



Quarrying and Geoconservation in the Republic of Ireland—the Effectiveness of Guidelines for Operators

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Abstract

Quarries are often the reason we know about the particular geology of an area in the first place, and the physical geological heritage we wish to protect may only exist at all because there has been extraction of an economic resource in a quarry or mine. This apparent dichotomy between a general understanding of ‘conservation’ and extraction of rocks or minerals is a hard message to get across to the general public and to those working in industry as well as planning officials and environment agency staff working in regulating industrial operations. This paper reviews efforts in Ireland to bridge that gap in understanding through the publication of some simple guidelines, aimed primarily at the extraction industry operators. This paper comprises a summary of the guidelines issued in the Republic of Ireland, a report on a simple survey conducted 7 years after their issue to assess industry awareness of them, brief reports on case studies where the guidelines have been used and lastly, an appraisal of the value of the guidelines in geoconservation, with a plan for future development and actions that would be applicable to anyone contemplating developing any similar guidelines or evaluation of existing ones.

Keywords Geoconservation · Quarrying industry · Guidelines · Statutory protection

Introduction

In many territories, quarries may be the only visible presentation of the geology, and inform our understanding of the stratigraphy, perhaps backed up by borehole records. In the Republic of Ireland, the full audit of County Geological Sites (Gatley and Parkes, this volume) is incomplete, but in 17 counties audited and published to date, out of 451 geosites, some 113 (25%) are quarries or extractive sites (old pits in large esker or Quaternary fan deposits are not counted). Many of these quarries may of course no longer be worked, but there are many that are active. These are most important in many of the counties in the Midlands of Ireland and around the Greater Dublin region, where the widespread Carboniferous Limestone bedrock is generally very poorly exposed. The

characterisation of the formations relies on exploration borehole data along with quarry exposures. The degree of karstification and extensive Miocene-Pliocene doline development in the Carboniferous limestones is also revealed in these quarries, but would otherwise be much obscured by cloaking glacial till deposits.

The geological heritage represented in those quarries only exists at all because there has been extraction of an economic resource. Sometimes ongoing quarrying is actually beneficial to further understanding of particular geological interests. There is an apparent dichotomy between ‘conservation’ as most people understand it, which involves keeping things as they are, and the ongoing extraction of rocks. This is a hard message to get across to the general public and to those working in industry as well as planning officials and environment agency staff working in regulating industrial operations. This is the case not only in Ireland. In a review of principal mining legislation across European countries, Tiess and Ruban (2013) found that only five countries placed any non-economic value on geological heritage in their legislation and then mostly in quite a general way.

In this paper, we describe efforts in Ireland to bridge that gap in understanding through the publication of some simple guidelines (Gatley and Parkes 2008). After some years of

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being available, we conducted a simple survey to assess the awareness of the *Geological Heritage Guidelines for the Extractive Industry* (hereafter referred to as the Guidelines), and the results of that survey are presented, along with some brief case studies where the Guidelines have been used or considered. An assessment of the value of producing and promoting the Guidelines is necessarily subjective, but the implications for future promotion and the wider international relevance are discussed.

Geological Conservation in Ireland

The original plan of the Irish Geological Heritage Programme, which commenced in 1998, was to define and document sites of national geological heritage importance, which could be designated as Natural Heritage Areas (NHAs) with statutory protection applied, based on notifiable actions that a landowner had to work with in their usage of land. The background and detail of this work is recorded in Parkes and Morris (2001), Parkes (2008) and Gatley and Parkes (2012) and references therein. A sustained lack of resources for the National Parks and Wildlife Service to actually designate geological NHAs and the change in priority in recent years to address European designations alone mean that, in 2017, no geological NHAs have yet been designated and that there is no statutory protection for any geological heritage in Ireland. A second tier of sites was originally planned which would constitute the candidates for NHA status but of these only the ‘best’ would be selected as NHAs. The vision of these County Geological Sites has since evolved significantly to encompass a wide range of geosites of local importance (Gatley and Parkes 2016, 2017) and is the only effective geoconservation protocol in operation at present, and for the foreseeable future.

County Geological Sites

In the National Heritage Plan (2002), the idea of a County Geological Site was first established, as proposed and promoted by the Geological Survey of Ireland in the creation of that plan. The County Geological Site designation is a purely advisory one, with no statutory (legal) protection. However, County Geological Sites receive some measure of recognition and protection through a greater awareness of them and within planning laws. In Ireland, there are 29 county councils which may each adopt County Geological Sites into their planning systems. Whilst the definition of a County Geological Site has no statutory protection, the inclusion of them in a statutory County Development Plan and within the planning system means that no significant development may occur without some consultation about the geological heritage, and representations on its behalf in case of conflicts.

The County Geological Sites within Ireland include many active quarries which have scientific value in demonstrating a particular aspect of geology, and in many places, they represent the best, if not the only place to see certain rock formations or stratigraphical successions. It is made clear that being classed as a County Geological Site has no implications for the normal legal operation of a quarry under other regulations. It does however provide opportunity for a dialogue between quarry operators and geological heritage interests, as well as wider geological research interests. It allows for discussion about possible end-uses of the quarry once it has ceased operating. It allows for the idea that accessible faces could be retained and promoted as conservation sections, along with other possible uses and that there actually is a geological heritage interest in quarries, that is often not considered within industry or planning circles.

Guidelines for Geological Heritage

From around 2000–2007, Ireland was at the height of the so called Celtic Tiger economy when construction development meant that new quarries were opening almost every week. Figure 1 is a crude but highly demonstrative example of the scale of this economic boom. In this time, there was a level of planning and development enquiry work in the Geological Heritage Programme of the Geological Survey of Ireland which was hard to sustain. As a background parallel initiative in the Geological Survey of Ireland, there was work beginning on Aggregate Potential Mapping, aimed at providing planners with a resource to prevent sterilisation of good potential aggregates by allowing development on the best resource areas. A set of Guidelines was devised (Gatley and Parkes 2008) partly to provide a handy response that condensed critical information in one resource which could reduce the time devoted to responding to each enquiry. However, the main purpose was to raise the awareness of geological heritage amongst the quarrying industry and the consultants working for the companies on the environmental and planning issues in extending or developing new quarries.

The Guidelines were drawn up with the support of Liam Smyth, the Environmental Officer in the Irish Concrete Federation (ICF). This industry body represents, and its members include, all of the major operators in the sector as well as many of the smaller companies. The Guidelines were jointly published by the Geological Survey of Ireland and the Irish Concrete Federation and launched at their 2008 annual meeting, with a large attendance of members and other interested parties. Copies were freely available and it was believed by the authors that they were also then well distributed to ICF members. The Geological Survey of Ireland also sent copies to all of the consultancies that routinely consulted with them in relation to County

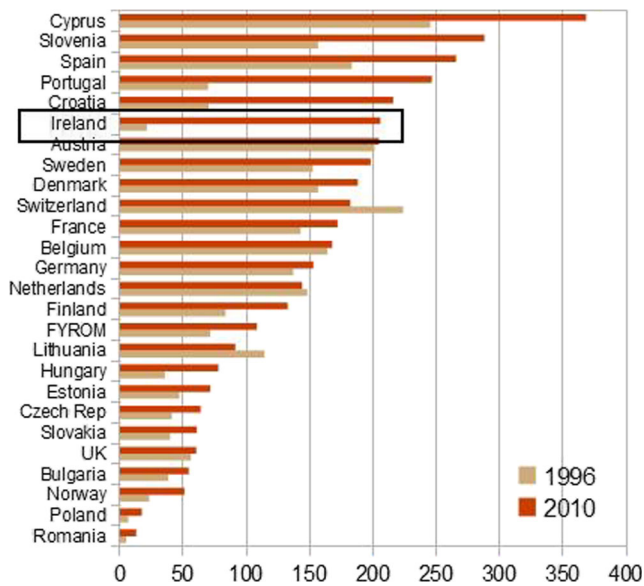


Fig. 1 A chart of km of motorway per million inhabitants in 1996 and 2010 in European countries. The 2010 figure demonstrates the significant construction-based economic boom which had occurred prior to that time

Geological Sites in planning issues and Environmental Impact Assessments. They may represent the first practical effort at partnership between geoconservationists and the mineral industry in the Republic of Ireland, which Prosser (2016) clearly defines as an essential approach for success.

To quote the inside first page summary: ‘these guidelines are intended for Irish Concrete Federation (ICF) members so that they may follow best practice and receive clear information concerning geological heritage in relation to any proposed quarry or related development or land purchase. They are also intended as a useful template for any quarry operator in addressing geodiversity issues and thereby contributing to the databases of the Geological Survey of Ireland. This furtherance of geological knowledge will ultimately feed back into Ireland’s extractive industry as well as help provide other benefits to society’.

The 16 pages comprise six topic headings and three appendices with very concise text and lots of colour images intended to make the guidelines attractive to pick up and read. A brief note on the legislative foundation is followed by an outline of the categories of geological heritage sites. The management issues that may arise with geological heritage sites is explored in the third topic. Then, the ways in which geological heritage data may be accessed are supplemented by a specific note about confidential pre-land purchase enquiries. The sixth note relates to the preparation of an Environmental Impact Statement. The appendices outline the legislation relating to geological heritage, the geological heritage themes of the IGH programme and some key references.

The guidelines themselves are in the centre pages and comprise six points under three stages: the EIS stage, the quarry operation stage and the end-operation stage. In brief form, the

six guidelines are (1) consult with IGH at scoping stage, (2) liaise with IGH during site investigation, (3) facilitate periodic visits from IGH during operation, (4) notify IGH of any new features exposed, (5) monitor and record faces during extraction, and (6) finalise restoration plans in consultation with IGH.

Survey of Awareness of the Guidelines

In 2015, it was felt that after 7 years, it was appropriate to evaluate whether the industry was aware of the Guidelines and whether they had been effective in their intent. As there was very limited scope for either author to invest significant time in such an evaluation, we devised a simple survey, using SurveyMonkey free tools available online. Only seven questions were included (Table 1) and an estimated completion time of only a few minutes was, we considered, not likely to be a deterrent to potential responders. A link to the survey with a request for people to complete it and why was circulated by email to all members of the Irish Concrete Federation. The Institute of Geologists of Ireland circulated to all its members, numbering well over 200. It was also sent to all members of the Irish Association for Economic Geology and of the Irish Mining and Quarrying Society. Between them, these would cover virtually all practising industrial geologists in mining, quarrying and ancillary activities, as well as exploration and engineering geology consultants, some academic geologists and active retired geologists. There are of course many individuals who are members of more than one, or all of these bodies. With the online survey, we did not expect to get sufficient returns (based on experience with other consultation exercises) to have a statistically valid sample, but were pleased to receive 73 responses (plus three others received after the deadline for presenting results at the Iceland ProGEO meeting in 2015, and not included in the figures in this paper). Consequently, some of the results are presented as percentages of 74 respondents (an initial test was included in the figures), but it was the qualitative results that we were most interested in.

Further evaluation of extended discussions with three key players in the industry have reinforced and expanded our understanding of the broader patterns identified in this study: Liam Smyth—Sustainability and Marketing Manager of the ICF; Fergus Gallagher—Kilsaran International, also Chair of the Planning and Environment Committee of the ICF and Charles Mount—Planning Consultant used by ICF members.

Survey Results

The responses (Fig. 2) came in three batches as the email request to different groups were staggered over the 12–26th

Table 1 The eight questions asked in the simple survey to assess awareness and usefulness of the Guidelines. Each question included an option for individual comments to be added

Q1 Are you aware of the Geological Heritage Guidelines for the Extractive Industry?

Q2 Do you have your own printed booklet copy of the Geological Heritage Guidelines for the Extractive Industry?

Q3 If you are aware of the Guidelines have you ever used them?

Q4 If you did use them, please give a short description of how you found them useful

Q5 How would you rate their usefulness to you?

Q6 Are you involved in Extraction or Geology as:
 Quarry or Mine operator
 Consultant Geologist or Company
 Government agency, e.g. GSI/GSNI/EMD/NPWS
 Other (please specify)

Q7 Are you a member of:
 ICF—Irish Concrete Federation
 IMQS—Irish Mining and Quarrying Society
 IAEG—Irish Association for Economic Geology
 IGI—Institute of Geologists of Ireland

Q8 Have you any other comments or views on the Guidelines that you wish to include?

August. The initial response is our own test response to see that it was working.

The most disappointing result quickly became apparent in the responses to questions 1 and 2, with nearly 55% of respondents being unaware of the Guidelines at all. Only some 27% actually had a copy of the Guidelines, either as a paper printed version, or downloaded as a pdf. From question three responses, of those that were aware of the Guidelines, only

28% had actually used them, with another 12% unsure if they had, but 60% had not.

Question 4 asked how respondents had found the Guidelines useful and question 5 attempted to quantify that usefulness (Fig. 3). From 36 responses, three out of four rated them as useful to some degree, with more than half finding them quite useful or better. From question 4, almost all responses were positive:

- Good
- Of value for preparing EIS in various projects
- Very useful for screening potential development sites
- Guideline allow the geological heritage of extractive sites to be recorded and geological data obtained during extractive site development
- I used the Guidelines to get an understanding of the IGH Programme and its application relative to the preparation of Planning Applications and EIS
- Provides a structured and reasonable approach on how to manage geological heritage and restoration of quarry sites
- They give a clear roadmap as to how the extractive industry should interact with geological heritage at all stages of an extractive site from early site selection, through planning and production and ultimately site restoration. The Guidelines are a very useful way of demonstrating that the extractive industry has a key role to play in furthering our national geological understanding
- Use for EIS for quarries. Very easy to use

Question 6 (Fig. 4) asked whether people were involved in different sectors of the extraction industry and this showed

Fig. 2 The online survey responses came in three batches due to staggered email requests to four industry bodies

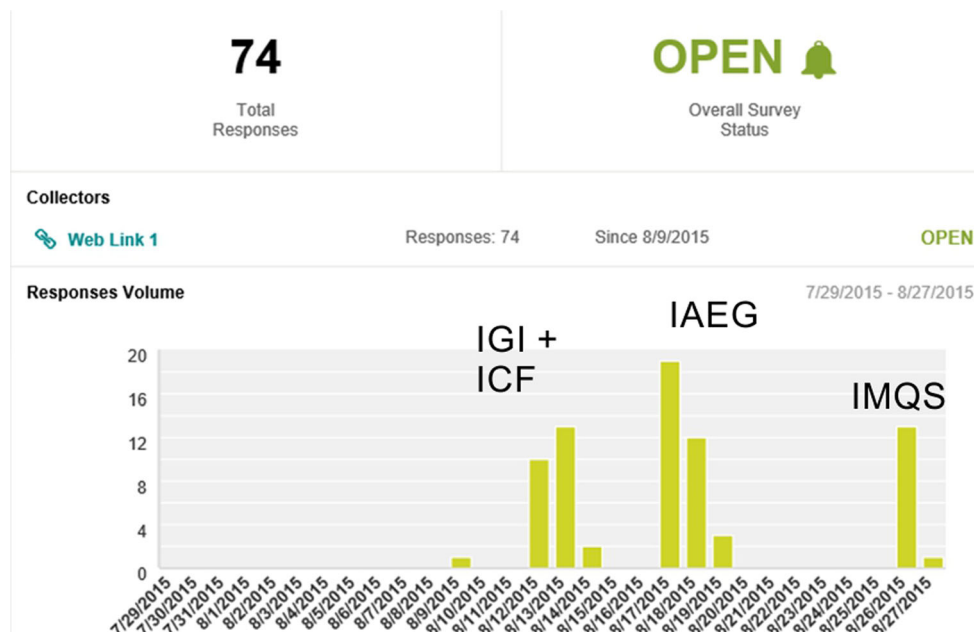
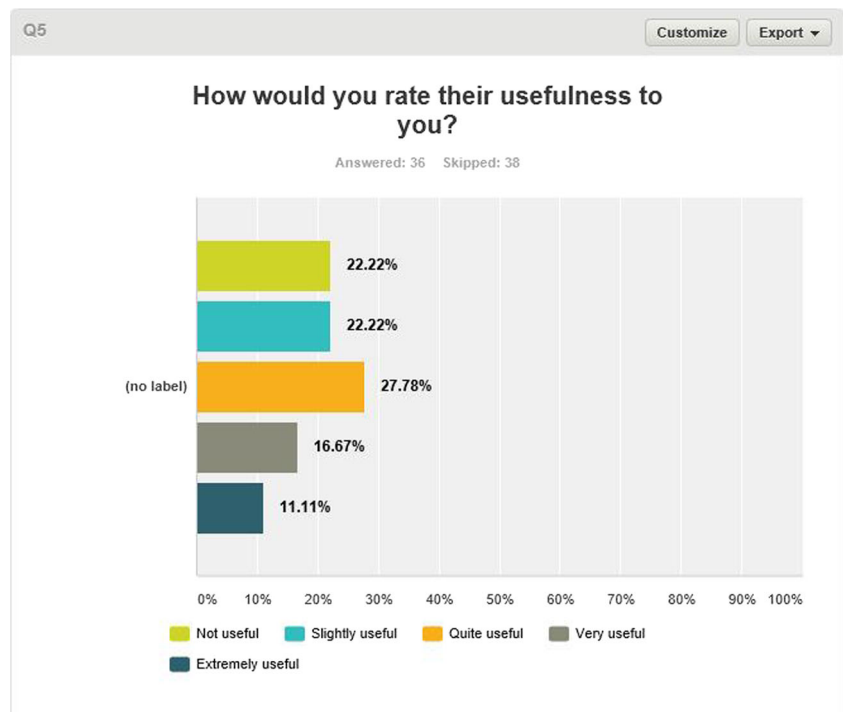


Fig. 3 Question 5 rated how useful the guidelines were; of 36 respondents around one quarter found the Guidelines very useful



almost half were consultants, nearly a quarter were directly involved in quarrying or mining, with only 6% in agencies of government like the Geological Survey of Ireland or the Exploration and Mining Division. Of the remaining 23%

classified as ‘Other’, many different related specialisations were represented.

Our question 7 (Fig. 5) asked people to identify if they were members of the ICF, the IAEG, the IGI or other bodies and as

Fig. 4 Question 6 explored what sector of extractive geology respondents were working in

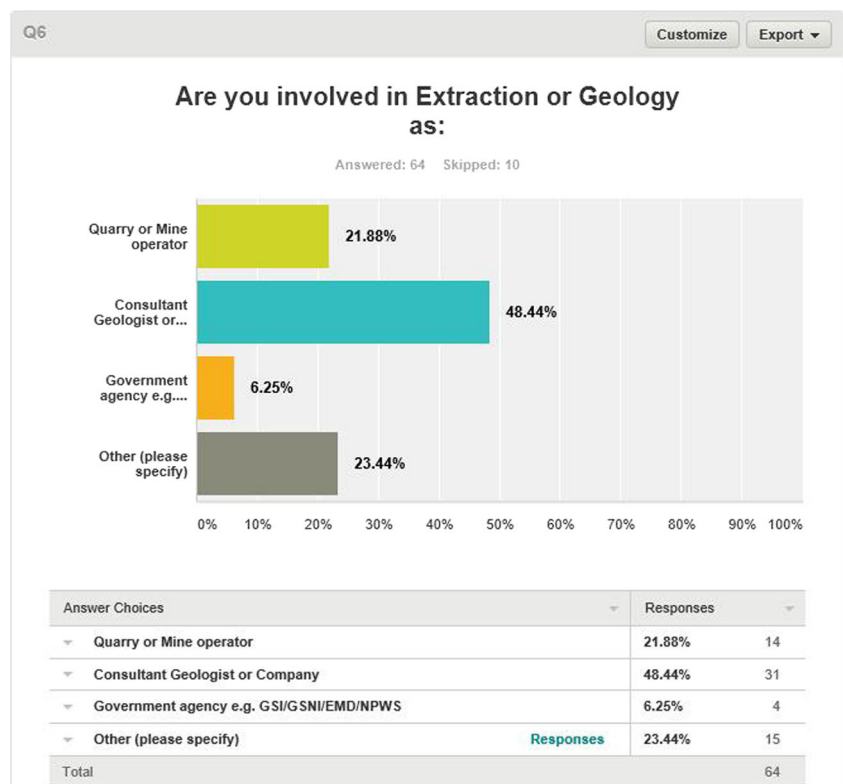
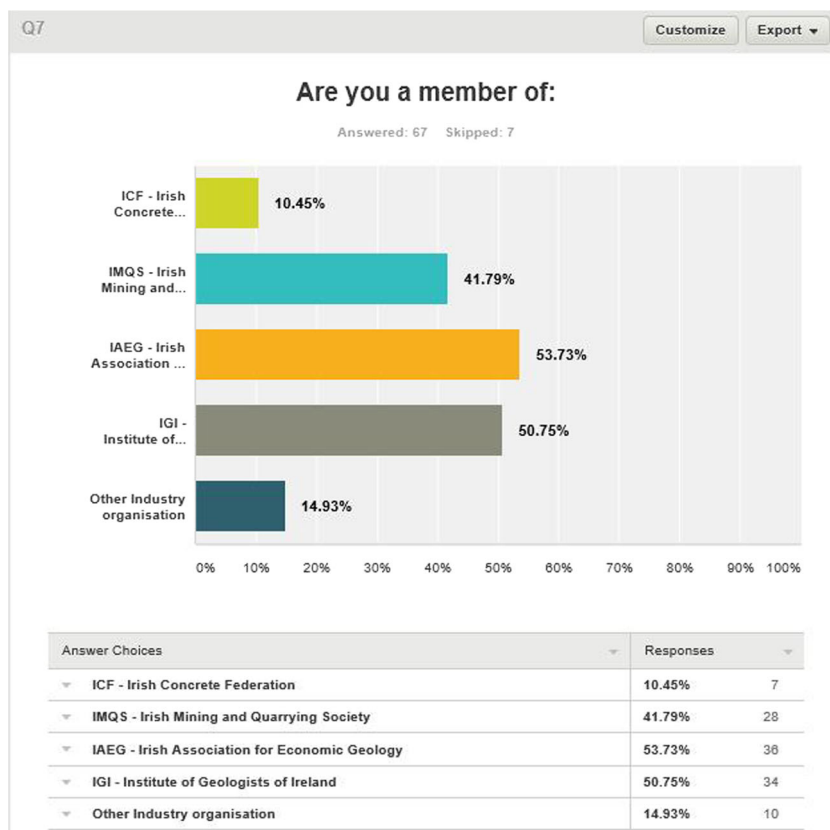


Fig. 5 Question 7 assessed whether geologists in extraction industries are members of more than one industry organisation, including over half who are Professional Geologists (members of the Institute of Geologists of Ireland)



expected the numbers showed many respondents must have been members of more than one body since over 50% each were in the IGI and the IAEG, with 42% in the IMQS and smaller numbers in the ICF and other industry organisations. This reflects the small size of the extraction industry and geological sector in Ireland, but also the plethora of specialist groups for different disciplines and interests.

Despite the numbers of respondents being relatively low for these questions, some useful data became evident, but again some of the general commentary offered in a ‘catch-all’ final question 8 provided us with more insight. Mostly, this related to people’s lack of knowledge of the Guidelines and their support for more promotion of them.

Discussion

In this survey, we attempted to review how useful the Guidelines have been in raising awareness of geological heritage within the industry and if they have been successful at all in helping to protect geological heritage in quarries. Some key points emerged from the survey results:

- Not enough people are aware of the Guidelines
- There is significant scope for new and continued promotion

- The Guidelines have been used by a range of operators, consultants and professional geologists
- Approximately half of them have found them useful/very useful
- Half of those using them are consultants
- Many respondents are members of several different geological organisations

The discussions with significant industry players (in the Republic of Ireland) revealed some key underlying factors that significantly impacted on the take-up of the Guidelines within the industry and which can partially account for the limited awareness of them and the apparent failure to have influenced geoconservation measures:

- the economic crash in 2008 meant an 80% decline in production from ICF members
- no new quarries opened from 2008 to 2015
- there were no new planning applications for quarries from 2008 to 2015 in greenfield sites, though there have been a few extension applications in recent years
- many quarries had to spend time and resources applying for retention permission under new government regulations for the quarry industry (Section 261)

- a notional 1700 quarry sites registered in 2004/2005 under Section 261 regulations was reduced to c. 1200 at the end of the registration process in 2007
- the 2007 figure was probably further reduced by several hundred in a 2012 review carried out by county councils
- there are now very many quarries that are fully compliant with registration and permission, but are in operational suspension until a material demand requires reopening

Case Studies

An intention of this survey and paper was to assess if the Guidelines have been successful at all in helping to protect geological heritage in quarries. Due to the very serious collapse of the industry in 2008, it is difficult to make any informed judgement on this question. However, five case studies do illustrate that the Guidelines have had a role in developing partnership or industry engagement with geological heritage.

Bellewstown Quarry

It is argued that some very constructive co-operation by one major aggregate company (Kilsaran International) with geological research projects has been strongly encouraged through the issue of the Geological Heritage Guidelines. It may have happened anyway based on an individual senior quarry manager with vision, but the Guidelines probably helped in establishing a good working relationship. Stratigraphical and palaeontological studies in the Bellewstown inlier of eastern Ireland have been ongoing for decades, attempting to define the position and track of this ‘island’ terrane from within the Iapetus Ocean of the Lower Palaeozoic. In 2011, construction of new environmental water filtration and protection systems meant that new shallow pits were dug for reedbeds. Not only did Kilsaran International, through Fergus Gallagher, provide full access for study but they also provided a long trench to bedrock to study and collect part of the section that is not exposed, including a condensed limestone horizon (Parkes 2011). In further constructive partnership, they allowed access inside the quarry for accessing freshly exposed areas, and then for the new GSI drilling rig to drill some short test holes, and solve a stratigraphical conundrum in the process. This has resulted in a new collection of graptolites and some zircon radiometric dates from this Ordovician hard rock quarry, constraining the age of the succession and its tectonic story (McConnell et al. 2015). Further work is ongoing with the assistance of the company.

Sand and Gravel Pit

Whilst the location and details of the quarry are not identified for commercial reasons, a recent (2017) detailed engagement between consultants acting for the owner/operator and the GSI has made it very clear that the Guidelines were consulted in great detail and used in arguments about specific aspects of an application to extend the existing quarry into untouched glacial deposits comprising internationally known landforms. Whilst this specific case is ongoing in 2017, the Guidelines have clearly helped define working parameters in the case where planning permission may hinge on the geological heritage.

Hard Rock Quarry

Another 2017 case, also anonymised for commercial sensitivity, concerns a hard rock quarry where the Guidelines were fully embraced by the operator and a creative restoration plan was put together to include public access to retained quarry faces with the best geological features. The outcome of this case is awaited.

Hard Rock Quarry

A further active case in 2017 is proof that the Guidelines have been considered by some industry operators, since the restoration plans discussed with GSI have explored options for retaining public access to parts of the quarry with viewing platform, signs and representative faces retained.

End of Life Quarry Conversion

The Guidelines were used in 2010 discussions with a quarry operator in the preparation of an application to convert a large quarry to an environmental waste facility, including for some hazardous waste materials. Permission for this facility included a temporary viewing platform for the geology of the quarry faces.

As recently explored by Prosser (2016), partnership is critical to any success in geoconservation where quarries are involved. In the UK, this is a well-established pattern with many guidance documents having been issued for the industry by the national agencies (e.g. Prosser 1992, 2003; Prosser et al. 2006). The Geodiversity Action Plans (e.g. national: <http://www.ukgap.org.uk/> and local: e.g. Isle of Wight - www.dinosaurisle.com/lgap.aspx and Doncaster - <http://www.doncaster.gov.uk/services/planning/the-geodiversity-action-plan> and the Geodiversity Charters for different parts of the UK are produced with the support and involvement of industry partners and include examples of many co-operative projects with individual quarries. The English Geodiversity Action Plan is available on the website of the English Geodiversity Forum

(<http://www.englishgeodiversityforum.org/>) and the Scottish Geodiversity Charter for 2015–2023 is available from the Scottish Geodiversity Forum website (<https://scottishgeodiversityforum.org/charter/>). A Northern Ireland Geodiversity Charter has also very recently been launched.

Many European countries have a long tradition of quarry operators providing fossil collecting and other opportunities for geological groups. Although informal good relations exist between geologists and most quarry operators, in the Republic of Ireland, there is no significant documented pattern of such co-operation, and so the issue of the Guidelines marked a small step forward in establishing partnership. As the ICF is a major representative of the extraction industry, it provides leadership that may be followed at local level. The case studies above, despite being essentially undefined in any detail at this time, demonstrate that usage of the Guidelines and active partnership are two distinct things and it is hoped that more partnership actions for the benefit of geoconservation will arise as the Guidelines are promoted and used more in the future. However, in Northern Ireland, there have been more partnership geodiversity actions with industry in specific quarries and school groups. Some of these have been documented in the magazine *Earth Science Ireland* (Gray 2006, Anon 2007, Parks 2008, Bazley 2009, Gaffikin 2013, Sloane 2014).

Planned Future Actions to Promote the Guidelines

The authors plan to make an effort to promote the Guidelines again, in conjunction with the publication of this paper, as a means of acknowledging respondents to the original survey and demonstrating some value in the use of their time. With the original Guidelines it is intended to:

- Send copies to all members of ICF, IMQS and IAEG
- Send copies to all PGeos (IGI Professional Geologist members)
- Send copies to the Chief Executives of all county councils, and to the Planning departments
- Send copies to key individuals in agencies such as the Environmental Protection Agency (EPA), relevant government departments and others
- Send copies to mainstream planning consultants who have worked on EIS etc. for quarries in the past decade
- Write short articles on the Guidelines for relevant newsletters and annual industry magazines of the main organisations represented.

If any reader in another country is considering the preparation and issue of similar Guidelines, the matter of promotion is critical to success. In 2008, underestimation of the level of promotion required is now suspected to be a reason for the

lack of awareness revealed by our survey. It is advised that extensive efforts must be made to actually reach the intended audience. Recirculating group notices would be advisable, rather than assume an original effort has reached all members of a particular group. Given a distinct split in how people access information today, between those who still prefer paper and hard copy, and those who rely on digital distribution, it is essential to cater for both styles of information gathering. Cross posting of notices from different groups and networks should only serve to ensure people become aware of them.

Longer-Term Revision of the Guidelines

The Institute of Geologists of Ireland produced some Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters in Environmental Impact Statements in 2013. Geological heritage is addressed in these and the Extractive Industry Guidelines are referenced as a tool to be consulted and used, which is useful in raising awareness of them. Some possible future actions to develop the Guidelines and prepare a new edition will require a look at different counties to compare how they operate. For example, County Cork has its own database of quarries. There will be a need to link into the Environmental Protection Association (EPA) extractive industry register. A priority action should be to engage with the Department of Housing, Planning and Local Government to encourage publication of a leaflet on planning and geological heritage in a series of planning advice documents (currently 14 in the series – see <http://www.housing.gov.ie/planning/leaflets/planning-leaflets>).

It is necessary to prepare documentation on case studies of good examples of best practice and how quarries have been restored. Considering the paucity of such examples in Ireland, this will require including countries outside of Ireland. There is also a need to connect with local authorities to ensure that County Development Plans include listing the Guidelines in their Development Management Guidelines. Ultimately, a detailed work like Prosser et al. (2006) but dedicated to Irish circumstances, is required to better inform planners, operators and consultants with good practice examples, and to clarify the paradox of quarrying and geoconservation.

One respondent observed that there should be more recording of quarry faces, especially in sand and gravel pits, with perhaps monthly photography as a standard (which is an advisable action in the Guidelines themselves). To make such a requirement mandatory would require an extensive campaign and may not succeed, but to develop a voluntary scheme in co-operation with the Geological Survey of Ireland and an easy facilitation of such recording for industry operators is far more likely to be acceptable to all sides. On a more cautionary note, however, an earlier attempt to provide an online platform in the GSI for reporting temporary exposures saw almost no

engagement from the geological, construction or extraction communities. With the explosion of social media in recent years, a new approach may be required to enable this aspiration.

Conclusions

1. The Guidelines were definitely not promoted as well as they could have been in 2008 when they were published; this could have been improved with better communication between GSI and ICF partners as to the division of responsibilities for distribution.
2. The economic crash in 2008 drastically reduced the importance of the Guidelines to the sector, which contracted by approximately 80%, as other priorities became more important.
3. The results of a survey to assess awareness of them indicate that although their reach was not extensive, they have been very useful to a core audience in the quarrying sector.
4. There was a complete hiatus in any planning applications for new quarries since 2008, hence a long period when the Guidelines were not of great relevance to the sector at all.
5. The time is right for a new effort to promote the Guidelines as the sector is beginning to expand again. Also many quarry managers and others still in the sector have no great experience of planning applications or working with the IGH Programme.

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