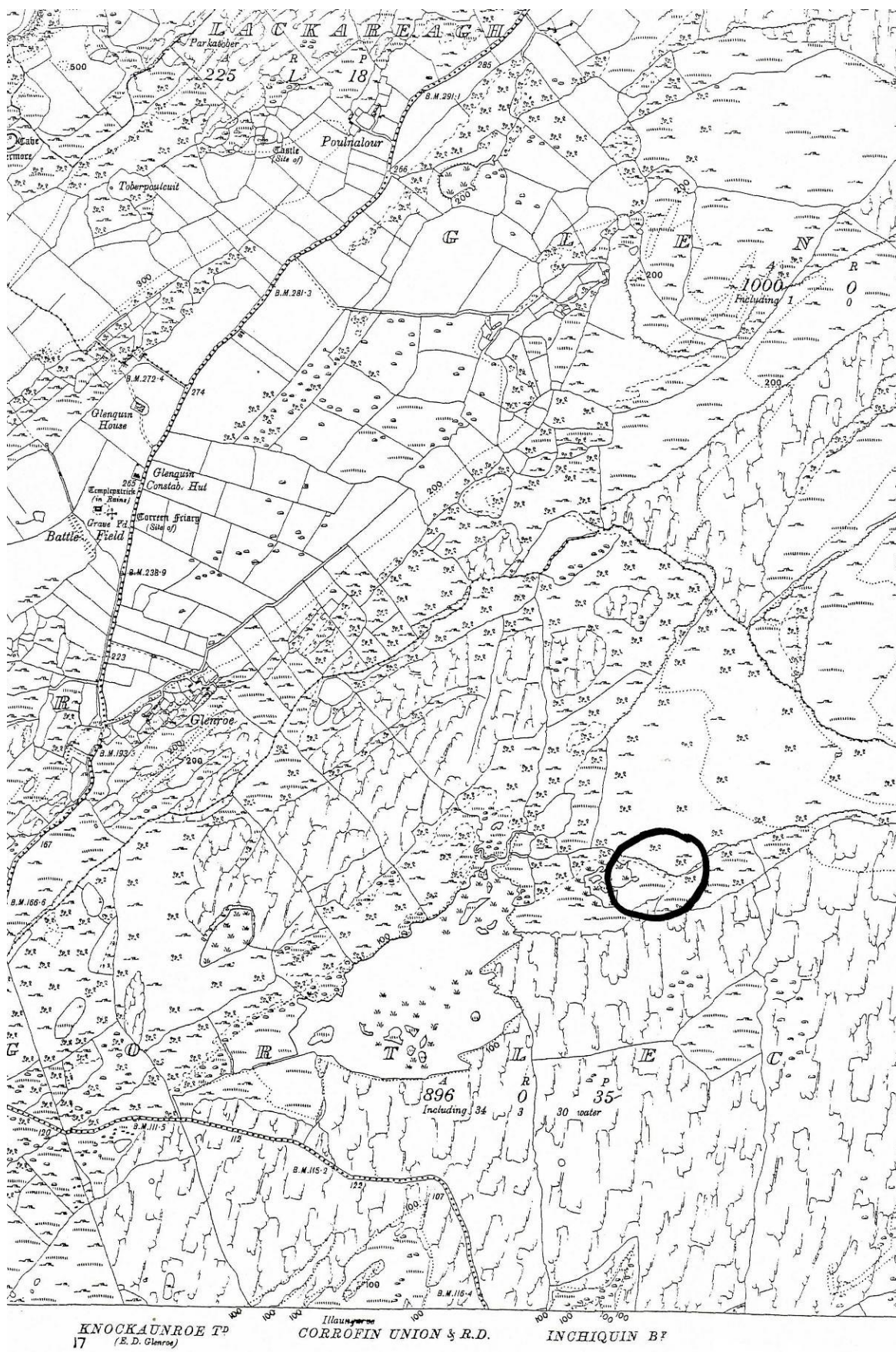
The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme, but are within the Burren National Park and the Mullaghmore site (IGH1-4) of national importance for demonstrating karst landscapes. The Gortlecka stones comprise a few of only about 63 mushroom stones known in the country as a whole.

Management/promotion issues

As the stones are inside the Burren National Park, they are the least vulnerable to damage or loss. They are potentially worthy of specific attention on interpretative panels, guidebooks etc.



Gortlecka 1 stone
(Photo: Louise Dunne)

Gortlecka

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Gull Island, Tullig Point and Trusklieve section

Other names used for site

TOWNLAND(S)

Quilty, Oughterard, Tullig, Trusklieve

NEAREST TOWN

Carrigaholt

SIX INCH MAP NUMBER

65

NATIONAL GRID REFERENCE

077000 151500 = Q 77 51 to

080000 155000 = Q 800 550

1:50,000 O.S. SHEET NUMBER

63

1/2 inch Sheet No. 14

Outline Site Description

Coastal cliffs section.

Geological System/Age and Primary Rock Type

Upper Carboniferous Namurian sandstones and siltstones

Main Geological or Geomorphological Interest

The coastal section around Gull Island and Tullig Point displays some of the best sections in Clare of the Shannon Group and Central Clare Group sedimentary rocks which infilled the Clare Basin in the Namurian, and which now are the foundation of most of south west and central County Clare. It is the type section for the Gull Island Formation of the Shannon Group. The top of this Group is marked by the R1 marine band with goniatite fossil markers. The Tullig Sandstone representing the Tullig Cyclothem is followed northwards by sandstones and siltstones of the Central Clare Group representing the Kilkee Cyclothem. These rocks are broadly lateral equivalents of what is seen in the lower part of the Cliffs of Moher. There are an extensive range of sedimentary structures, and also tectonic structures, many of which were formed at the time of deposition, and record the sediment instability on the basin slopes. There are slides, growth faults and slumps present. Key sections are at Gullisland to Tullig Point and at Illaunglass and Pouladav.

Site Importance

The site is at least of National importance and may be proposed for NHA designation under the IGH 9 Upper Carboniferous and Permian theme of the GSI's IGH Programme.

Management/promotion issues

These sections are frequently visited by oil industry and academic field parties. Maintaining access is important. There are no known access problems at present, but concerns have been expressed to GSI over the removal by quarrying of some key sections around Tullig Point.



A view westwards to the cliffs at Trusklieve, indicating the sort of exposures available to view or examine in the site

[illegible]

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Kilbreckan
Other names used for site	Kilbreckin
TOWNLAND(S)	Kilbreckan
NEAREST TOWN	Ennis
SIX INCH MAP NUMBER	
NATIONAL GRID REFERENCE	139900 176300 = R399 763
1:50,000 O.S. SHEET NUMBER	58 1/2 inch Sheet No. 17

Outline Site Description

Abandoned Mine site and spoil

Geological System/Age and Primary Rock Type

Lead and silver-bearing mineral deposits in cherty Carboniferous limestone and dolomite.

Main Geological or Geomorphological Interest

Kilbreckan Mine is situated between Ennis and Quin. It was worked intermittently for silver and lead from 1834 until 1856. The mineralized bodies contain silver-bearing galena, pyrite, chalcopryite, sphalerite and calamine in a calcite gangue. Other minerals include Bindheimite (a silver-bearing antimonite of lead), Bournonite (a sulphide mineral of copper, antimony and lead), Hemimorphite (a minor ore mineral of zinc), Quartz, Smithsonite (another zinc ore). In addition Kilbreckan is the type locality for the mineral 'Kilbrickenite' – now confirmed as the mineral Geocronite (a white sulphosalt mineral of lead). The main orebody, trending north-south, has a pipe-like shape and is up to 1m in width. A second, northwest trending mineralized body of similar thickness occurs also.

Site Importance

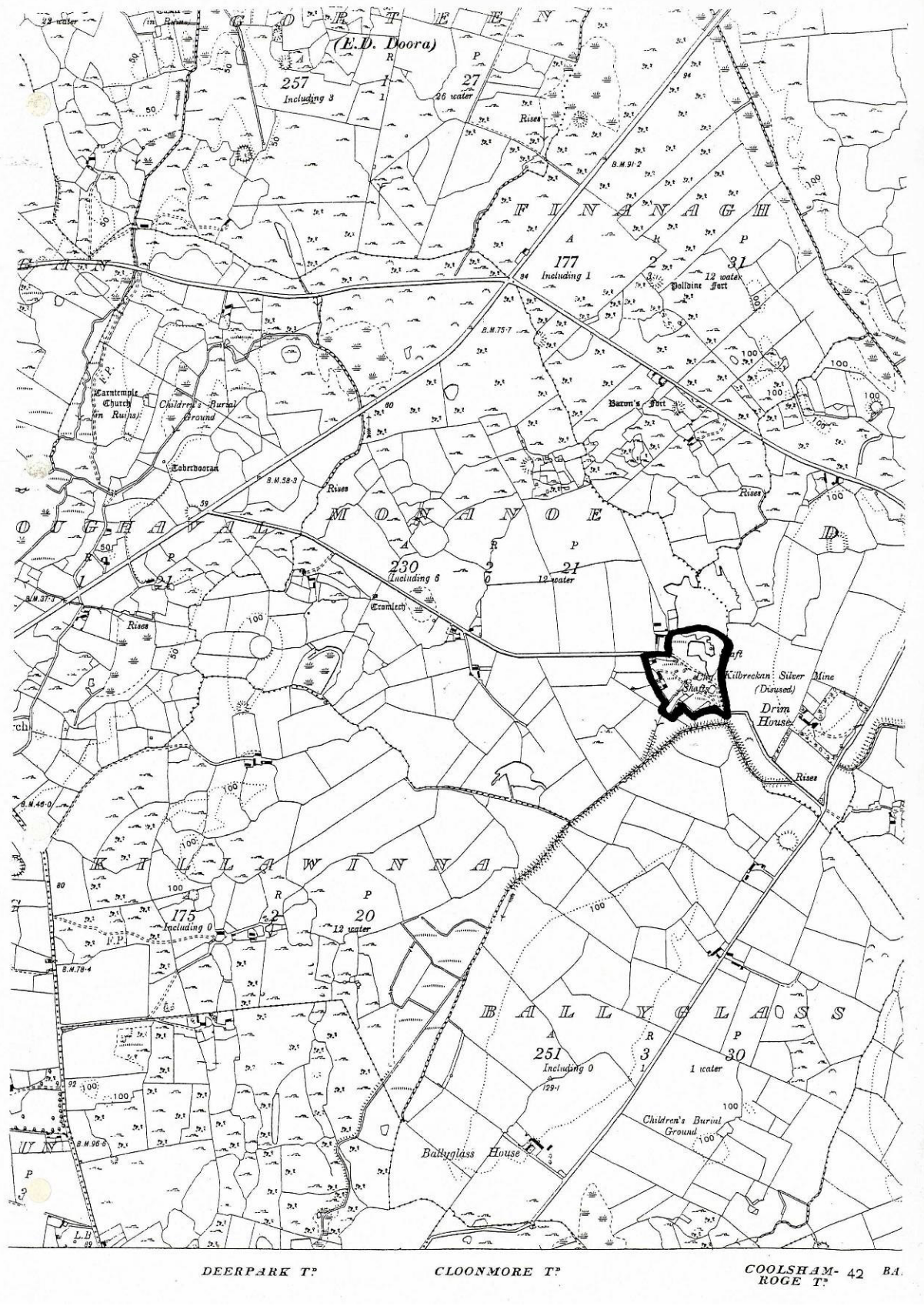
The site is of possible international importance under the IGH 6 Mineralogy theme of the GSI's IGH Programme and may be proposed for NHA designation. It also has some importance in the IGH15 Economic Geology theme.

Management/promotion issues

Much of the site is heavily vegetated, and individual shafts and other features are fenced off for safety reasons by the Exploration and Mining Division of the Department of Communications, Marine and Natural Resources. All shafts appear to be flooded and at the same level as the adjacent lake. There are areas with spoil (mostly white calcite) especially on trackways (presumably where ground disturbance takes place), and other areas where vegetation will not gain a foothold due to metal toxicity. The site has considerable mining heritage interest to specialists, as well as the mineralogical importance. There are some problems with dumping on site: fridge, washing machine, garden waste etc. Due to the above issues and unknown ownership and access concerns, it is not suggested that promotion of this site to the general public is viable without resolution of some of the problems. General information on the history and importance of the site should be made available for guides.



Kilbreckan



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Killinaboy
Other names used for site	
TOWNLAND(S)	Killinaboy
NEAREST TOWN	Corofin
SIX INCH MAP NUMBER	17
NATIONAL GRID REFERENCE	127200 191330 = R2720 9133
1:50,000 O.S. SHEET NUMBER	51 1/2 inch Sheet No. 14

Outline Site Description

Mushroom rocks – isolated wave worn stones in grazing fields

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The stone in question is an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones such as at Killinaboy, this has created a marked smooth surface below a lip, whilst in more extreme cases a mushroom shape develops with a cap on a pedestal. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes probably had a wider extent such as in the River Fergus floodplain, but in others the lake has entirely disappeared. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made, but this seems unlikely for Killinaboy.

Site Importance

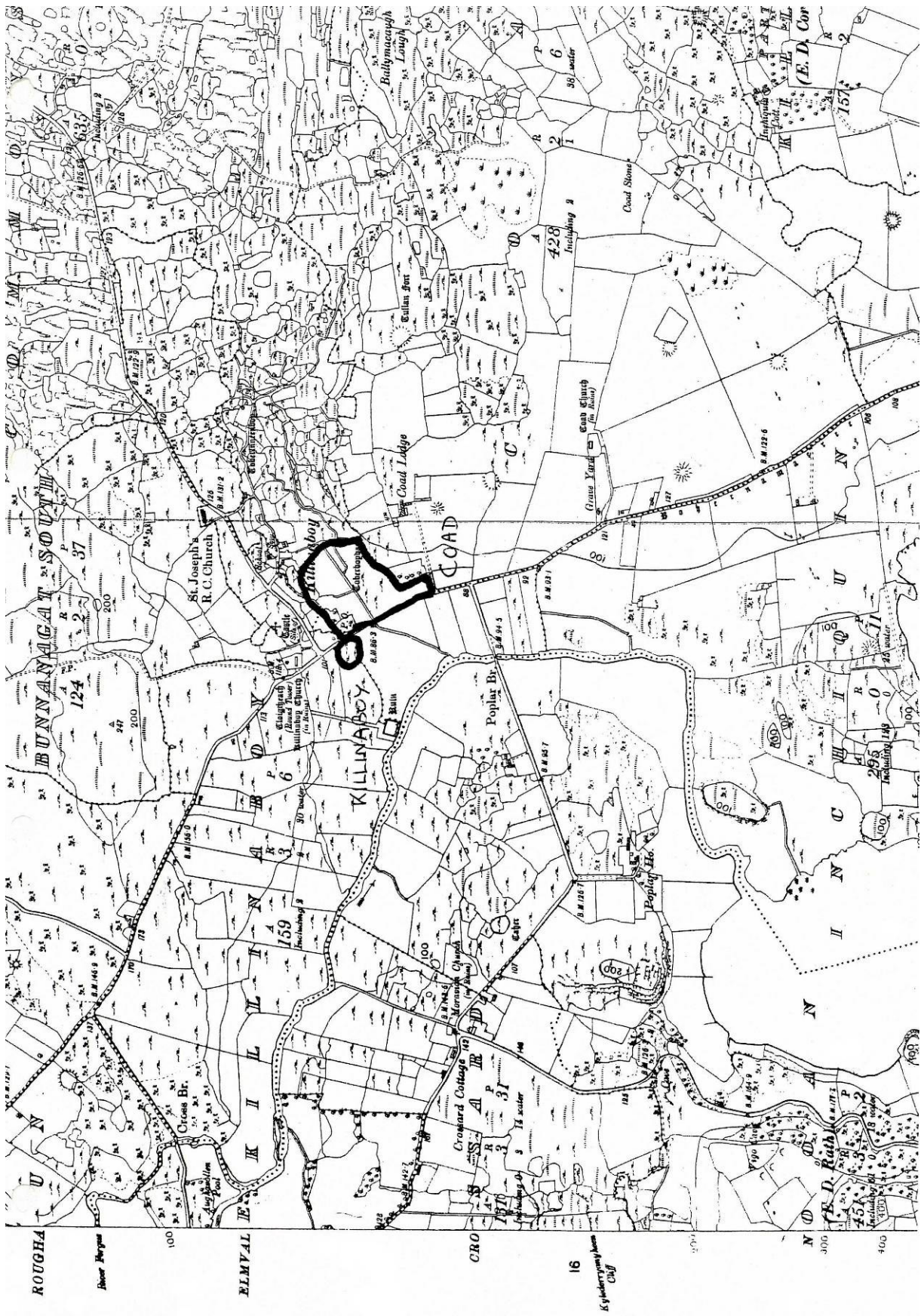
The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. It is one of only about 63 mushroom stones known in the country as a whole. This stone is named differently as it is in a different Townland to those in Coad on the other side of the adjacent road. The site should include all the obvious stones.

Management/promotion issues

The subtlety of the wave worn features means that the stone is vulnerable to field clearance, agricultural 'improvement' or road widening as well as the use of the field as a building site for a new domestic dwelling, although the situation in the Fergus floodplain makes the latter unlikely. It would seem that the field was largely bulldozed in the recent past, from aerial photo images and the large boulder pile in the western end of the field. It appears that this one stone fortuitously escaped, but there may originally have been many more present.



Killinaboy



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Other names used for site

TOWNLAND(S)**NEAREST TOWN****SIX INCH MAP NUMBER****NATIONAL GRID REFERENCE****1:50,000 O.S. SHEET NUMBER****Loop Head**

Kilbaha North, Kilbaha South

Kilbaha

71, 72

069300 147300 = Q693 473

63

1/2 inch Sheet No. 17

Outline Site Description

Coastal cliffs section.

Geological System/Age and Primary Rock Type

Upper Carboniferous (Namurian) sandstones and shales of the Ross Sandstone Formation.

Main Geological or Geomorphological Interest

The rocks between Loop Head and Ross village represent the type section of the Upper Carboniferous Ross Sandstone Formation. This formation consists of alternating, parallel-bedded sandstones and dark shales. Sedimentary structures such as scouring and channeling can be seen as well as flute, groove and rill casts. Some sand-filled channels are up to 10m deep and 100m wide. These rocks were probably deposited in a deep-marine trough or sub-marine fan where occasional turbidites deposited sandstones. At Loop Head and along the coast many fold structures can be seen in the cliffs. These rocks were folded towards the end of the Carboniferous by a period of mountain building called the Variscan Orogeny. There are numerous features of coastal erosion, such as arches, stacks, storm beaches, blowholes and cliff patterns totally influenced by the geological structures.

Site Importance

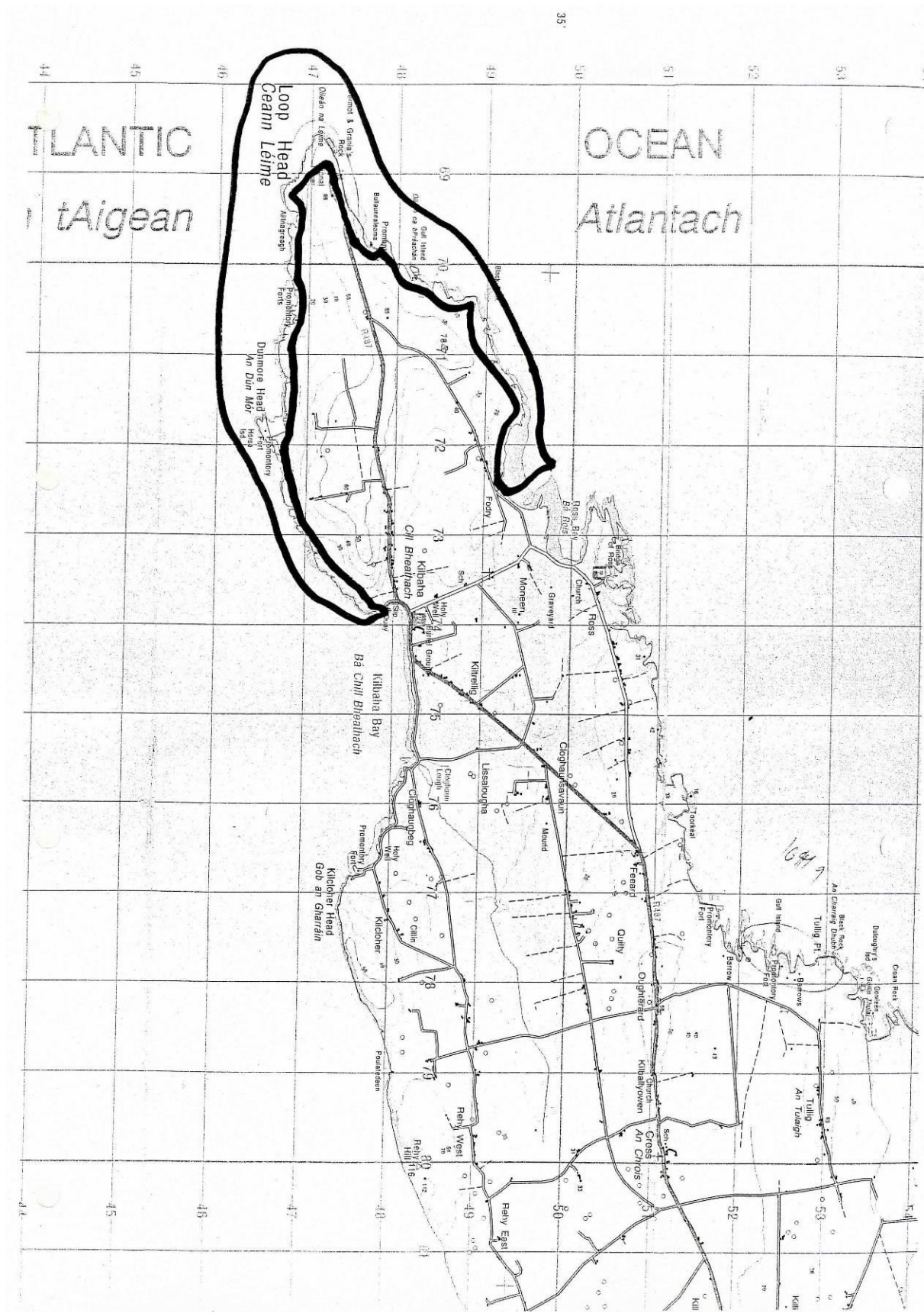
This site is of National importance and may be proposed as an NHA under the IGH 9 Upper Carboniferous and Permian theme of the GSI's IGH programme.

Management/promotion issues

No apparent access problems. Site already attracts many tourists.



35



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Maghera quarry

Other names used for site

TOWNLAND(S)

Maghera

NEAREST TOWN

Feakle

SIX INCH MAP NUMBER

19

NATIONAL GRID REFERENCE

152000 190150 = R520 901

1:50,000 O.S. SHEET NUMBER

52, 58 1/2 inch Sheet No. 14

Outline Site Description

Small quarry on a forestry track off a private road

Geological System/Age and Primary Rock Type

Ordovician Caher Hill Formation, pyroxene tuffs – a volcanic rock

Main Geological or Geomorphological Interest

Olivine-pyroxene tuffs are exposed in a small quarry along a private road. They are within the Caradoc rocks of the Caher Hill Formation which include a suite of volcanic rocks such as spilite, pyroxene-olivine basalt, basic tuffs and volcanic breccias, amygdaloidal trachytes, graptolitic black shales and cherts.

Site Importance

The site is of National importance and may be proposed for NHA designation under the IGH 4 Cambrian – Silurian theme and the IGH 6 Mineralogy theme of the GSI's IGH Programme.

Management/promotion issues

The site is unsuitable for general promotion being on private land, and difficult to access as the road to the Maghera TV transmitter is a private road. However, if the quarry is on Coillte land, then walking access should be possible.



Maghera quarry



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**Magowna**

Other names used for site

Magowna Castle

TOWNLAND(S)**NEAREST TOWN**

Kilnamona

SIX INCH MAP NUMBER

Clare 25

NATIONAL GRID REFERENCE

129000 182500 = R 29 825

1:50,000 O.S. SHEET NUMBER

57

1/2 inch Sheet No.

17

Outline Site Description

Waterfall exposure of the limestone/shale contact.

Geological System/Age and Primary Rock Type

Carboniferous limestones and Clare Shales.

Main Geological or Geomorphological Interest

The junction between the Carboniferous Limestone and the Clare Shales can be seen in the waterfall, almost half a kilometre northwest of Magowna Castle. This is an interesting site and demonstrates well the contrast between the two different rock types. According to Hodson and Lewarne (1961), this exposure does not provide any faunal evidence with which to date the rocks but their age can be assumed from the relationships between the two rock types. Interesting microfossils have been found at this site.

Site Importance

The site is of County Geological Site importance and may be proposed for NHA designation under the IGH 3 Carboniferous-Pliocene Palaeontology theme, the IGH 8 Lower Carboniferous theme and the IGH 9 Upper Carboniferous and Permian theme of the GSI's IGH Programme.

Management/promotion issues

No observable damaging operations. However, the access and exposure is poor due to vegetation, for some distance upstream and downstream.



This is a detailed topographical map of a region in Ireland, showing various townlands and geographical features. The map includes labels for numerous townlands such as KILKEENAN, DRUMM, CAPPA, TOONAG, MAGOWNA, and CAHERBAN. It also shows roads, rivers, and other landmarks like 'R.C. Church', 'Dusert School', and 'Drumma House'. A specific area is highlighted with a thick black line, indicating a boundary or a specific land parcel. The map is oriented with North at the top.

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Mullaghmore / Slieveoe / Knockanes

Other names used for site

TOWNLAND(S)

Glenquin, Coolorta, Creehaun, Gortlecka, Knockans
Lower, Leitra, Aglish, Ballyeighter, Rockforest

NEAREST TOWN

Gort

SIX INCH MAP NUMBER

10, 17

NATIONAL GRID REFERENCE

133000 195750 = R33000 95750

1:50,000 O.S. SHEET NUMBER

52 1/2 inch Sheet No. 14

Outline Site Description

Isolated mountains with a diverse range of subaerial [karren](#) developed on flat and dipping limestone beds.

Geological System/Age and Primary Rock Type

Terrace and pavement development on flat and inclined bedded Carboniferous limestone, diverse karren features, limestone erratics, shallow marl-floored lake, abandoned cave and a structurally controlled gorge.

Main Geological or Geomorphological Interest

The isolated mountains of the Mullaghmore – Slieve Roe – Knockanes site hosts many interesting features including spectacular limestone terraces and pavements, which have developed on the flat and inclined limestone beds. A diverse range of sub-aerial karren features such as rundkarren (rounded solutional grooves), kamenitza (shallow pools in the limestone) and rillenkarren (narrow, sharp-edged solution grooves formed on steep limestone faces) are found at this locality. Densely scattered limestone [erratics](#) are another feature and are particularly abundant in the Rock Forest townland. The erratics here are the best such examples in the Burren region. Other features of note include the ancient, structurally controlled Glenquin gorge, the marl-floored Lough Gealáin and the abandoned [phreatic](#) cave at Gortlecka. Movements deep within the earth's crust were responsible for the formation of the Glenquin Gorge, which appears to be quite a shallow feature to the north but becomes cliff-sided to the south. Lough Gealain, a pseudo-[turlough](#), is a shallow lake with interesting [marl](#) deposits and some wave stones on the northern shore. Large [scallops](#) are preserved in the abandoned cave at Gortnaleck. The Mullaghmore – Slieve Roe – Knockanes site is a very important karst site, but extremely little scientific work has been done here. It has great potential for academic study.

Site Importance

The site is of International importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme. It is entirely within SAC 1926 East Burren Complex, and is mostly part of the Burren National Park.

Management/promotion issues

Due to the variety and scattering of features, it is proposed that the boundary to the site is taken by the minor tarred roads that are the circumference to the three mountains, plus an extension to the south-east to include the rest of the limestone erratic field in Creehaun Townland.



Knockanes - Slieve Roe - Gort lowlands (G. Ll. Jones).

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Pol an Ionain

Other names used for site

TOWNLAND(S)

Craggycorrodan

NEAREST TOWN

Lisdoonvarna

SIX INCH MAP NUMBER

8

NATIONAL GRID REFERENCE

109800 199700 = R09800 99700

1:50,000 O.S. SHEET NUMBER

51 1/2 inch Sheet No. 14

Outline Site Description

Ancient chambered cave with important sediments and a large stalactite.

Geological System/Age and Primary Rock Type

Situated within Carboniferous limestone.

Main Geological or Geomorphological Interest

The cave is an ancient chambered cave, containing varved sediments (alternating layers of light and dark sediment) and a renowned stalactite (known as 'the Great Stalactite'), 6.541m long, which was reputed to be the largest free hanging stalactite in the world. The sediments are potentially of great importance as a record of environmental and climatic changes over the time the cave has existed. As the cave contains the largest single chamber of the Burren caves, this accumulation of sediment is of great potential in analysis of landscape evolution, and Pol an Ionain, as an isolated chamber, has a good sequence of undisturbed deposits. These deposits have not yet been dated but are suspected to be relatively ancient since the chamber is large and unrelated to present day hydrogeological conditions.

Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

Proposed commercialisation as a showcave. Current status is awaiting decision of An Bord Pleanála to appeals against granting of development permission.



Left: the excavation to part completed shaft to access showcave development
Right: a view from road across site.

[illegible]

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**Poulsallagh**

Other names used for site

Cancapple, Poulsallach

TOWNLAND(S)

Ballyryan

NEAREST TOWN

Lisdoonvarna

SIX INCH MAP NUMBER

4

NATIONAL GRID REFERENCE

108550 201800 = M08550 01800

1:50,000 O.S. SHEET NUMBER51 **1/2 inch Sheet No. 14****Outline Site Description**

Well-developed range of **karren** forms in the inter-tidal zone of the limestone coast.

Geological System/Age and Primary Rock Type

The karren features have developed within the Asbian (Lower Carboniferous) Aillwee Member limestones.

Main Geological or Geomorphological Interest

At Poulsallagh Bay and the coastal section immediately to the north of it, a compact area of foreshore exhibits a sequence of biochemically induced karren landforms (mainly hollows 1-50cm deep and 5-300cm wide) that is the equal of any site in the world. Karren formation at this locality is a result of respired carbon dioxide dissolving the limestone as well as the boring and burrowing activities of marine life and algae. Direct dissolution of the limestone by seawater is of negligible significance. The karren forms become increasingly well developed towards low water mark, reflecting the increase in life. Eroded glacial deposits have protected some of the limestone from solutional erosion. On the south side of Poulsallagh Bay, where part of this protective layer has been eroded away, smooth, karren-free limestones are exposed and still preserve **glacial striae**. The northern part of the site includes remnants of cave passages, some with quartz rich sediments derived from across Galway Bay. These exotic clasts are evidence of an earlier glacial **till** removed from the Burren area by later ice movement. A karst spring, presumed to drain much of southern Slieve Elva, is located in the inter-tidal zone south of Poulsallagh. It is an overflow outlet for the mainsprings located offshore (at a depth of -12m). The area provides an ideal teaching environment and fuses biological, geological and geomorphological processes.

Site Importance

The site is of International importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

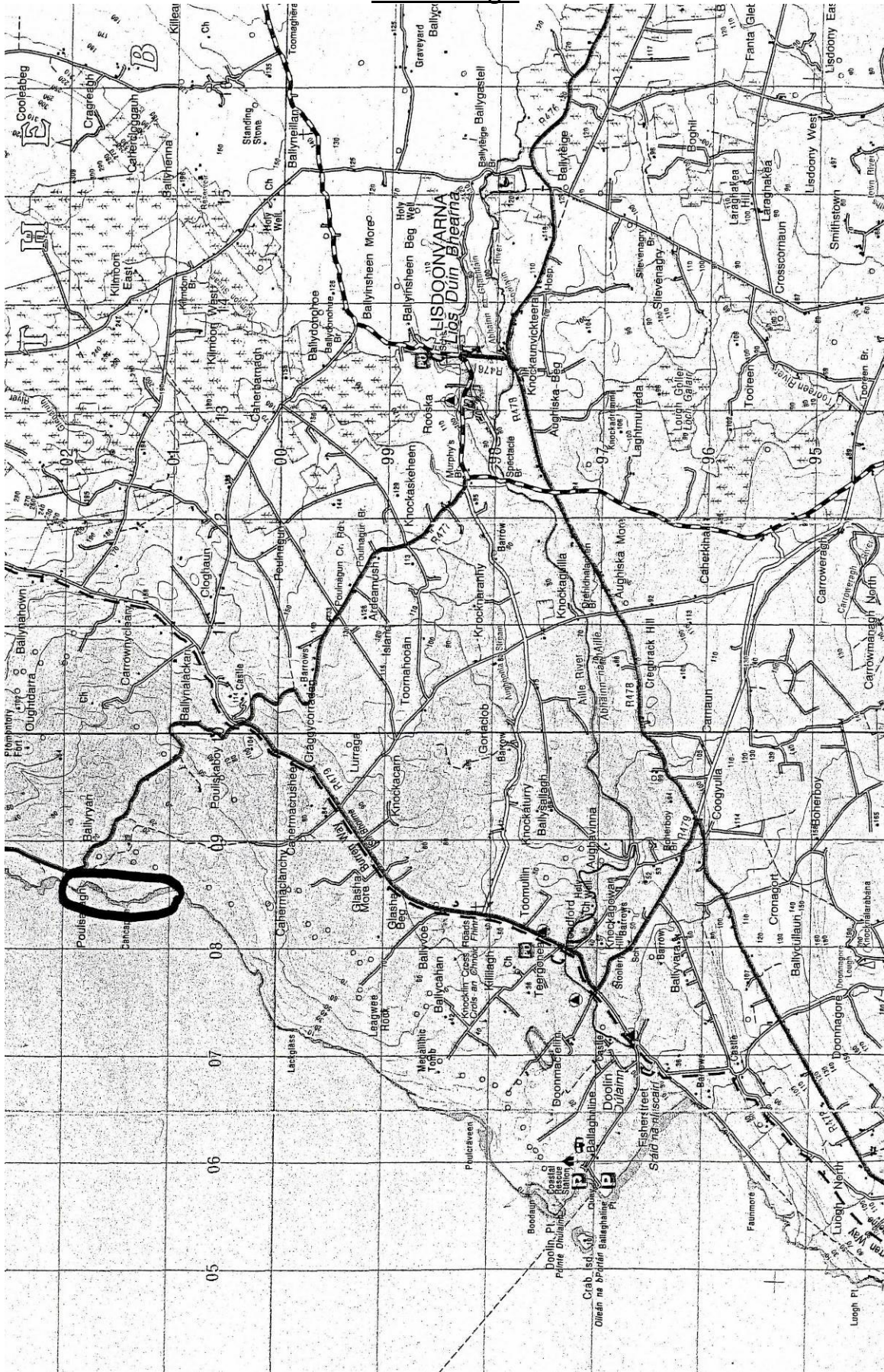
The area extends to 6ha and includes the inter-tidal zone but also extends up to 130m inland to include moraine and some areas of subaerial karren. The boundary is not drawn precisely, reflecting a lack of distinctive features such as walls, and because the entire site is already within an SAC, and therefore boundary definition is not so critical.



Left: Poulsallagh Bay at low tide showing the karren zones. Right: Echinoid pits and pools near low tide level. Photos: D. Drew.



Poulsallagh



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Rineanna Point, Shannon Estuary

Other names used for site

TOWNLAND(S)

Rineanna North

NEAREST TOWN

Shannon

SIX INCH MAP NUMBER

Clare 60, 61

NATIONAL GRID REFERENCE

135200 159700 = R352 597

1:50,000 O.S. SHEET NUMBER

64 1/2 inch Sheet No. 17

Outline Site Description

Low exposures along shoreline and coast.

Geological System/Age and Primary Rock Type

The base of Carboniferous Waulsortian limestone strata.

Main Geological or Geomorphological Interest

The base of Carboniferous Waulsortian limestone is exposed along strike on a shore section on the southern shore of Rineanna Point, comparable to the Deel River section on the opposite side of the Shannon in Limerick. Only a thin sequence is exposed as it is very low lying ground. The limestone is heavily karstified, with karren and kamenitza (solution pits).

Site Importance

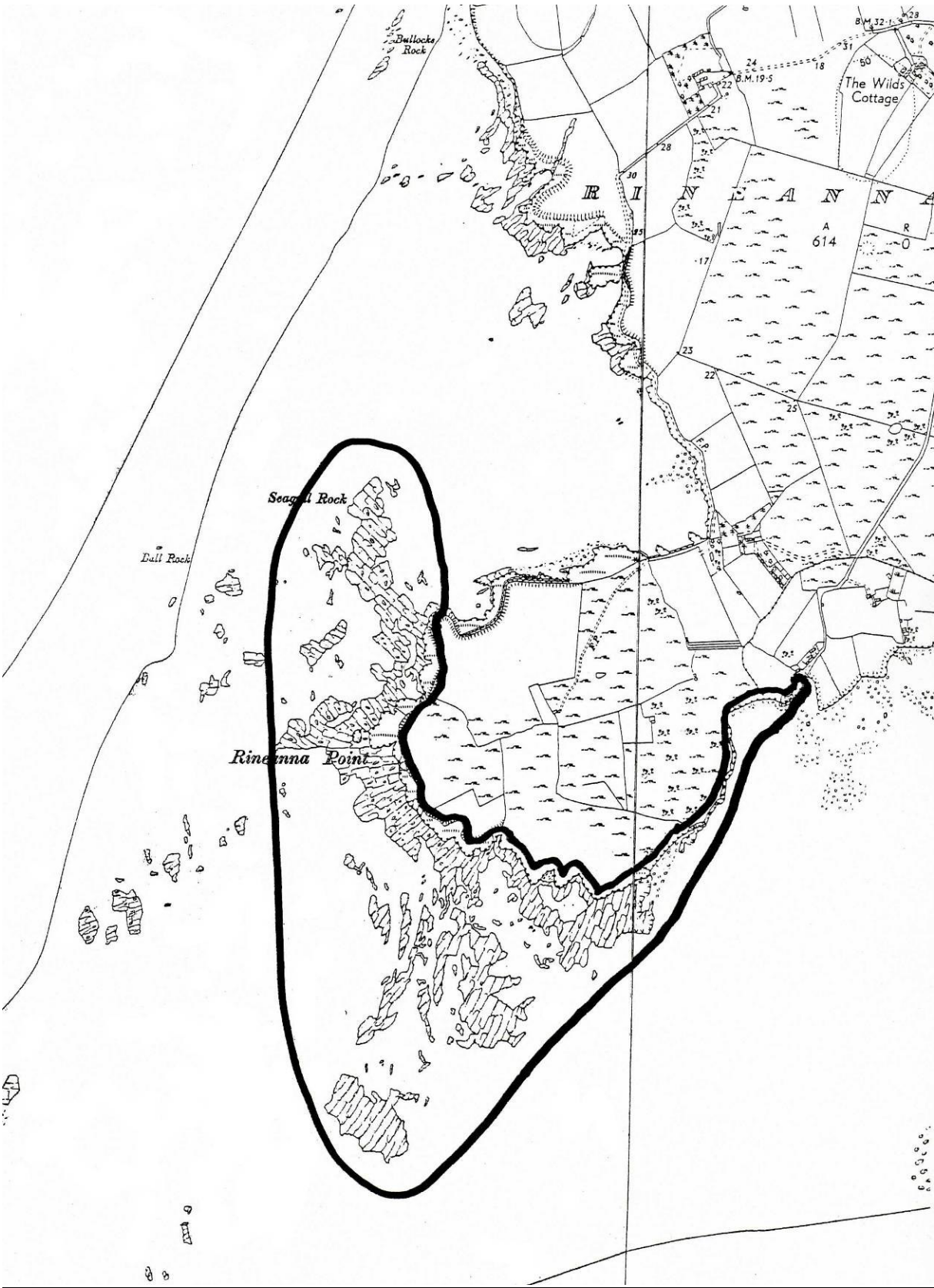
This site is of County Geological Site importance, but may be proposed for NHA designation under the IGH 8 Lower Carboniferous theme of the GSI's IGH Programme, after comparison with other similar basal Waulsortian sections.

Management/promotion issues

The natural coastal exposures are accessible by easy walking westward around the shoreline from the end of the road (at NGR R355 600) although it necessitates crossing a farmyard. Other parts of the coastal path are probably on private land rather than foreshore. As the site is directly under the Shannon Airport flight path, there is unlikely to be any development proposal directly affecting this site. Promotion for non-specialists is not necessarily recommended other than as a brief description or explanation in the context of locally developed walking or area guides.



Rineanna Point, Shannon Estuary



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE	Rinnamona
Other names used for site	
TOWNLAND(S)	Rinnamona
NEAREST TOWN	Corofin
SIX INCH MAP NUMBER	10, 17
NATIONAL GRID REFERENCE	Rinnamona 1: 129690 194040 = R2969 9404 Rinnamona 2: 129810 194190 = R2981 9419 Rinnamona 3: Rinnamona 4: 129580 193950 = R2958 9395
1:50,000 O.S. SHEET NUMBER	51 1/2 inch Sheet No. 14

Outline Site Description

Mushroom rocks – isolated wave worn stones in grazing fields

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The four stones in question are an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones such as at Rinnamona, this has created a marked smooth surface below a lip, whilst in more extreme cases a mushroom shape develops with a cap on a pedestal. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes probably had a wider extent, but in others the lake has entirely disappeared. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made, but this seems unlikely for Rinnamona.

Site Importance

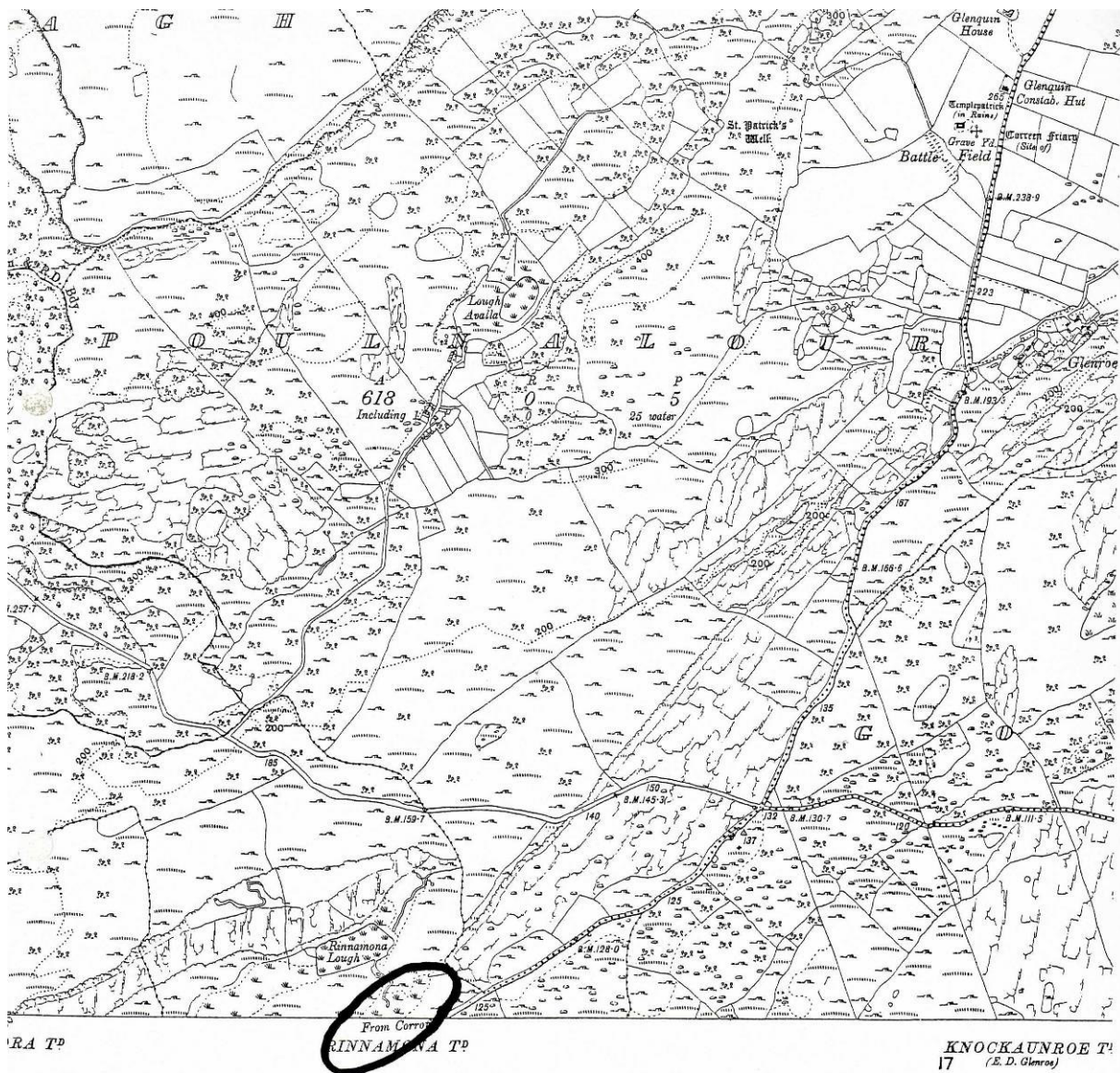
The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. The stones at Rinnamona comprise a few of only about 63 mushroom stones known in the country as a whole.

Management/promotion issues

The subtlety of the wave worn features means that the stones are vulnerable to field clearance, agricultural 'improvement' or road widening as well as the use of the field as a building site for a new house although the low lying wet ground makes this unlikely.



Rinnamona



Compiled and Printed by the Ordnance
Director at the Ordnance Survey C

Altitudes are referred to Ordnance Survey Datum, which is a Low Water of Spring Tides observed in C
Altitudes indicated thus (B.M. 54.7) refer to Bench Marks on Buildings,

© Government of Ireland

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**Roadford**

Other names used for site

Doolin Phosphate mine

TOWNLAND(S)

Toomullin, Doolin

NEAREST TOWN

Lisdoonvarna

SIX INCH MAP NUMBER

8

NATIONAL GRID REFERENCE

108200 197000 = Q 082 970

1:50,000 O.S. SHEET NUMBER

51

1/2 inch Sheet No.**Outline Site Description**

Abandoned mine site with some natural streambank exposures

Geological System/Age and Primary Rock Type

Phosphate mines in the basal Namurian strata, overlying the Carboniferous limestone.

Main Geological or Geomorphological Interest

In the river about 500m above Roadford, an outcrop of rock phosphate occurs at the base of the Namurian Clare Shales overlying the Carboniferous limestone. Phosphate mining has taken place here from 1924 to 1947, although there is little now remaining to indicate the works apart from overgrown spoil heaps and some building remains. The phosphate deposits were localised concentrations, that became viable to mine here and opencast at Noughaval, further east, where nothing now remains. Some phosphatic nodules may be found in the shale exposures in the area. Although mining heritage remains are sparse, the unusual nature of this deposit makes it of some importance. In addition the location of Doolin Cave underneath the Aille River has been used in karst text books as an example of the heterogeneity of limestone drainage. However, since the removal of phosphate deposits from the Aille river bed, sinking of the stream into the underlying Doolin Cave has begun, suggesting that the impermeable phosphate layer was actually the controlling factor.

Site Importance

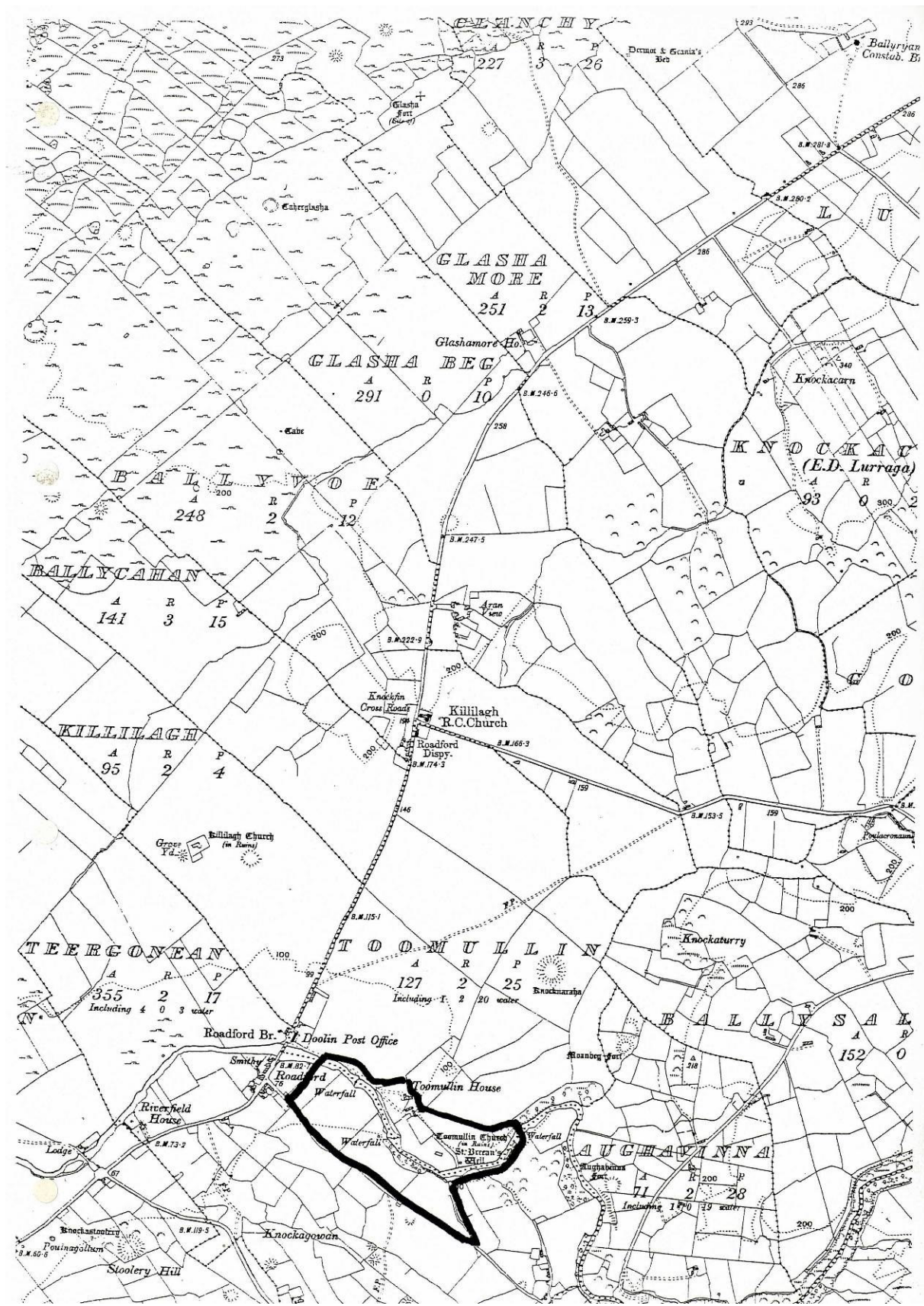
The site is of National importance and may be proposed for NHA designation under the IGH 6 Mineralogy theme, the IGH 9 Upper Carboniferous and Permian theme and the IGH 15 Economic Geology theme of the GSI's IGH Programme.

Management/promotion issues

Local access is usually willingly given, but underground access is impossible due to adit collapse etc.



Roadford



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Sheshymore

Other names used for site

TOWNLAND(S)

Sheshymore

NEAREST TOWN

Kilfenora

SIX INCH MAP NUMBER

9

NATIONAL GRID REFERENCE

124150 195900 = R24150 95900

1:50,000 O.S. SHEET NUMBER

51 **1/2 inch Sheet No.** 14

Outline Site Description

Extensive area of undisturbed limestone pavement containing large **clint** blocks, deep **grikes** and a variety of **karren** forms.

Geological System/Age and Primary Rock Type

The pavement is developed on a single bed of upper Brigantian limestone.

Main Geological or Geomorphological Interest

Sheshymore hosts an extensive area of undisturbed limestone pavement with well-developed karren forms. Tabular blocks of limestone or clints in this area are defined by east-west and north-south orientated **joints**. The clints are elongated in an east-west direction (1.2-1.5m spacing between east-west joints and 2-3m spacing between north-south joints). Curved joints are particularly evident in the northeastern part of the pavement and northeast-southwest orientated crosscutting joints are common in the southwestern area producing triangular clint blocks. The central and eastern areas of pavement are smooth and predominantly karren-free suggesting previous burial beneath a protective layer of **calcareous** glacial till. Grikes are deepest in this area (1.5-2.5m). Several of the larger north-south trending joints have been enlarged to form vegetated trenches, 1.5m wide, rich in the shrub *corylus*. Karren forms in this area include solution pans (or kamenitza; shallow pools in the limestone), rundkarren (rounded grooves) and meanderkarren. Physical and chemical weathering has resulted in the decay of the peripheral limestone pavement to **clitter** and vegetated rocky grassland.

Site Importance

The site is of International importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

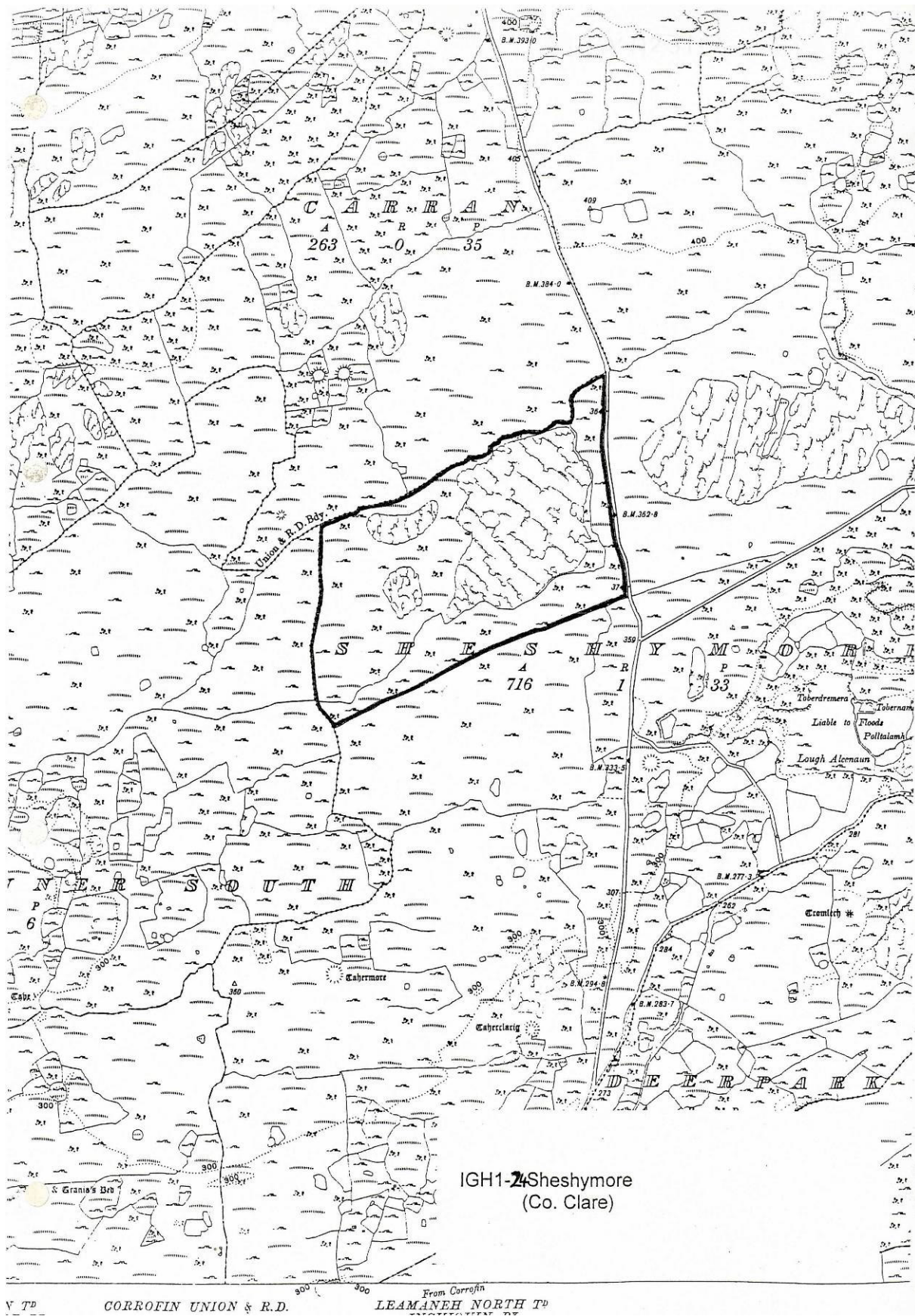
Management/promotion issues

There has been some disturbance of loose clint slabs in the north of the area, re-arrangement, building of miniature cairns and wedging into grikes. The area of best pavement is 11.3ha. A more extensive area within enclosing walls (also shown on 6" map) is 33ha but includes some degraded pavement and scrub, especially in the south and west of the site.



Wide grikes with well developed fluting and horizontal solutional fretting and irregular clint blocks.

Sheshymore



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Spanish Point

Other names used for site

TOWNLAND(S)

Breaffy South, Leagard South

NEAREST TOWN

Milltown Malbay

SIX INCH MAP NUMBER

30

NATIONAL GRID REFERENCE

102300 178500 = R023 785

1:50,000 O.S. SHEET NUMBER

57

1/2 inch Sheet No. 17

Outline Site Description

Coastal section – foreshore exposures

Geological System/Age and Primary Rock Type

Upper Carboniferous (Namurian) sandstone, siltstone and mudstone of the Central Clare Group.

Main Geological or Geomorphological Interest

The coastal section at Spanish Point consists of well-bedded sandstones, siltstones and mudstones of the Upper Carboniferous (Namurian) Central Clare Group. Sedimentary structures are well preserved here and include cross-bedding, cross-laminations and symmetrical wave ripples. Some of the thicker sandstone units have undergone segmentation, or boudinage, as a result of the extensional forces exerted on the limbs of folds during the Variscan Orogeny. A marine band is present on the north side of the Spanish Point bay, with a prominent palaeosol horizon 2.5m below it stratigraphically, with rootlets, dessication cracks etc. This represents a higher ground area between deltaic channels, exposed above water when the sediments were accumulating.

Site Importance

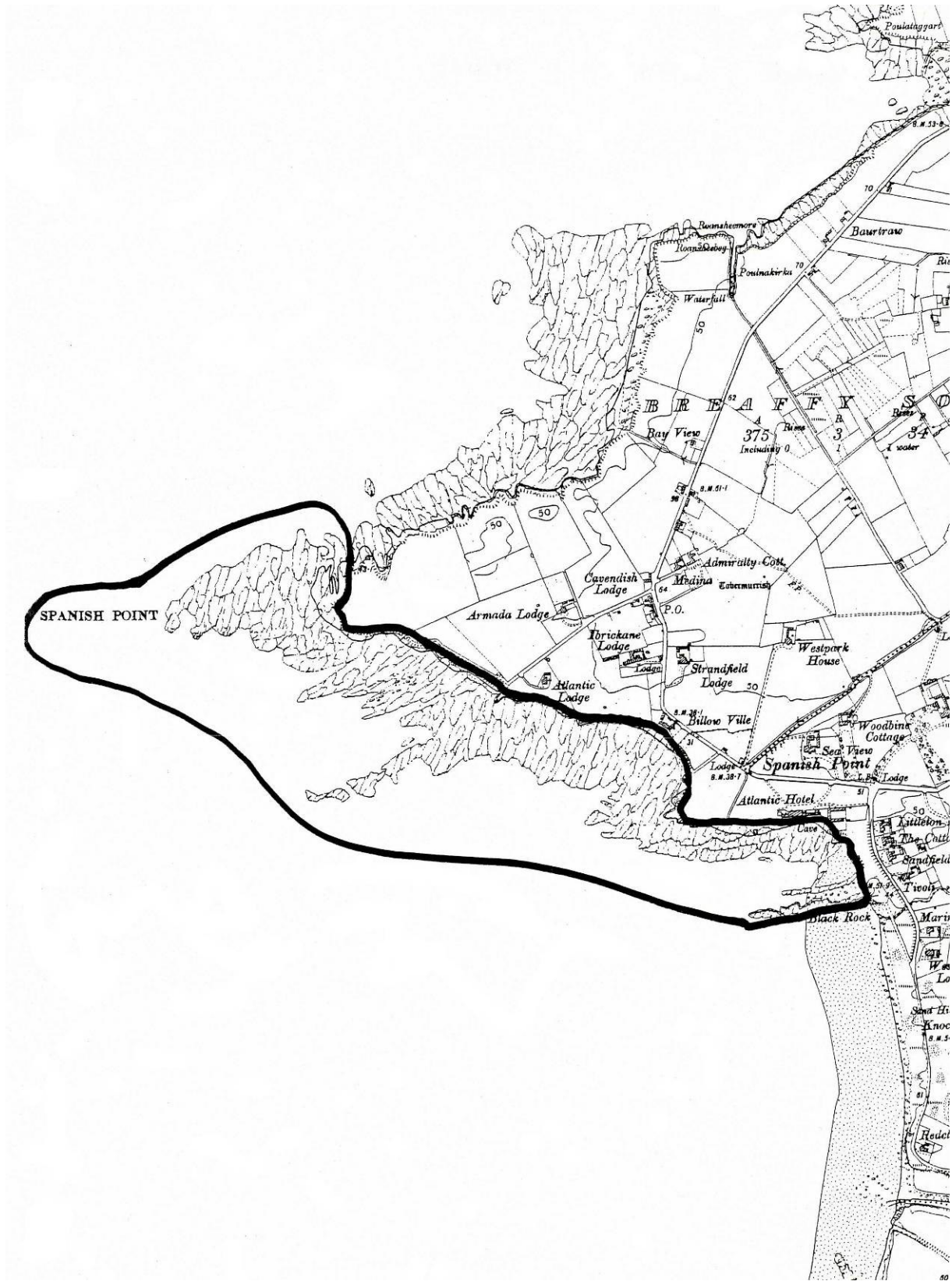
This site is of National Importance and may be proposed as an NHA under the IGH 9 Upper Carboniferous and Permian theme of the GSI's IGH programme.

Management/promotion issues

None known



Spanish Point



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Sraheen

Other names used for site

The Banshee Stone

TOWNLAND(S)**NEAREST TOWN**

Tulla

SIX INCH MAP NUMBER

34

NATIONAL GRID REFERENCE

142860 179640 = R 4286 7964

1:50,000 O.S. SHEET NUMBER

58 **1/2 inch Sheet No. 17**

Outline Site Description

Mushroom rock – isolated wave worn stone in grazing field

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The stone in question is an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. In some stones such as at Sraheen, this has created an etched lower surface with a major overhang, whilst in more extreme cases a mushroom shape develops with a cap on a pedestal. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes had a wider extent, but in others the lake has entirely disappeared, as at Sraheen. In some cases an alternative explanation that the stem of the mushroom was buried by bog has been made, but this seems unlikely for Sraheen.

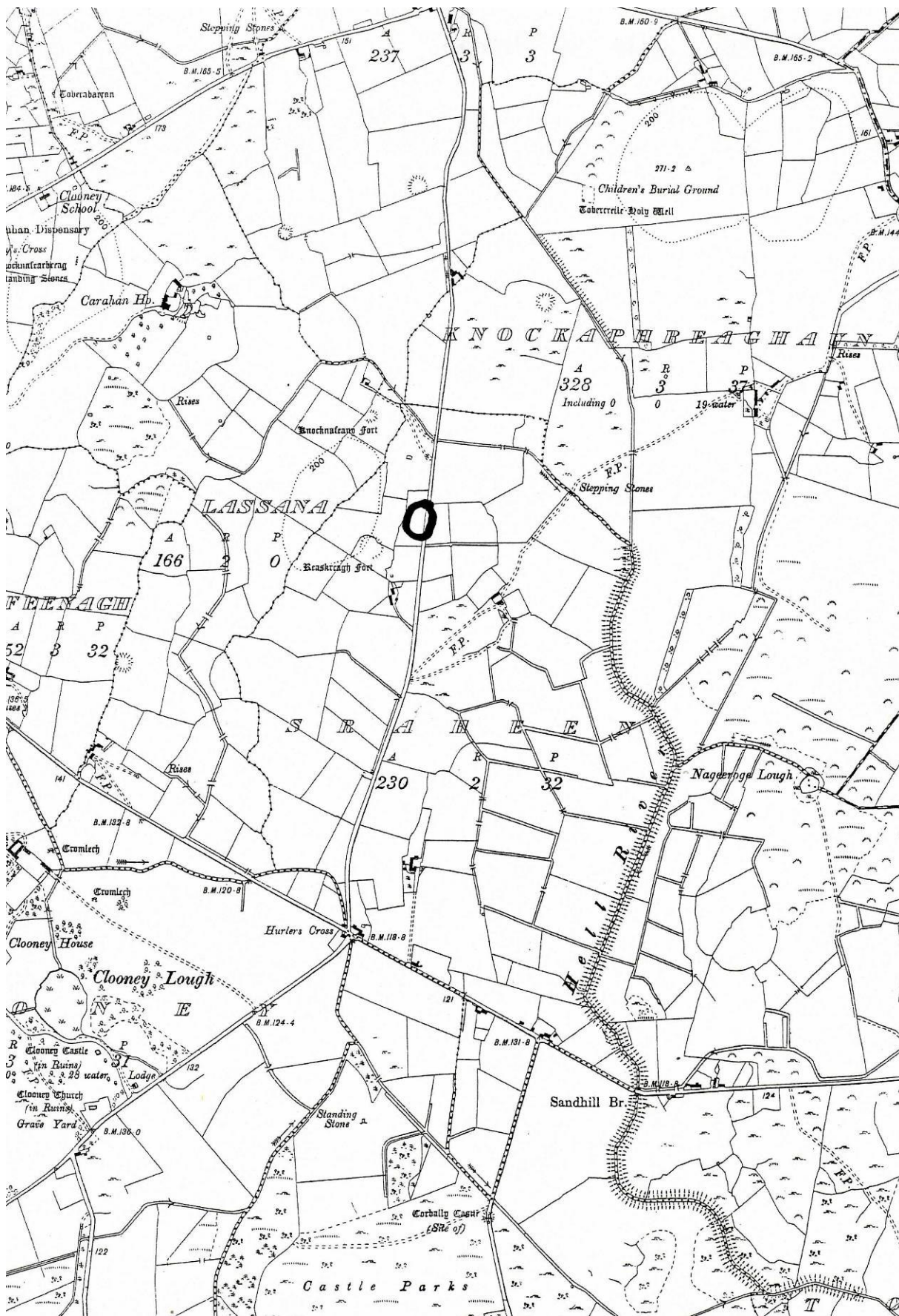
Site Importance

The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. It is one of only about 63 mushroom stones known in the country as a whole.

Management/promotion issues

The subtlety of the wave worn features means that the stone is vulnerable to field clearance, agricultural 'improvement' or road widening as well as the use of the field as a building site for a new domestic dwelling.



Sraheen

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE**St. Brendan's / Poulmagollum**

Other names used for site

Killeany Valley, St. Brendan's, Poulmagollum, Poulelva, Cullauns 0-3

TOWNLAND(S)

Ballydonohoe, Ballyteige, Ballycastell, Ballyconnoe North, Ballyconnoe South, Ballydonohoe, Ballyinsheen Beg, Ballyinsheen More, Ballyneillan, Caherbarnagh, Caherbullog, Cahercloggaun, Cahermaan, Cahermakerrila, Cooleabeg, Cooleamore, Coolmeen, Cragreagh, Cullaun, Gowlaun, Killeany, Kilmoon East, Kilmoon West, Larheenbeg, Lisdoonvarna, Lisheeneagh, Lislarheenmore, Lismorahaun

NEAREST TOWN

Lisdoonvarna

SIX INCH MAP NUMBER

4, 5, 8, 9

NATIONAL GRID REFERENCE

St. Brendan's Well	114600 198400=R14600 98400
Poulmagollum E2	115300 205200=M15300 05200
Cullaun 0	118100 202400=M18100 02400
Cullaun 3	117400 199200=R17400 99200

1:50,000 O.S. SHEET NUMBER51 **1/2 inch Sheet No.** 14**Outline Site Description**

The longest, anastomosing, dendritic, complex cave system and associated risings in Ireland, plus other major systems.

Geological System/Age and Primary Rock Type

Cave system developed within Carboniferous Limestone.

Main Geological or Geomorphological Interest

The St. Brendan's - Poulmagollum site includes St. Brendan's Well near Lisdoonvarna, the main rising for a significant area of karstic drainage focused on the Poulmagollum – Poulelva cave system on the eastern side of Slieve Elva, the intermediate Killeany rising and the proven drainage from the Cullaun caves (Cullaun 0-3) on the western side of Poulelva. The rising at Killeany flows as the Owentoberlea and sinks again within a short distance and re-emerges at St. Brendan's Well except when in flood. On these occasions a surface stream may flow in the normally dry valley, although there is a further intermediate rising and sink at Upper St. Brendan's Rising.

The Poulmagollum –Poulelva cave system is Ireland's longest cave system. With approximately 14km total passage, much of which is active streamway, this cave system exhibits many features of interest revealing a complex history of development. The most obvious control is the input of streams sinking at the limestone – shale margin along the break in slope below Slieve Elva. The two major potholes of Poulmagollum and Poulelva themselves probably reflect former major sinks at the shale margin in a preglacial or interglacial period.

The St. Brendan's - Poulmagollum site also includes a number of less developed, simple canyon type and supposedly postglacial streamways in the caves of Cullaun on the east of the site. The drainage from these and from the Poulmagollum master cave runs southwards with the general shallow dip of the limestone strata in the Killeany valley, converging at Killeany from where it continues to St. Brendan's Well, or drains directly to the latter rising. Not all the Cullaun caves drain to St. Brendan's Well; those that drain eastwards to the Fergus River Cave are not included in the site.

This site has a complex history relating to at least one previous glacial advance and retreat. There is major scope for research, both underground and on the surface, of the various phases of development of the karst history of the valley.

Site Importance

The site is of International importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

Threats to the site include dumping in swallow holes / dolines, agricultural sewage drainage, forestry and urban development. There have been historical access problems to Poulmagollum pothole.



Poulmagollum Pothole.
Photo by G. Ll. Jones.



A stream flowing off the shales, sinks immediately on reaching limestones.
Photo by G. Ll. Jones.

[illegible]

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

St. Brendan's Well

Other names used for site

St. Brendan's Bridge on Gowlaun Stream

TOWNLAND(S)**NEAREST TOWN**

Lisdoonvarna

SIX INCH MAP NUMBER

8

NATIONAL GRID REFERENCE

113000 198000 = R 13 98

1:50,000 O.S. SHEET NUMBER

51 **1/2 inch Sheet No.** 14

Outline Site Description

Stream section exposing lower Clare Shales.

Geological System/Age and Primary Rock Type

Lower Clare shales, Namurian in age.

Main Geological or Geomorphological Interest

St. Brendan's Well is located about 1 mile east of Lisdoonvarna along Gowlaun Stream. The lower Clare Shales are exposed in this stream overlying the Carboniferous Limestone. These deep-water marine shales define the base of the Namurian. According to Hodson (1954) one of the more notable features of exposures of the Clare Shales in the Lisdoonvarna area is the reduction of the Phosphate Group (a group consisting of mainly black shales) to a few inches and the occurrence of faunal band rich in goniatites (in particular *Homoceras beyrichianum* group and *Homoceras* aff. *subglobosum*). The site also shows a diverse cephalopod fauna within concretions or nodules at the exposure together with a rich conodont fauna. Tanebe *et al.* (1995) have recently used goniatitic material from the area in a study on the early life history of Carboniferous ammonoids, recognising various growth stages including embryonic forms from this area. The area indicates the attenuated nature of the northern Clare Shales, and the junction between the Upper and Lower Carboniferous. It is one of the few places in Ireland in which this horizon is exposed. The risings are the outlet for water from the whole Poulmagallum – Pollelva System and the Cullaun caves on the western Poulacapple ridge.

Site Importance

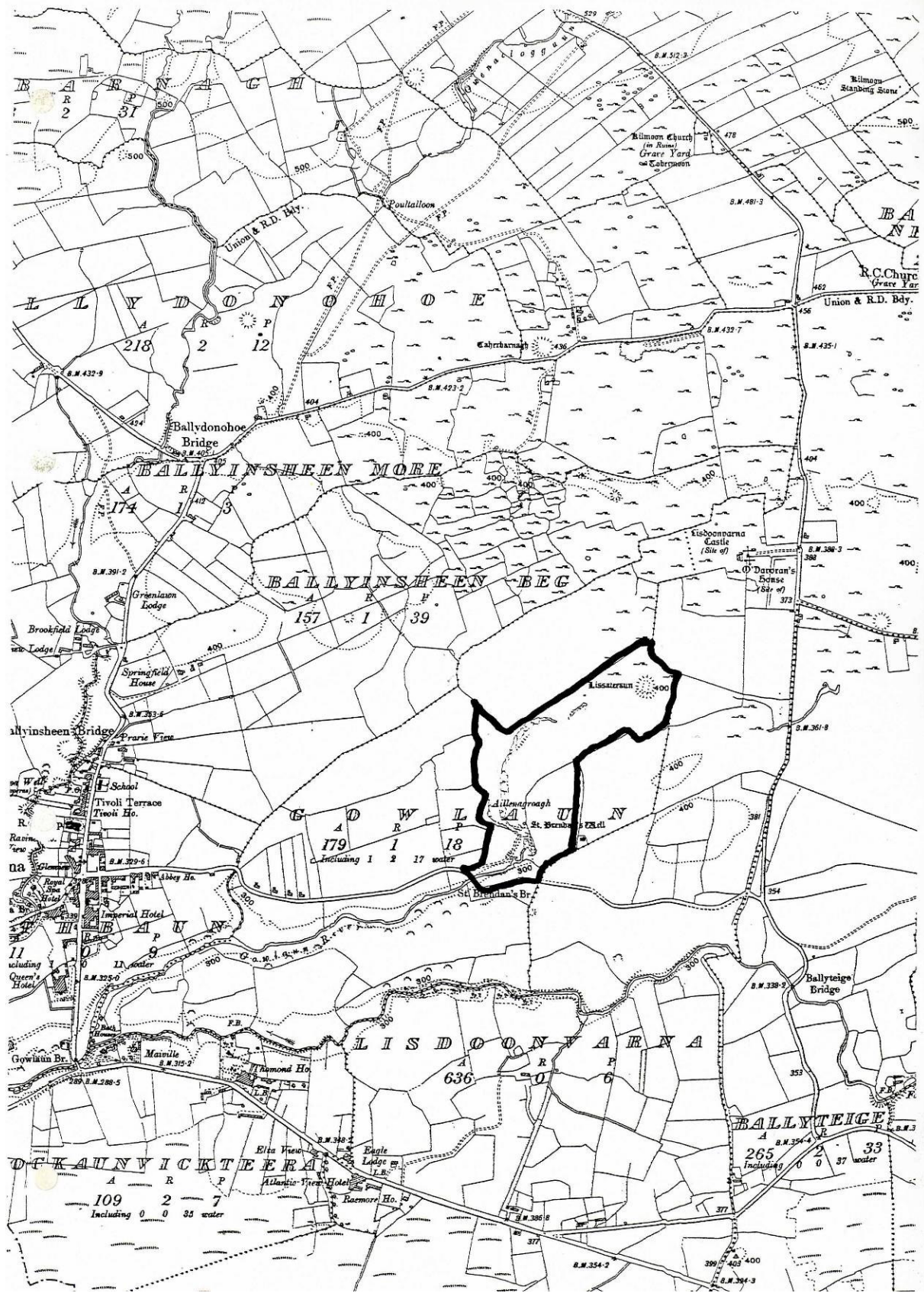
The site is of National importance and may be proposed for NHA designation under the IGH 3 Carboniferous-Pliocene Palaeontology theme, IGH 8 Lower Carboniferous theme and IGH 9 Upper Carboniferous and Permian theme of the GSI's IGH Programme. It is also part of a larger site (St. Brendan's – Poulmagallum) under the IGH 1 Karst theme.

Management/promotion issues

The area is one used by many University and Industrial Field Trips.



St. Brendan's Well



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

The Tomeens

Other names used for site

TOWNLAND(S)

Milltown, Kiltanon

NEAREST TOWN

Tulla

SIX INCH MAP NUMBER

27, 35

NATIONAL GRID REFERENCE

146700 181300 = R467 813

1:50,000 O.S. SHEET NUMBER

58 1/2 inch Sheet No. 17

Outline Site Description

Unroofed and partially roofed active river cave.

Geological System/Age and Primary Rock Type

River cave developed within Waulsortian limestone.

Main Geological or Geomorphological Interest

The Tomeens consists of a linear river cave on part of the Tomeens River consisting of roofed, partially roofed and unroofed sections. There are 10 caves in total, each separated by surface collapses (Self 1983). The amount of surface collapse is not surprising owing to the fact that there is rarely more than 2-3m between the ground and the roof in areas where the cave has a width of 10-15m. Also of interest are a number of [stream oxbows](#) and [dry oxbows](#), where the part of the river has been abandoned in favour of a more direct route. Many factors including surface collapse, tree roots forcing open joints in the limestone and humic acids (derived from rotting vegetation) dissolving the limestone will see the cave eventually becoming an open canyon with the river downcutting its limestone bed (Self 1993). The site was originally a significant tourist attraction and drew lavish praise in the 18th and 19th centuries e.g. Lloyd (1986).

Site Importance

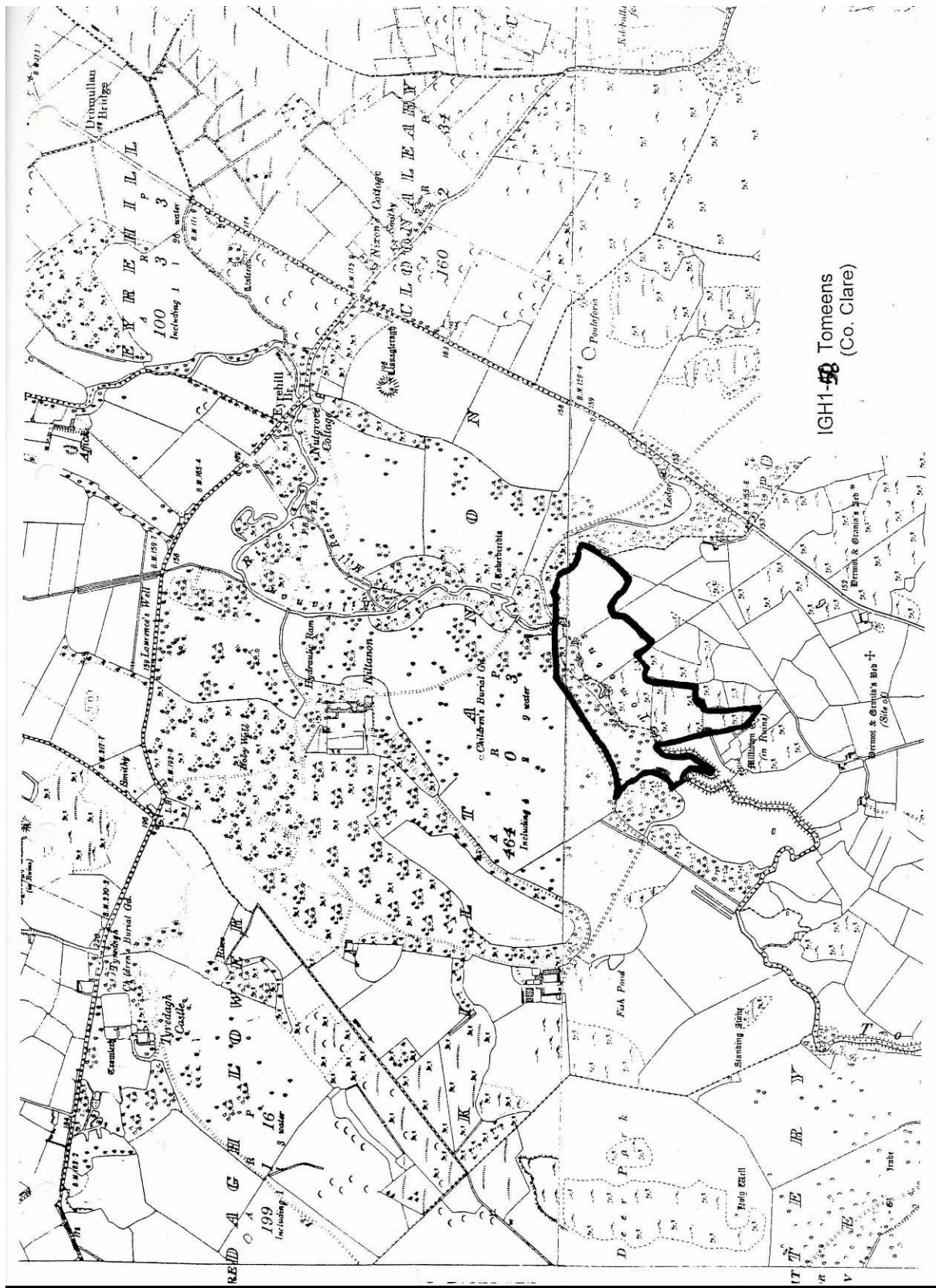
The site is of National importance and is proposed for NHA designation under the IGH 1 Karst theme and the IGH 8 Lower Carboniferous theme of the GSI's IGH Programme.

Management/promotion issues

No known threats at time of writing. The most convenient access to the Tomeens is from a farmhouse on the Milltown side of the river. Access with the landowners permission is through the farm along an unmade track.



The Tomeens



IGH1-58 Tomeens
(Co. Clare)

CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Toonagh Quarry

Other names used for site

TOWNLAND(S)

Ballybrody, Drummina, Toonagh Commons

NEAREST TOWN

Ennis

SIX INCH MAP NUMBER

25

NATIONAL GRID REFERENCE

130319 183800

1:50,000 O.S. SHEET NUMBER

57

1/2 inch Sheet No. 17

Outline Site Description

Active limestone quarry

Geological System/Age and Primary Rock Type

Burren Formation, Carboniferous, Viséan limestone

Main Geological or Geomorphological Interest

This quarry, 3.5km north off the main Ennistymon road from Ennis on the Corrofin road, is the best representative section in the county, other than karstic exposures in the Burren, for the typical Clare Burren Formation. The broad dip of the beds, and features of the overall sequence can be seen in an always changing quarry.

Site Importance

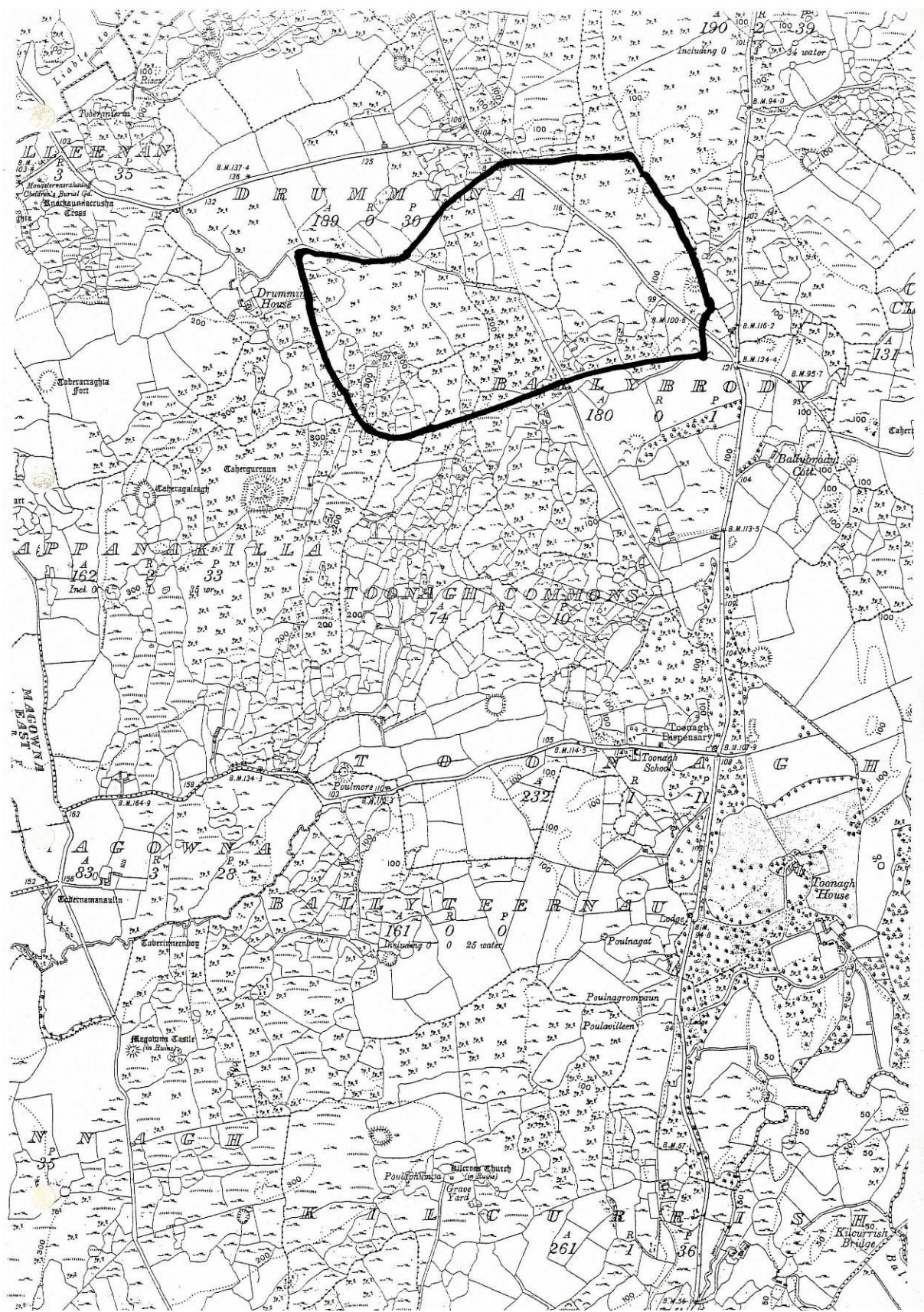
The site is of County Geological Site importance and may be proposed for NHA designation under the IGH 8 Lower Carboniferous theme of the GSI's IGH Programme.

Management/promotion issues

As an active working quarry there are safety and access issues which mean that it is not suitable for general public promotion, but it is a valuable site to examine the limestones in a well exposed situation.



Toonagh Quarry



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Tuamgraney

Other names used for site

TOWNLAND(S)**NEAREST TOWN**

Tuamgraney

SIX INCH MAP NUMBER

28

NATIONAL GRID REFERENCE

163700 183150 = R637 831

1:50,000 O.S. SHEET NUMBER

58

1/2 inch Sheet No. 17

Outline Site Description

Isolated rock outcrop in town centre Garden of Remembrance

Geological System/Age and Primary Rock Type

Carboniferous limestone with karstic features

Main Geological or Geomorphological Interest

The green area, or Garden of Remembrance in the town centre is notable for the large tree, the memorial to Dr Edward MacLysaght (1887-1986) and the Marion Shrine. However, it is also a fine geological feature, displaying some fine beds of Carboniferous limestone, with a moderate dip of about 30 degrees to the north west. They are characterized by solution runnels called karren, down the surfaces, more usually seen in the Burren.

Site Importance

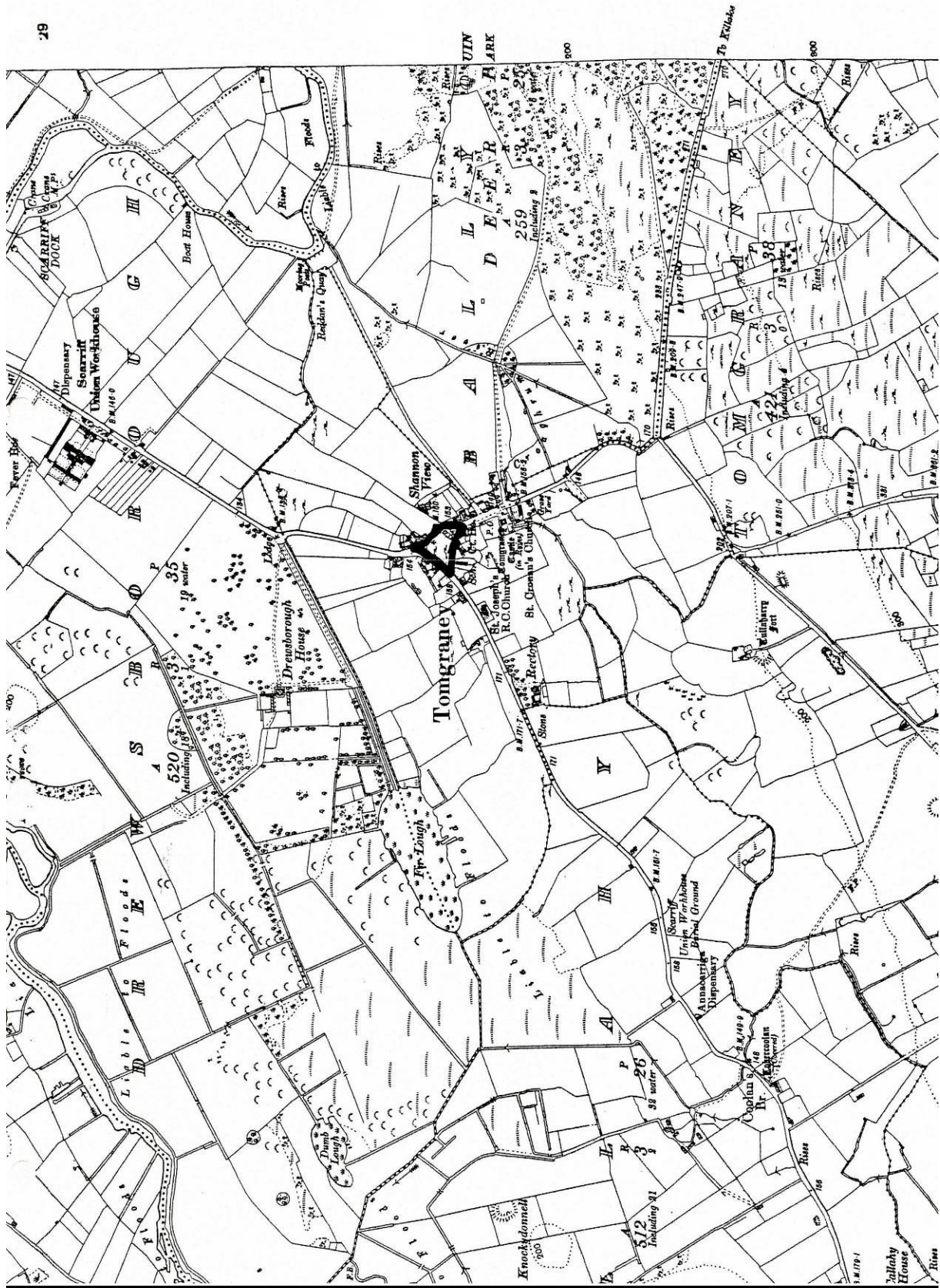
The site is of County Geological Site importance under the IGH1 Karst theme of the GSI's Irish Geological Heritage Programme, and is a useful example in a prominent place to demonstrate local rocks and landscape processes for educational purposes.

Management/promotion issues

It is reasonably safe from damage in the centre of the town, but should be managed to maintain the geological interest as well as the Garden interest. For example, *Cotonoeaster* plants on the south side (see picture below right) should be removed before they obscure the geological interest, as there is plenty of surrounding space for planting of interest.



Tuamgraney



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Turkenagh

Other names used for site

TOWNLAND(S)

Turkenagh

NEAREST TOWN

Corofin

SIX INCH MAP NUMBER

10

NATIONAL GRID REFERENCE

133870 192460 = R3387 9246

1:50,000 O.S. SHEET NUMBER

51 1/2 inch Sheet No. 14

Outline Site Description

Mushroom rocks – isolated wave worn stones in limestone pavement area, adjacent to turlough

Geological System/Age and Primary Rock Type

Although the limestone is of Carboniferous age, the probable development of the undercut lips and mushroom shapes is a postglacial development.

Main Geological or Geomorphological Interest

The Turkenagh stones in question are an example of a phenomenon classed as mushroom stones. These are thought to have formed when lakes existed for periods long enough for water to dissolve the limestone below the lake level. Emergent limestone above the lake level was not dissolved. These lakes are thought to have probably existed from around the end of the Ice Age when water levels were much higher. In some cases the present day lakes probably had a wider extent, but in others the lake has entirely disappeared. At Turkenagh it appears that the lake is actively still forming mushroom stones at high water levels by dissolution of limestone pavement. They may in fact represent what many other sites were like at an early stage in their development, with residual mushrooms being an advanced state. The prevalence of 'stump' like smoothed boulders at other sites such as Coad and Ballykinnacorra supports this idea.

Site Importance

The site is of County Geological Site importance under the IGH 1 Karst theme of the GSI's IGH Programme. The Turkenagh stones comprise an unusual example of only about 63 mushroom stones known in the country as a whole, in that they are dissected bedrock pavement, rather than possibly erratic boulders.

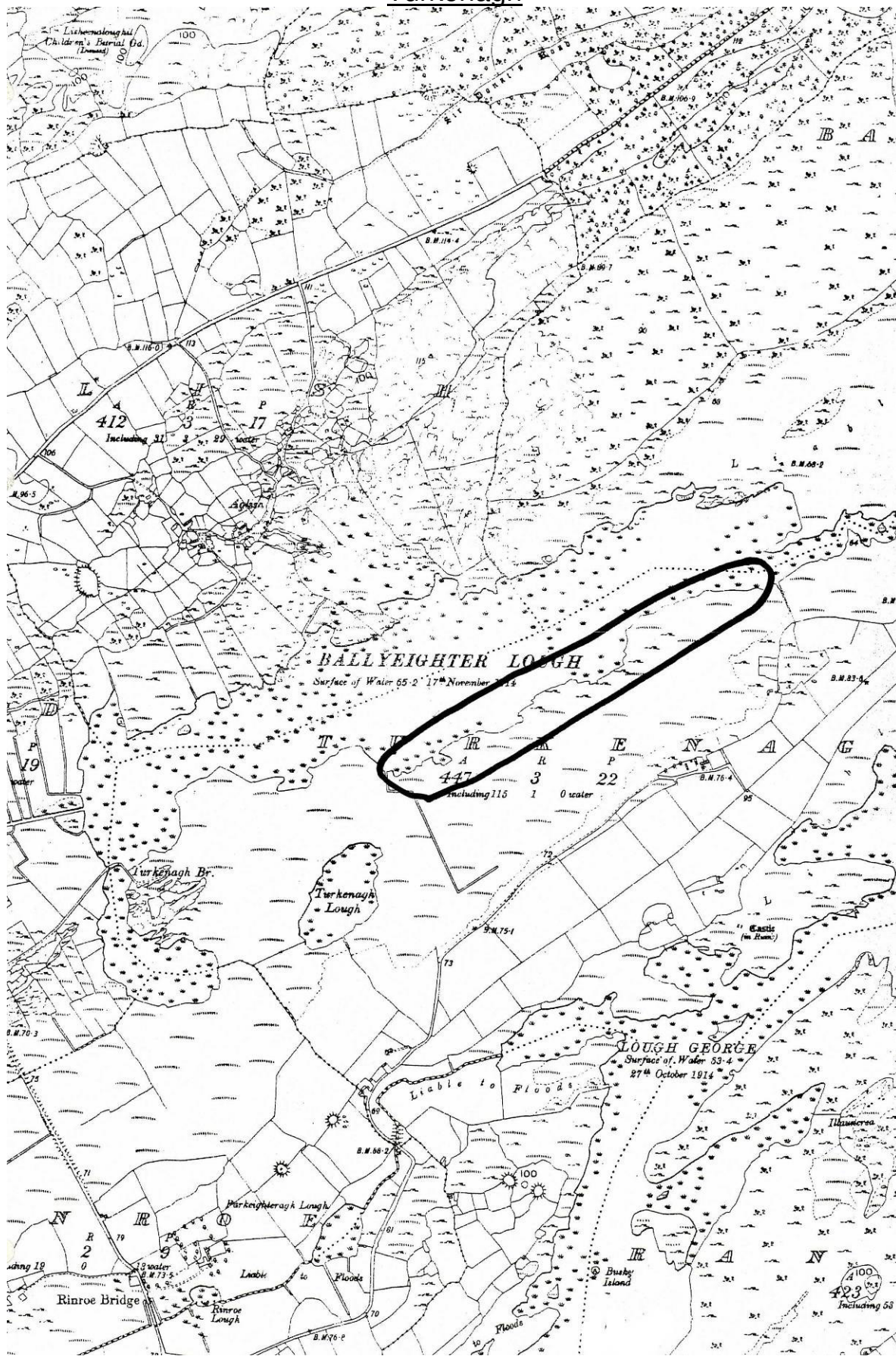
Management/promotion issues

As the stones are outside the Burren National Park, they are still vulnerable to damage or loss although their situation on a regularly flooding lakeshore environment is unlikely to attract development.



Turkenagh pavement
(Photo: Louise Dunne)

Turkenagh



CLARE - COUNTY GEOLOGICAL SITE REPORT

NAME OF SITE

Vigo Cave

Other names used for site

TOWNLAND(S)

Nooan

NEAREST TOWN

Corofin

SIX INCH MAP NUMBER

17

NATIONAL GRID REFERENCE

126030 190500 = R26030 90500

1:50,000 O.S. SHEET NUMBER

51

1/2 inch Sheet No.

14

Outline Site Description

Ancient, abandoned vadose cave exposure site.

Geological System/Age and Primary Rock Type

Drew and Jones (2000) record a minimum age of more than 6000 years for the cave based on calcite dating.

Main Geological or Geomorphological Interest

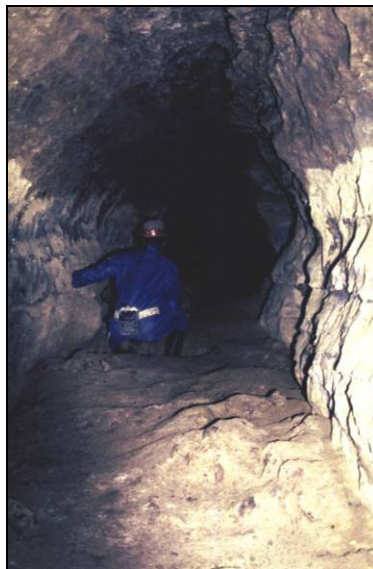
Vigo is a significant cave, approximately 200m long, unrelated to present day topography and containing entrance and deep cave sediments. The cave is unusual as it runs almost in a straight, SSW direction beneath the Namurian Shale cover. Although the precise nature of the cave's formation is obscure it is clear from the evidence above that its origins must be related to a topography very different that of the present day. It has one of the best, undisturbed cave entrance facies in Ireland with considerable potential for fruitful excavation. The complementary interior cave sediments together with the distinctive morphology of the ancient cave make it a valuable karst heritage landform.

Site Importance

The site is of National importance and is proposed for NHA designation under the IGH 1 Karst theme of the GSI's IGH Programme.

Management/promotion issues

It is important to negotiate access with the landowner. The cave is probably just within the East Burren Complex SAC 1926.



Abandoned vadose trench largely infilled near the cave entrance (D. Drew).



Inside the cave

Vigo Cave

