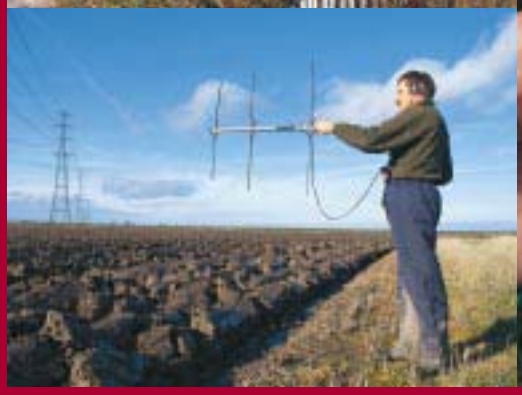
ENGLISH NATURE

Report Number
505

# Mineral collecting and conservation -hammering out a future?

## Proceedings of a one-day conference in Salford, 16 April 2003

English Nature Research Reports



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**Number 505**

# Mineral collecting and conservation – hammering out a future?
# Proceedings of a one-day conference in Salford, 16 April 2003

Compiled by
Hannah Townley, English Nature
on behalf of
English Nature, The Russell Society and
The Geoconservation Commission of The Geological Society of London





ISSN 0967-876X

# Introduction

The conference was co-convened by English Nature, The Russell Society and the Geoconservation Commission of The Geological Society of London. The idea for this conference arose due to the issues surrounding over- and irresponsible collecting, collecting bans, mineral collecting permit policies and the increased powers for English Nature through the *Countryside and Rights of Way Act (2000)*. This conference builds on English Nature's experience of working towards sustainable fossil collecting.

Mineral collecting is scientifically and educationally important and a hobby enjoyed by many. However, many mineral sites are finite and the issue of sustainable collecting on mineral sites is becoming increasingly important. Collecting is fundamental to mineralogical research, and for educational, commercial and aesthetic purposes, but indiscriminate activity can quickly deplete or destroy a mineralogical site.

The aim of the conference was to discuss the different aspects of mineral collecting and the best way of conserving the available mineral resource for future use by all interest groups. This meeting provided an opportunity to share views and identify and discuss issues between the different stakeholders. Speakers were chosen to reflect a wide range of views on the issues surrounding mineral collecting and included; the statutory conservation bodies; professional, hobbyist and academic collectors; museums; landowners; and industrial archaeologists.

All speakers were well received and some of the themes from their talks were drawn on to produce the structure for the debate at the end of the conference. One of the main outcomes of the conference was to highlight the need for further open discussion between all the parties involved in mineral collecting issues to develop an approach to 'responsible' mineral collecting. As a follow-up to this conference, English Nature intends to produce a position statement on mineral collecting, outlining its policy position on responsible mineral collecting.

The views expressed by individual authors in this volume are their own unless stated otherwise. English Nature, the Geoconservation Commission and The Russell Society will not be held responsible for any opinions expressed in the text.

Hannah Townley
English Nature

July 2003

# Acknowledgements

This conference was organised by Prof Peter Doyle (The Geological Society of London's Geoconservation Commission), Prof Alan Dyer and Dr Frank Ince (The Russell Society) and Dr Colin Prosser, Dr Hannah Townley and Dr Mick Murphy (English Nature).

Jennifer Yau and Emma Clifton (English Nature) are thanked for administrative support during the organisation of the conference. Thank you to Alan Dyer, who chaired the afternoon session and to Peter Doyle, who chaired the morning session and the concluding debate. Thanks also go to all the presenters, all those who contributed to the debate or the proceedings volume and to Hannah Townley for compiling the volume. David Green and Brian Jackson are thanked for their editorial contributions.

Financial support for the conference, from English Nature, is gratefully acknowledged.

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**University of Salford, 16 April 2003**

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10.30 The mineral resource: what it is, who collects it and why (Brian Young, British Geological Survey)

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# The mineral resource: what is it, who collects from it and why, and what threatens it?

Brian Young[1]
British Geological Survey, Murchison House, West Mains Road, Edinburgh EH9 3LA

## Introduction

Minerals, whether in the ground, or as specimens in collections, are elements in a nation's heritage as important as any work of art, historic building or wildlife site. Whereas inappropriate management of any of these would today be unthinkable, minerals have hitherto been rather overlooked as part of this heritage.

Like most natural objects, minerals have long attracted collectors, many of whom have played a key part in building the collections without which mineralogical science would have been impossible. Recreational collecting is probably more popular today than even in the heyday of the Victorian collector-naturalists. However, mineral collecting is not just the preserve of the amateur collector. Other forms of collecting include dealers and academic researchers. All have very different objectives and different methods of operating. All have a legitimate place in the science of mineralogy: all place demands on the mineralogical resource.

With the closure of all but a handful of Britain's mines, and the long years of abandonment of workings in former mining fields, the mineralogical resource in the field is finite and declining, especially under continuing collecting pressures.

Whereas a significant number of today's collectors, like their predecessors, fulfil an important role in modern mineralogy, the activities of a very large number can only be viewed as seriously destructive.

The need to restrict the collecting of most natural objects is well established in Britain. Indeed, in the wildlife field the law has long protected many species from collection, or in some instances even disturbance. Until comparatively recently mineralogy was almost unique in natural history in regarding collecting as acceptable and subject to few real constraints. Collecting will continue to have a crucial role in furthering our understanding of minerals but, if we care as much for our mineralogical heritage as we do for our wildlife and archaeological heritage, some form of control is needed, and urgently. Whereas a place clearly exists for legal regulation, a change of culture on the part of many collectors is also essential.

## What is the resource?

Britain has a greater variety of geology than almost any comparably sized area on Earth. This geological diversity offers an enormous range of mineralogical riches, be they as essential components of the rocks themselves or as discrete mineral deposits, many of which have

[1] In this review of the mineralogical resource the views expressed are those of the author, developed over many years experience of mineralogical sites, and do not necessarily reflect the opinions of BGS.

formed the basis of centuries of economic and social history. The mineralogical resource is part of the country's natural heritage.

The resource may be considered to comprise mineralogical material which exists in the field where it is available for study *in situ,* or for collecting. In addition, the mineralogical resource may be seen to include material which has already been collected, and which is, together with accompanying documentation, at least theoretically, available for study. The resource also encompasses the extensive scientific literature relating to the mineralogy of Great Britain, as well as the collectors themselves.

It is all too easy to imagine the nation's mineralogical heritage as synonymous with fine specimens of beautiful or unusual species. This is a perception common to many recreational collectors, and although an important facet of the topic, is by no means the full picture. By definition, rocks are aggregates of minerals. Any study of the composition, origins, or use of rocks, or rock formations, for whatever purpose, depends very much upon a knowledge of the mineralogy of those rocks. Attractive though many may be, minerals should not be seen purely as aesthetic objects. They are the products of, and often the tangible evidence for, complex Earth processes. Deciphering these through the full range of techniques available to the modern science of mineralogy has enormous potential and application beyond the individual mineral specimen. All minerals, whether strikingly beautiful, ordinarily dull, rare, or common, have an important contribution to this understanding. They all comprise essential elements in the mineralogical resource. An understanding of the component mineralogy is as important to unravelling the nature and history of a mudstone or a recent sediment as it is to revealing the origins of a basalt, a granite or a mineral vein.

A major source of mineralogical material derives from the working of Britain's diverse mineral deposits. When accessible, in working or abandoned mines, these comprise important parts of the resource, offering unique opportunities to study minerals and mineral assemblages *in situ*. Associated spoil heaps commonly provide major sources, in some instances the sole remaining evidence, of mineralised material from these deposits. With the demise of mining these are a finite and diminishing resource.

Mineralogical collections in national and regional museums commonly offer the only means of researching material from sites which are now inaccessible, or from which mineralised material has long been unobtainable. Over recent years important new discoveries, in some instances leading to the identification of new mineral species, have been made through such work. Examples include namuwite (Bevins *et al,* 1982), macphersonite (Livingstone and Sarp, 1984) and scotlandite (Paar *et al.,* 1984). Private collections, maintained to variable curatorial standards, may well contain important examples of representative material, though the whereabouts and scope of such collections is commonly difficult or impossible to establish. Mineral collections thus comprise part of the mineralogical resource.

Published literature on British mineralogy comprises another element of the resource. Whereas much of this literature is the result of professional work, a significant number of important contributions, notably those dealing with aspects of topographical mineralogy, stem from the work of amateur collectors. In this respect all collectors are included as part of the mineralogical resource. For many areas detailed knowledge of sites and the minerals they contain, resides with a small and enthusiastic group of local collectors, many of whom may be regarded as experts on their chosen area. Field mineralogy remains one of the few scientific pursuits still to offer a true role to the amateur. (Young, 1994, p 440).

## Who collects from it and why?

Collecting takes a variety of forms, is carried on by a variety of people and for a variety of purposes (Bevins, 1993; Young, 1993; 1994; Starkey, 1993).

Minerals have always exercised an appeal to the curious and to collectors of natural objects. This is as true today as ever, and many casual visitors to a site may be attracted to carry away some piece of mineral as a souvenir of their visit. Children and educational groups are commonly keen collectors of such pieces. Such collecting rarely poses any threat to the integrity of a site. Indeed, as some form of collecting at an early age often fosters an interest in natural sciences, and may even lead to a career in Earth science, such collecting has merit. However, with the rapid depletion of many sites, raising awareness and focussing such educational activities away from sensitive locations deserves encouragement.

Today's collector is often more sophisticated than his or her predecessors of even a decade ago. Most serious collectors today routinely access a wide range of mineralogical literature and other relevant archival information. Many have skills in determinative techniques and have often established working contacts with institutions or individuals capable of undertaking modern determinative methods. Some, though by no means all, collectors are keen to share their finds and information with museums and other research institutions.

Amateur collectors are driven by a variety of eclectic motives. For example, some are content to acquire representative, but otherwise unremarkable, examples of generally common minerals. Others, the mineralogical equivalent of the 'twitchers' of the bird world, collect as great a variety of species as possible, without necessarily gaining any understanding of what it is they are collecting. Some collectors concentrate on one group of minerals or those from a particular area and often become remarkably knowledgeable and commit their findings to permanent record in published reports, or as contributors to scientific papers, commonly in association with professional mineralogists.

Two unrelated phenomena have impacted significantly upon modern mineral collecting. The progressive depletion of many sites, over years of collecting, allied with the availability of inexpensive, but good quality, stereomicroscopes, has spawned the practice of 'micromounting'. Introduced some years ago from the USA, this has become a major aspect of mineral collecting in Britain today. Practitioners seek to collect tiny specimens to be viewed as 'micromounts' under the microscope. Well-crystallised or otherwise aesthetically pleasing material is preferred. Massive, amorphous or apparently drab minerals are usually held in low esteem or discarded. 'Micromounting' has undoubtedly made the mineralogical world more accessible to a large number of collectors, many of whom have developed skills in mineral identification such that numerous significant finds of hitherto unrecorded species have come to light. However, some significant disadvantages which attach to this practice are discussed below.

Probably for as long as there have been mineral collectors, there have been mineral dealers or commercial collectors eager to supply coveted specimens for a price (Wilson, 1994). Like amateur collectors, numerous dealers, many of whom lack formal training in mineralogy, have made extremely important contributions to mineralogy. Our museum collections would be the poorer, perhaps might not even exist, had it not been for their efforts. A feature common to most dealers is that their trade is typically dictated by aesthetic considerations and

perceptions of what is collectible, and thus saleable. A dealer will often wish only to acquire beautifully crystallised or colourful material, and chose to ignore associated minerals which may be either extremely rare or which may provide important insights into the paragenesis or origins of the deposit. The dealer's perception of value is normally an estimate of its saleable value and may bear no relationship to any scientific merit.

A few museums enhance their collections by collecting, sometimes in collaboration with amateur collectors, often from localities under some form of threat. By this means existing national collections are significantly enhanced and the material collected is fully documented and professionally curated. Much research is undertaken using material from existing collections, but many research projects require the use of newly collected material coupled with modern field observations. Such research rarely requires aesthetically pleasing specimens and often necessitates the acquisition of minerals commonly discarded or even destroyed by the amateur collector.

## What threatens the resource?

A finite resource is vulnerable and cannot be sustained unless it is managed effectively.

Collecting presents the most obvious, and readily identifiable, threat to the U.K. mineralogical resource. Although a vital part of mineralogical investigation which has contributed much to the understanding of our natural heritage, it is a destructive practice which, if uncontrolled, will eventually render worthless any sites of mineralogical interest. Numerous sites across Britain have already been seriously depleted, or damaged irreparably by uncontrolled, or even illegal, collecting. Examples include numerous small mine spoil heaps in the Caldbeck Fells, Cumbria, several underground mines in the northern Pennines, and the famous Hope's Nose gold mineralisation at Torquay, Devon. In this context 'rescue collecting' of specimens may be an appropriate means of preserving scientifically important material from especially sensitive sites (Nature Conservancy Council, 1987). The recovery of specimens specifically for museum collections, in some instances from vulnerable sites, can also be seen as a form of rescue collecting. Whereas such collecting can safeguard important specimens, it may not always be able to preserve adequate evidence of the full context of the material rescued, and is thus best employed only in cases of most extreme risk.

Paradoxically one of the most effective means of revealing the country's mineralogical heritage can also be a potent threat. Mining and quarrying commonly expose important material which, if not collected, will inevitably disappear through the crusher or treatment plant. In these circumstances appropriate collecting offers the only hope of saving such material, though with ever more onerous safety legislation access to workings is increasingly difficult to arrange.

Commercial dealers are commonly singled out for opprobrium. Whereas numerous sites have certainly suffered serious damage by unauthorised commercial collecting, dealers can, and often do, fulfil a particularly useful role in recovering material from active mines or quarries.

As great a threat as damaging or destroying the resource is the lack of understanding of the minerals, or their context, by some collectors, many of whom see minerals in isolation, purely as targets for their own collecting. Any associated material or minerals which do not excite their interest are perceived as waste, or "worthless matrix", to be discarded in order to obtain

a choice specimen. This is most evident in the practice of 'micromounting', where very large amounts of potentially interesting or scientifically important material are commonly pulverised beyond any useable size in pursuit of an aesthetically pleasing 'micromount'. Even where the preserved 'micromount' displays a mineral or minerals of interest, it is not uncommon to find that insufficient of the accompanying matrix is preserved to enable the mineral to be seen in context. Several mineral localities, including many mine dumps on the Caldbeck Fells, Cumbria, have been effectively rendered useless for serious study by the activities of 'micromounters'. The very modest size of the retained specimens is commonly cited as evidence of restraint in collecting. More significant is the volume of material destroyed in its collection and the level of 'collateral damage' was inflicted upon the locality. The sustainability of this form of collecting, which appears to be a significant threat to the mineralogical resource, invites serious scrutiny.

These problems focus attention on the need to define clearly the objectives and methods of collecting in order to conserve an important, and irreplaceable, resource. Recent attempts to control unauthorised and destructive collecting in the Caldbeck Fells in the northern Lake District, have met with mixed responses (Young, 2000). Whereas many collectors have accepted the need for control measures and obtained collecting permits, many others have expressed vigorous opposition. Objections include suggestions that collecting metalliferous minerals offers an important contribution to ridding the fells of dangerous toxic contaminants or that collecting as many minerals as possible is essential to prevent their inevitable destruction by weathering.

Abandoned mineral workings, whilst an important resource to the Earth science community, are frequently perceived in a less favourable light by planners. Sites may present environmental or safety hazards requiring remediation but many offer no threat, though may be perceived as eyesores in need of removal. Thus, many important sites have already been lost, often without any consultation with the Earth science or mineralogical community. Appropriate consultation, together the preservation of adequate material and records, should form part of all such restoration projects.

Many mineralogical sites have other associated interests, notably industrial archaeology. Recent years have seen a drive to identify and list the most significant of these under a variety of scheduling schemes. Despite their obvious connection with Earth science, in few cases has any consideration been given to this interest in the evaluation and scheduling process. Although such scheduling might protect artificial structures, it can effectively destroy the Earth science interest of the site by restricting or preventing any disturbance or collecting from spoil heaps or outcrops. Some management proposals for scheduled mine sites have proposed the importation of exotic mineral wastes to undertake landscaping, for example at Coniston in Cumbria. It is difficult to imagine a more damaging activity at sensitive mineralogical sites. Many mineralogical sites also exhibit significant biological interest. Here again, in planning for conservation there appears to be little sharing of views or proposals with other interest groups, though studies by Jenkins and Johnson (1993) and Purvis (1993) demonstrate the value of such a multidisciplinary approach.

Thus scheduling or conservation plans designed to protect one interest should not be allowed to cause damage to related interests. It is essential to establish effective dialogue between conservation bodies to ensure an holistic approach to management, if inadvertent damage is not to result. Local geodiversity action plans offer an effective means of identifying, and

hopefully eliminating, such risks. At present inappropriate and conflicting conservation interests are a major threat to the mineralogical resource.

## Conclusions

Mineral collecting has made essential contributions to the science of mineralogy. The ability to collect material from Britain's mineralogical resource is a vital part of Earth science research. Whereas many sites are robust and are unlikely to suffer serious damage by present or potential future levels of collecting, many are extremely vulnerable. Collecting practices are imposing unacceptable pressures on scarce resources at some sites. Previous proposals to encourage a more responsible attitude by recreational collectors (eg Young, 1994), and attempts to regulate sustainable collecting by some land owners and conservation bodies, appear to have been frustrated by a lack of support from sections of the collecting fraternity. If we value and wish to preserve and protect our mineralogical resource for all legitimate interests, including recreational collectors, a significant change in culture is required by all, backed if necessary by enforceable controls. With such safeguards, and by engaging with other interest groups in an holistic fashion, Britain's mineralogical resource can not only be secured but enhanced.

## Acknowledgements

The views of numerous collectors, dealers, museum curators, colleagues and representatives of local authorities and conservation organisations are incorporated into this text. I am especially grateful to my colleagues Drs David Millward and Martin Smith for helpful discussions and comment.

This paper is published with the approval of the Director, British Geological Survey (NERC).

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# Mineral sites – legislation, conservation and co-operation

Colin Prosser & Hannah Townley
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## Abstract

The geology, including the mineralogy, of Great Britain is diverse and of great scientific importance. Mineralogical sites currently provide a resource for scientific study, education and specimen collecting for a range of end-uses, as well as for the study of industrial archaeology.

Efforts to conserve the best of British geology have resulted in many mineralogical sites of national importance being identified and designated as SSSIs (Sites of Special Scientific Interest). Other sites, of regional/local mineralogical importance have been designated as RIGS (Regionally Important Geological/geomorphological Sites). Some sites may also fall into areas designated for landscape conservation (eg National Parks, Areas of Outstanding Natural Beauty), for wildlife (Special Area for Conservation) or for industrial archaeology (Scheduled Ancient Monuments). Future approaches to mineral collecting must take full account of these designations as well as addressing the politically and socially driven goal of sustainable development.

In contrast to many other types of geological site, most mineralogical sites have a finite supply of minerals. Thus, irresponsible collecting can lead to the total loss of the mineralogical resource – an unacceptable and unsustainable practice.

In order to successfully conserve our heritage of mineral sites, it is essential to manage them in a sustainable fashion. This involves, amongst other things, developing and implementing an agreed approach to responsible mineral collecting. To do this, all stakeholders including site users, managers and owners need to understand each others views, take full account of conservation legislation, and work together to reach an agreed way forward.

## Introduction

The geology of Great Britain is spectacular and diverse, with many sites and features being of great scientific importance. Along with a wealth of rocks, fossils, geomorphological features and physical processes, our mineralogical heritage makes a major contribution towards Great Britain being one of the most geodiverse areas in the World. However, having a geological heritage of such great scientific importance and diversity, brings with it, a moral responsibility to conserve it for future generations to study and enjoy.

Mineralogical sites form a key part of this geological resource, with 87 nationally important mineralogical sites being notified as SSSIs (Sites of Special Scientific Interest) in England alone. In addition to this, many other mineralogical sites have been identified as being of regional or local conservation importance, and have been designated as RIGS (Regionally Important Geological/ geomorphological Sites). Numerous other mineralogical sites also exist with no geological designation, and these too contribute in some way to our wealth of geodiversity, and are enjoyed by many people in many different ways.

Issues relating to mineral collecting and conservation were last explored in any depth as part of a conference held at the University of Manchester in 1992. This paper builds upon views expressed in Manchester and subsequently published papers (Starkey, 1993; Young, 1993).

## Why do we need to conserve mineralogical sites?

The scientific importance of British geology, and the need for its conservation, has been recognised by government since 1947, when a report, *Command 7122, Conservation of Nature in England and Wales*, was published by the 'Wild Life Conservation Special Committee.' This committee, set up by the government of the day to explore issues around the development of a national approach to nature conservation, fully recognised the scientific and educational importance of geology, and through its report, paved the way for geological conservation to be included in the *National Parks and Access to the Countryside Act* (1949), and all subsequent nature conservation legislation in Great Britain.

In more recent times, the concept of sustainable development has been high on the political and social agenda. Definitions such as "development that meets the need of the present without compromising the ability of future generations to meet their own needs", "effective protection of the environment", and "prudent use of natural resources" have come to the fore, and are relevant to the way mineralogical sites should be managed. There is certainly an increasing desire within society to see our natural heritage handed on in a healthy state to future generations.

Given a long standing governmental recognition of the importance of our geological heritage, expressed through nature conservation legislation, strong support from the scientific community through involvement in geological conservation, a growing voluntary conservation movement, increasing concern about damage to mineralogical sites, and increased public interest in conservation and the sustainable use of our natural resources, there is a strong and growing social and political drive for conservation. This includes conservation of mineralogically important sites.

## Conservation tools

The legislation, policy and practice relating to geological conservation has been described widely in recent years (Nature Conservancy Council, 1990; Ellis *et al*, 1996; and Prosser and King, 1999). In short, the primary activities are the identification, notification, management and promotion of SSSIs on a national scale, and RIGS on a regional/local scale. This is coupled with various initiatives to raise awareness of our geological heritage and the need to conserve it. Putting to one side the extremely important, but more 'educational' role of raising awareness of the need for geological conservation, the main thrust of mineralogical site conservation in the UK revolves around site-specific conservation designations.

Designation as a SSSI, under the *Wildlife and Countryside Act (1981)*, is the main tool available for conserving nationally important mineralogical sites. SSSIs must be of at least national scientific importance. Candidate sites have been identified and assessed with great rigour through the GCR (Geological Conservation Review), a systematic site selection exercise carried out on a Great Britain wide basis by geological specialists from across the geological community (Ellis *et al*, 1996). GCR site status offers little protection in itself, but once a site is approved as being of SSSI standard, by the Council of the appropriate country

conservation agency, full statutory conservation legislation applies. There are 101 mineralogical GCR sites in England, notified as 87 SSSIs.

In practical terms, an SSSI is a nationally important site notified to the Secretary of State for the Environment, the relevant planning authority, and the owner/occupier of the land in question. Documentation includes a brief description of the scientific importance of the site, a map showing the location of the notified interest, and a list of operations which are likely to damage the special interest of the site (OLDs) where consultation with English Nature is required prior to the activity being undertaken. Examples of a SSSI citation (figure 1), boundary map (figure 2) and OLD list (table 1) are given for Meldon Aplite Quarry SSSI, Devon (see below). SSSI status should ensure that there is consultation with English Nature over any potentially damaging activity or development planned for an SSSI. In many cases, activities and development can be accommodated without damaging the designated interest, but where this is not possible the case may be determined at a public inquiry. The biggest threats to geological sites are: coastal protection, landfill, poorly sited development and neglect. On mineralogical sites collecting too is a threat too.

In addition to the safeguard aspect, SSSIs are expected to be managed appropriately for their notified conservation interest, and thus may be subject to site management work or enhancement. This requirement is emphasised in the *Countryside and Rights of Way Act (2000)* which strengthened nature conservation legislation in England and Wales, making it an offence for a third party to "knowingly or recklessly damage an SSSI". Irresponsible mineral collecting could certainly be described in this way.

For regionally/locally important mineralogical sites, designation as a RIGS offers a non-statutory option for conservation. RIGS sites can be notified to local authorities, and although not given statutory protection, become a material consideration in considering any planning applications that may impact on them.

A number of other, non-geological designations can influence how a mineralogical site is managed. Landscape designations such as National Parks run by National Park Authorities (there are seven in England, accounting for 7% of the land) and Areas of Outstanding Natural Beauty (there are 35 of these 'jewels of the English landscape' covering 15% of England) both have implications for activities on mineralogical sites. The same applies for wildlife conservation designations, in particular biological SSSIs and sites of European importance such as SACs (Special Areas for Conservation), which often coincide with sites of mineralogical interest, and place significant requirements on how land is managed.

A further relevant designation is that of a SAM (Scheduled Ancient Monument). This is very topical, with a number of mineralogical sites being designated as SAMs or identified for designation as part of English Heritage's monuments protection programme relating to industrial archaeology. Designation of a mineralogical site as a SAM has major implications for management of mineral collecting.

COUNTY: DEVON SITE NAME: MELDON APLITE QUARRY

DISTRICT: WEST DEVON

**Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act, 1981, (as amended).**

Local Planning Authority: DEVON COUNTY COUNCIL, Dartmoor National Park Authority

National Grid Reference: SX 566919 Area: 20.8 (ha.) 57.4 (ac.)

Ordnance Survey Sheet 1:50,000: 191 1:10,000: SX 59 SE

Date Notified (Under 1949 Act): 1964 Date of Last Revision: 1976

Date Notified (Under 1981 Act): 1986 Date of Last Revision:

**Other Information:**
Within Dartmoor National Park. Boundary amended by extension.

**Description and Reasons for Notification:**
This site consists of two quarries in the Meldon Aplite with an associated suite of very rare minerals. In the southern quarry the aplite, mainly within hornfelsed shalves and tuffs, is about 20m thick. In the upper level of the quarry it splits into several smaller dykes. Mineralisation along joints through both the aplite and the tuffs consists mainly of fluorite (calcium fluoride). Local pegmatite segregations contain most of the interesting minerals. In the northern quarry the aplite comprises several dykes up to 2m in width, with many offshoots into the cherts and shales. Contacts with these rocks are often mineralised and these can be clearly seen in both quarries.

The aplite is lithium-beryllium rich, and this is reflected in the mineralogy. Petalite (a lithium-aluminium silicate) may be found in perthite veins and occasionally as disseminations in the aplite up to 30% by volume. Lepidolite mica is common and other lithium rich phases include spodumene, montebrasite, amblygonite, and lithium-rich pink and green tourmalines. Beryllium is represented by beryl, chrysoberyl, beryllonite, milarite, eudidymite, bavenite and rhodizite. The last named also contains caesium and boron. The only other known caesium mineral, pollucite, is also in the aplite, while boron is also present in axinite, tourmaline, datolite and priceite. Many of the minerals listed above are unknown elsewhere in Britain and only known from a few localities in the world. Columbite has also been recorded from Meldon. However, the more common minerals such as feldspar, muscovite, apatite and topaz are also of interest in the more pegmatitic parts of the dyke, while prehnite occurs in some veins and cordierite in the surrounding shales. The Meldop Aplite Quarries are world famous for the variety of rare granitic minerals they contain.

Red-a-Ven, an old copper trial mine in the Meldon Chert Formation, has a sulphide-rich chert bed about 0.75m wide, containing abundant pyrrhotite with arsenopyrite and chalcopyrite, which outcrops in the Red-a-Ven Brook below the mine dumps. It is associated with narrow bands of wollastonite hornfels (scarns) containing tin-bearing garnets and the rare tine silicate mineral malayaite. The garnets are of two types, both the andradite and grossularite are tin-bearing, but the amount present varies depending on the presence or absence of malayaite in the same rock. Other minerals of interest are scheelite, helite, axinite, datolite, danburite, lollingite, bornite, molybdenite, pyroxenes, and good specimens of green idocrase.

The dumps at Red-a-Ven yield interesting specimens of sulphide bearing scarns and cherts in which the associated tin-tungsten mineralisation is represented by unusual silicates. Malayaite is only known from one other locality in the world and tin-bearing garnets are also very unusual. The site is important for research on the genesis and metallurgical benefication of ore-bearing scarns. In addition, interesting specimens of fairly rare calc-silicate minerals can be collected.

**Figure 1** Citation for Meldon Aplite Quarry SSSI

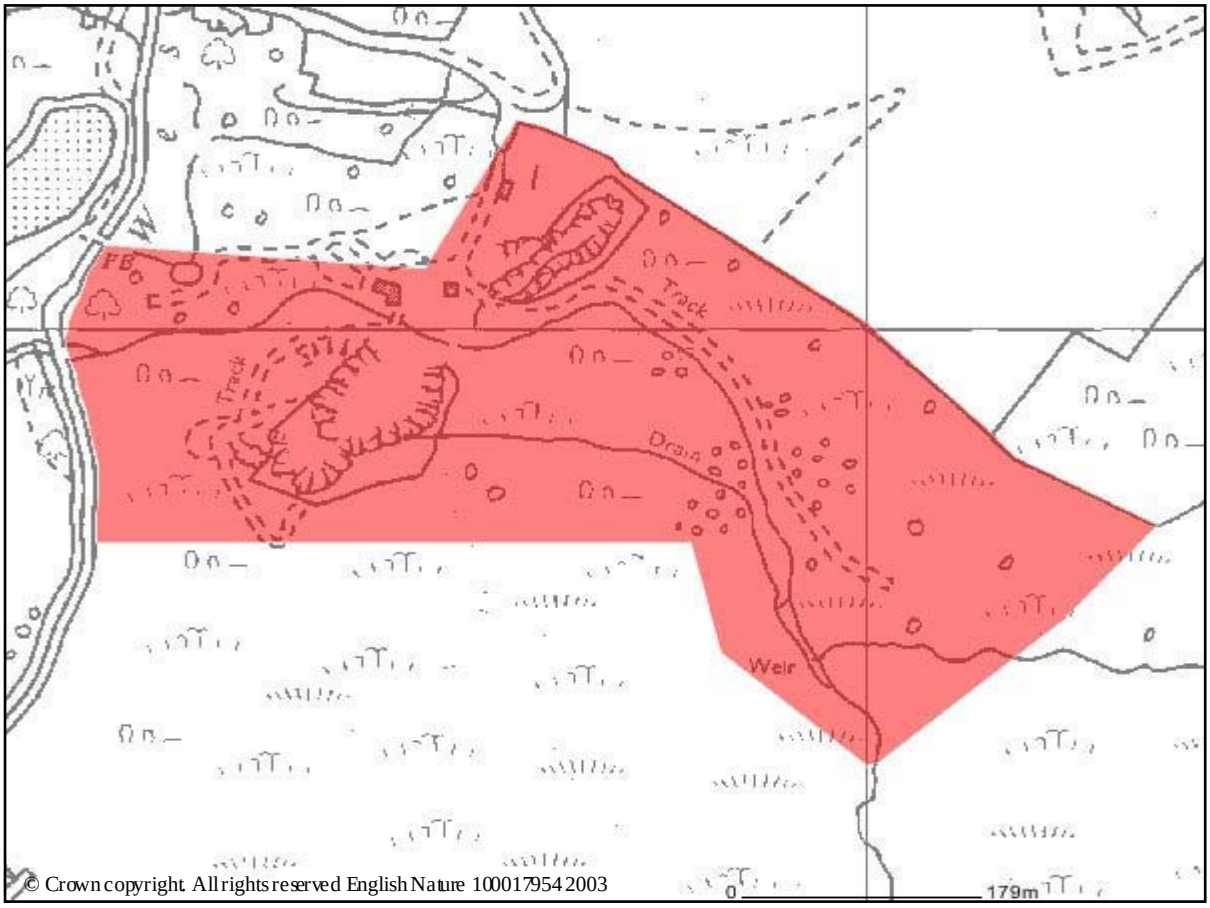


**Figure 2** Map of Meldon Aplite Quarry SSSI; solid grey shading highlights the site.

**Table 1** Operations likely to damage (OLDs) for Meldon aplite Quarry SSSI. These operations require consent from English Nature before they are undertaken.

| Standard reference number | Type of operation |
|---|---|
| 7 | Dumping, spreading or discharge of any materials |
| 12 | The introduction of woodland management including afforestation or tree planting |
| 15 | Infilling of quarries |
| 20 | Extraction of minerals |
| 21 | Construction, removal or destruction of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, or the laying, maintenance or removal of pipelines and cables, above or below ground |
| 22 | Storage of materials on or against any rock outcrop or the mineral dumps |
| 23 | Erection of permanent or temporary structures, or the undertaking of engineering works, including drilling |
| 24 | Battering, buttressing or grading rock faces or grading mineral dumps |
| 25 | Removal of geological specimens including minerals |

## Who has a role in mineral site conservation?

In Great Britain, the key players in delivering the conservation of nationally important mineralogical sites are the three nature conservation agencies (the Countryside Council for Wales, English Nature, and Scottish Natural Heritage). These agencies, working in their respective countries, act as advisers to government on nature conservation issues, and have a lead role in identifying, protecting and managing mineralogical sites, especially nationally important mineralogical SSSIs. These agencies are statutory consultees on any proposals impacting on the designated interest of an SSSI.

With regard to regionally/locally important sites, the RIGS movement and other local geological groups have an important role to play in mineralogical conservation. Many mineralogical sites of importance on a local scale may have been identified as RIGS and included in local development plans. Here, RIGS groups can advise the appropriate local authority on the impacts that any proposed development or use of a RIGS may have on its interest. RIGS groups also play a role in promoting the use, understanding and sustainable management of RIGS within their local community.

English Heritage, and their equivalents in Scotland and Wales, through their role in the conservation of industrial archaeology, have an important role to play in the management of mineralogical sites, although this is not from a geological perspective. The increasing number of mineralogical sites, including some SSSIs, which are being declared as Scheduled Ancient Monuments, means that industrial archaeology is becoming a very significant issue on a number of sites.

Others with an important role to play in conservation management of land where a mineralogical site occurs includes countryside managers such as National Park Authorities, the National Trust, and any other owners or occupiers.

Despite the very important roles of the agencies and conservation groups described above, truly successful conservation can only be achieved if everyone with an interest in mineralogical sites works together responsibly to manage and use sites in a sustainable manner. Thus, conservation agencies and groups need to work with landowners, land managers and planners, as well as with site users such as scientists, educationalists, and mineral collectors (academic, educational, commercial and recreational).

## Conservation principles

Many geological sites, for example the fossil rich cliffs of the Dorset coast, have laterally or vertically extensive features of interest and are therefore able to accommodate responsible specimen collecting without serious damage to their special interest. In fact, for an eroding coast or working quarry, specimens are lost to erosion or a ‘crusher’ if not collected.

Mineralogical sites, however, rarely fit into this ‘extensive features’ type of site, and tend to occur as discrete veins or dumps, and are much more finite in nature. Here, collecting can very quickly result in complete removal of the mineralogical feature of interest, and destruction of the interest of the site. If a site is a mineralogical SSSI with a finite resource, its safeguard and management revolves around having the site available for use, but in a way that maximises the scientific gain from any collecting, whilst also retaining a resource for the future. It is important to involve a range of partners, especially museums, in collecting from

finite resources within a mineralogical SSSI. For a RIGS site, integrating educational use with collecting and conservation is likely to be the management challenge. Management of a site with no mineralogical designation should allow a more relaxed approach to collecting, but should still take account of the need to manage all of our natural heritage in a sustainable manner.

In all cases described above, the 'ideal' approach to management of a mineralogical resource will be complicated by the need to take full account of the wishes of those who own or manage the site, as well as of any other designations on the land such as for wildlife or archaeology.

To further illustrate principles for conservation it is useful to consider examples of good and bad practice that regularly come to light.

Examples of bad practice include Hopes Nose to Wall's Hill SSSI, Devon (see figure 3), where intensive and unconsented collecting, using rock-saws, has effectively removed gold-bearing limestone-hosted veins of very limited extent (Murphy, 2001). Here, there has been no scientific gain, no material has been placed in museums, and the specimens have been in effect stolen. At Meldon Aplite Quarry SSSI, also Devon, where pegmatite pods within the aplite contain rare caesium, lithium and beryllium minerals, numerous cases of un-consented collecting have resulted in the pegmatite being broken up by hammers and chisels then removed. Landowners here have reported the theft of material to the police, and in a recent case, a member of the public was threatened with a chisel when they tried to intervene.

Good practice in mineral collecting is as yet hard to find. The collecting scheme recently introduced on the Caldbeck Fells, Skiddaw Group SSSI, Cumbria (see figure 4) may help to point a way forwards. Here intensive mineral collecting is being managed by the Lake District National Park through a permit system. Meetings with key players have been held, designations are being taken account of, emphasis is on consented collecting for scientific purposes, with others interested in minerals being catered for through a series of specially arranged educational days.

Figure 3 Bad practice in mineral collecting. Hope's Nose to Wall's Hill SSSI, Devon, showing damage caused by unconsented collecting using rock-saws.
Photo by Mick Murphy, English Nature.

Figure 4 Good practice in mineral collecting? Roughton Gill, Skiddaw Group SSSI, Cumbria, where a managed approach to mineral collecting has been introduced.
Photo by Mick Murphy, English Nature.

## Principles for going forward

Over the last 15 years English Nature has been heavily engaged in addressing the issue of sustainable fossil collecting. Here a number of similar issues arise to those with mineral collecting and it is possible to learn from this experience where working together has resulted in good dialogue and partnership working, well thought out positions, the hosting of conferences, production of publications and the implementation of trial collecting schemes (English Nature 2002, Bassett *et al* (eds) 2001).

Drawing on this experience, the principles for developing a sustainable approach to mineral collecting are:

- Raising awareness of the views of all stakeholders, including owners, managers & users of sites.
- Raising awareness of appropriate legislation, especially the constraints on collecting arising from nature conservation, landscape and archaeological legislation.
- Generating discussion with interested parties to explore ways forward.Being inclusive, all stakeholders should be involved in trying to reach decisions on how best to manage mineralogical sites.

The eventual outcome of the above dialogue should be to reach agreement on an approach to the 'Sustainable management of mineralogical sites through an agreed approach to responsible mineral collecting'. In agreeing a definition of responsible mineral collecting it is important to take account of:

1. The need to secure the permission of site owners/occupiers for site access and collecting.

2. The scientific/educational/recreational value of responsible collecting and the need for conservation.

3. The need for compatibility with relevant geological designations – different approaches to collecting on sites with different designations.

4. The need for compatibility with other wildlife, landscape and archaeological designations.

5. The need to conserve our mineralogical resource for future generations.

6. The usefulness of site management plans, integrating collecting and conservation.

7. The need to have systems in place which ensure appropriate records are kept of material collected and that key specimens are brought to the attention of the scientific community and are available for study.

8. The usefulness of developing codes of conduct and pilot schemes that put into practice the theory of responsible collecting.

## Conclusions

Whilst mineral collecting is currently a widely enjoyed activity, there is a duty, backed through nature conservation legislation, to conserve mineralogical sites, especially scientifically important mineralogical sites for future generations to study and enjoy.

The way forward is for all interested parties to work together to develop an approach to the 'Sustainable management of mineralogical sites through an agreed approach to responsible mineral collecting'. This conference and its proceedings provides a starting point from which the necessary dialogue can take place.

English Nature will use learning from this conference to produce an English Nature Position Statement on mineral collecting. We encourage other interested parties to do the same, and we look forward to further dialogue and co-operation in 'hammering out a future' for mineral sites.

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# The mineral dealer's tale

Don Edwards BSc(tech), AMCST

I feel it is entirely appropriate that a mineral dealer be asked to offer his views on the conservation issue as it applies to minerals (and earth science specimens in general) since members of my profession were conservationists long before the word was even coined. Indeed had it not been for the activities of the mineral dealer over the centuries I would suggest that our national collections would be depleted to the point where they were unrecognisable.

For myself, I am a chemist by profession and have been a full-time dealer in mineral specimens for over 30 years. I have attended and continue to attend many of the world's major mineral fairs and I have been active in collecting and purchasing specimens in many countries. Many dealers will develop a specialization and my own for almost 20 years has been the minerals of the former communist block and I have travelled extensively in Eastern Europe and particularly in Russia, a country I have visited probably in excess of 50 times. This has not been entirely at the expense of the rest of the world and I have pursued projects in Tunisia, Morocco, Cyprus and many of the countries of Western Europe.

Closer to home I have collected personally at many renowned sites in Britain and, when mines were working, developed many lengthy relationships with miners and quarrymen in Derbyshire and the Northern Pennines.

Mineral dealing is very much a way of life rather than an employment and for me it has occupied most waking moments for the majority of my working life. I am not unique in having this obsession.

Mineral dealers have always been passionate and knowledgeable about the specimens they handle: there are things which can be bought and sold with little knowledge and little passion, but mineral specimens do not come into this category. To be successful a mineral dealer must have a sound knowledge of the science of mineralogy and also a refined appreciation of the singular aesthetics that make minerals such attractive and desirable objects.

The other major difference between mineral specimens and other objects of trade is that they are, in general, not readily available, even at source. The mineral dealer has always had a primary responsibility for going out in the field and tracking down his merchandise even to the extent of collecting it himself or dealing directly with the working miner.

Perhaps as a consequence of what can be a rather solitary pursuit the mineral dealer has had more responsibility than most for influencing and perhaps even creating the market in mineral specimens.

The creation of a market in mineral specimens, the cultivation and satisfaction of clients who appreciate the inherent beauty possessed by the mineral world, has in itself had a profound effect on specimen conservation. It has provided that often despised but realistically most enduring of motives for rescuing specimens, whether from the earth itself or the otherwise inevitable transport to crusher or smelter, the motive of financial reward.

At its most basic a collection which has been put together at some substantial cost is, when the original owner dies, much more likely to be disposed of sensibly by his relatives. If they have absolutely no appreciation of the contents of the collection the fact that, if only by rumour, the original owner spent sizable sums of money on his passion means that the specimens will be taken to be of significance in terms of the rest of the owner's estate. This outcome is yet more likely if the original owner keeps some sort of catalogue of the collection with some (regularly updated) idea of the monetary value of the individual specimens. It is often difficult to conceive for those of us who have loved minerals for a long time that there are people abroad that can see no beauty or value at all in the objects of our desire and are quite capable of consigning a collection worth thousands or even tens of thousands of pounds to the dustbin.

It is, however, in the determination shown by the mineral dealer in obtaining specimens for his clientele where his very significant contribution to mineral conservation is to be found. So how does the dealer obtain his specimens? The main source of important specimens, the sort of specimens forming the basis of significant public and private collection is, and always has been, as a sort of by-product of commercial mining and quarrying activity. A mineral dealer will turn up in a mining area and let it be known that he is interested in purchasing specimens. Ultimately he will meet miners who have set a few specimens on one side and will develop a relationship or a series of relationships which may endure for several years or even decades. He may educate the miners with regards to the suite of minerals, which may be found and, particularly, in the techniques needed to collect specimens without damaging them.

This relationship between dealer and miner has been an essential component in specimen conservation because it has almost always proved impossible to develop any sort of relationship with the management of the companies operating the mines and quarries. It may seem unbelievable but mining and quarrying companies exhibit an indifference to the specimen potential of their sites even when this can be shown to be of monetary significance. The word 'indifference' may be not sufficiently strong. There have been instances where management has actively sort to destroy specimen areas within their workings to reduce the possibility of miners spending time collecting rather than mining!

It must of course be admitted that this essential process by which specimens are rescued, this first step which recognizes that the aesthetic component of a lump of, let us say, galena makes it of far greater value than the lead that it contains is a step of dubious legality. At best a mining company may turn a blind eye to the private activities of its employees, seeing it as a perk, which costs the company nothing and increases employee satisfaction. At worst a company can impose a regime in which a worker caught removing specimens can expect dismissal and prosecution. Fortunately for the fate of the specimens themselves even the latter harsh regime has rarely prevented miners smuggling specimens out of the workplace.

In the rare instances (very rare instances when we look at Britain) where a company makes some attempt to satisfy its perceived demand for specimens from its workings it does it in a less then satisfactory method. As an example some years ago when British Steel was operating the iron ore mines of West Cumbria the management became aware that despite fearsome consequences miners were still managing to take specimens from the mines at Beckermet and Haile Moor. Eventually the miners were called to a meeting, offered a sort of amnesty and told that they could collect specimens legitimately. The company itself would look after the 'marketing' of the specimens from their offices in Workington and for every

tomato tray of specimens brought to the surface the company would put £1 into the miners' welfare fund. Needless to say, with this sort of incentive very few specimens found their way to Workington!

So a large number of specimens appear on the market as a result, let us be brutal, of theft. Now people might feel uncomfortable about this illegality, but we have to accept that if the law had been observed (here and elsewhere in the world) to the letter our collections, and I include here our most revered national collections, would be very much the poorer. The answer would be to change the law and place some obligation on the part of mining and quarrying companies to conserve specimens that come to light in the processes of extraction. There are instances where this has been done. In the former Soviet Union mineral specimens were recognized as a significant natural resource. The management of a mine or quarry was obliged to notify the Soviet Ministry of Geology and take steps to collect specimens. The Ministry had a marketing division that included a department (Exportquartzsamotzvety) with the specific purpose of marketing the specimens harvested in this way. There were bureaucratic shortcomings as in many Soviet institutions but the principle was enlightened and many specimens were rescued from the jaws of the crusher as a result.

If we have to draw up a league table of threats to the survival of our beloved mineral specimens (and this should help to channel constructively the always limited resources of the conservation lobby) then there is only one contender for the top of the list: the extractive industry itself. Ironically it is this very industry which, alone, has the finances to reach specimen-bearing deposits many hundreds of feet underground but the industry by its nature must extract and process as quickly as possible large volumes of rocks and minerals. There can be no doubt but that mining and quarrying are the biggest destroyers of mineral specimens. We can be grateful for the very tiny percentage of specimens which are saved during these processes since otherwise we would have nothing, but we could also put as much effort as possible into persuading mining and quarrying companies that it would not be too difficult to institute practices (perhaps self-financing) which would lead to a much greater recovery of specimens. I might add that it would be advantageous to ensure that at any future conference on mineral conservation there is some representation of the extractive industries.

When work stops at a mine or quarry there is much less chance of recovering specimens and certainly specimens of any consequence. Such specimens as might still be recovered are still threatened by a variety possibilities. Of these weathering is probably the most significant and without any form of intervention the 'life expectancy' of a mine site or disused quarry is relatively short. If we use the term 'weathering' in its broadest sense then for a mine-working underground 'life expectancy' can be almost zero as the workings flood or the stopes and haulage-ways collapse.

Above ground the processes involved can be slower (although wave action, flash flooding and even gravity can have dramatic consequences) but they are just as destructive ultimately. Indeed the forces which attack mine tips and quarry exposures are many and varied: rain, frost, plants, algae, bacteria, lichen, sunlight, oxidation, burrowing animals, ion exchange, hydration, dehydration…the list is long.

In addition we have to accept that the mass of humanity as represented by local authorities sees no beauty or interest in mine and quarry sites. This is even true in areas such as the Peak District where the character and history of the area is defined by its long association with mining and quarrying. Mine tips are cleared for use as aggregate and quarries are filled with

domestic and industrial waste thus buying a little more time before we have to really address our waste disposal problem. If the conservation lobby has any resources still to hand after forcing the mining and quarrying companies into adopting a more responsible attitude toward specimen conservation their next target could possibly be local authorities and regional planning bodies.

Whilst accessible productive sites both above and below ground obviously encourage the activities of collectors, usually amateur but, if the site is sufficiently productive, professional as well. I, personally, cannot feel too much concern about this activity: indeed I would suggest it should be welcomed before all is lost. The collecting is done with, in general, minimal tooling and consequently the effect on the surrounding environment is minimal. If specimens are recovered so much the better and if the site has attracted the attention of professional collectors then the specimens will have been collected with the care an object of financial value merits.

The Smallcleugh Mine at Nenthead is a site where I and many others have collected, my own activities spanning a period of at least 25 years. Despite the attention this site has received it has hardly changed in appearance or potential over this period. I'm sure I do not need to say this to my current reader but venturing into an old mine such as Smallcleugh does not present the intrepid collector with a succession of crystal grottoes where fine mineral specimens are just waiting to be selected and plucked like ripe apples. Above or below ground mineral collecting is hard work and the specimens exposed by the collector would never have been seen without his labours.

For in the final analysis it is nature itself which takes care of the real conservation at the site of a mineral deposit and there will always be fine specimens locked in the rocks which the efforts of collectors with hand tools (and even light mechanical tools) will have no chance of uncovering.

If this seems unlikely let me draw your attention to a couple of the extremely rare operations where adequate resources and the full armoury of modern mining equipment has been invoked purely in the interests of specimen extraction. At the Home Sweet Home mine, Alma, Colorado intensive work over several years has meant that some fine (and extremely valuable) specimens have been brought to light. The often-dispiriting work has been pursued with admirable determination by a consortium of relatively wealthy mineral enthusiasts. These have taken the rewards of seeing the new specimens from this remarkable locality as the most significant component of what must otherwise be a somewhat lacklustre balance sheet. When the project at Alma is finally concluded I'm sure that all involved would agree that anyone with the necessary determination to pursue a quarter inch quartz stringer further into the hillside would probably find comparable specimens to the ones already unearthed.

In the UK the recent work at Rogerley Quarry, work involving very substantial financial commitment, has produced a wealth of fine specimens of the emerald green fluorite for which the site is renowned. Yet to put the effort at Rogerley into perspective the deposit has barely been broached and when this project is finally closed down the group involved "will have left far more fluorite still in the mine than it has taken out", this in the words of one of the project's chief instigators.

I hope I do not sound too patronizing when I say that the concern shown by the conservation lobby for some of our British mineral sites is a concern which lacks perspective: the

conservation of minerals is a very serious matter, but it is a matter which needs to be subjected to scrutiny with a telescope held the right way around. It is always easiest to legislate and enforce that legislation against one man with a shovel.

In comparison to the threats posed to a mineral specimen by the indifference of mining companies, local authorities and the weather, the activities of the individual field collector and the lone commercial 'digger' are as naught, but our human tendency is always to put the greatest effort into controlling that which is easiest to control. Ultimately it is the mineral specimens which suffer.

They suffer also as a result of a further misconception. There is an assumption that the prime importance of mineral specimens is their value to science. This concept has had such an impact on mineral collectors that the vast majority will at least make some attempt to catalogue their collection with details of locality etc, and specimens without such information have a reduced, sometimes very reduced value. Where does this concept come from? Mineral specimens are beautiful things, and, indeed, inspire some to such a degree that they go on in life to become mineralogists and petrologists. Unfortunately all too often these same people overlook the aesthetic wellspring and the arrogance of science takes over (and I speak as a scientist myself): there is only one possible reason for any activity of any sort and that is to advance science. Well, I apologize, but I have to disagree and I see no reason why mineral sites should be rendered untouchable because at some time in, as we have seen, a rather questionable future they may have some scientific significance. If at some future time there arises some absolutely crucial question regarding a mineral deposit then the necessary specimens can be found by a little serious excavation.

From the point of view of aesthetics (and, as will be apparent by now, I believe this to be the really important consideration) the sooner specimens are rescued from old mine sites, old quarries or wherever they are sufficiently close to the surface to render them accessible to the collector, amateur or professional, the better. Leave them where they are and weathering will soon take its toll affecting the aesthetic and, even, the scientific value of the specimen (unless you are one of the rare breed investigating mineral weathering...!)

Of course, speaking as a dealer, what is being removed here is, generally, inconsequential. At the site of a quarry or mine (or even underground at a mine) the specimens of any consequence have already gone. In the majority of instances into a crusher and/or smelter, or in that much rarer but more felicitous (if illegal) circumstance, into some miner's lunch box.

To conclude, I would suggest that whatever human and financial resources the conservation lobby can muster would be best employed in urging (by education or, if necessary, legislation) commercial quarrying and mining concerns to some responsibility when they break into a crystalline pocket and urging planning authorities that spoil is beautiful!

# Mineral collecting – walking the tightrope

Roy Starkey
An Amateur Collector

## Introduction

People collect mineral specimens for a wide variety of reasons, not least because of their aesthetic qualities, but also as a consequence of an interest in their science and chemistry or of the outdoors, geology and natural objects in general. To collect minerals because they are attractive or interesting is not a bad thing, nor is it necessarily less worthy for the lack of academic rigour. Many amateurs take great pride in looking after their collections, and certainly curatorial standards may be higher than those afforded in certain provincial museums and other institutions.

## The negative aspects

Mineral collecting may of course, have an adverse impact on other countryside stakeholders. Landowners, farmers, and residents, depending upon the circumstances, may have cause for concern, where for example collectors have attacked a roadside outcrop, or left sharp broken shards of rock scattered across grazing land where it may present a hazard to livestock. Where working quarries are concerned, access is generally tightly controlled, and nowadays problems with organised visits are few and far between. On the other hand, there have been instances where unauthorised visits have been made to working quarries outside of working hours and these have resulted in loss of access for bona-fide groups and individuals.

In any walk of life there is a spectrum, ranging from casual observer through to fanatical participant, from 'good' to 'bad', from acceptable to unacceptable behaviour. In the case of the mineral collector this can be portrayed as below

Ranging from the relatively benign to greater impact:

1. Family members with a casual interest in the natural world collecting a few pebbles on the beach or specimens from a mine tip.

2. Students in education – from junior through GCSE to A Level following up an interest sparked by the National Curriculum.

3. Students in Further Education on organised field parties or unsupervised groups – potentially quite destructive, but possibly with no great sense of purpose.

4. Amateur collectors as individuals and in groups, possibly under the auspices of a Club or Society.

5. 'Serious' collectors and 'responsible' dealers active individually or in groups, and research workers, seeking permission and following a recognised code of conduct.

6. Collectors and/or dealers actively working a deposit or mine, with the owner's consent, eg St Peter's Mine, Rogerley Mine.

7. Institutions and Museums on official 'rescue collecting trips' – sometimes removing major amounts of material from localities in the name of conservation.

8. Irresponsible collectors or dealers, acting through ignorance or commercial greed to destroy an outcrop in search of 'high quality material'.

9. Illegal use of explosives and or power tools to remove large amounts of material, often resulting in the sterilisation of a locality for further use – either for educational purposes or as a collecting site.

10. Criminal activity including breaking into mines, or quarries, damage to property and potential impact on other people's safety.

Depending upon one's point of view the boundary between acceptable and unacceptable activities will no doubt vary, but it is clear that most people would not condone 9 and 10, and I do believe that the climate is changing with respect to 8.

## Where have we come from, and where are we going?

The collecting 'scene' has changed beyond all recognition during my lifetime.
In the 1950s and 60s the UK still had an active mining industry – in south-west England, in south Wales, mid Wales and north Wales, in the Lake District, in the northern Pennines, and in Scotland. Nowadays we have no minerals industry to speak of, save for construction materials, and what remains is a resource worthy of recording and preservation.

Mining history as an academic and recreational pursuit probably started in the 1950s-1960s, marked for example by A. K. Hamilton-Jenkin's series of mining monographs on south-west England, and the founding of the Northern Mine Research Society in 1960.

During the early 1970s there was an explosion of interest in minerals and mineral collecting in the UK. *Gems Magazine* did much to promote the gem and mineral hobby, and acted both as an advertising and communication medium, and introduced many new enthusiasts to the mineral hobby. In 1981 two south-east based collectors launched *Mineral Realm* in an effort to provide a more specialist publication for mineral collectors, rather than gemstone or fossil interests. This modest organ eventually amalgamated with *Gems* in 1984, and the joint publication sadly ceased publication in 1985.

The *Russell Society Journal* first appeared in 1982 and was an attempt to provide a peer-reviewed publication where amateur workers could record their findings in a scientific format. The next issue of the Journal should appear this year.

The *UK Journal of Mines and Minerals* first appeared as *Rockbottom* in 1986, with the objective of becoming a *Mineralogical Record*-quality publication for the United Kingdom mineral collecting community. After 17 years this has now developed into a high quality publication featuring full colour illustrations.

As the numbers of collectors grew, pressure on localities started to become apparent, at first in a few cases, and then increasingly as collectors became more sophisticated, and were able to travel further a field as car ownership and leisure time increased. At the same time mine sites were being cleared for construction purposes, and much dump material disappeared without a second thought, either being used to repair farm tracks, or as hardcore, and in a few cases to be re-processed as economics determined that money could be made from the mineral or metal content.

Why then should mineral collectors be seen as the pariahs of the earth science community? Fossil collectors by comparison seem to enjoy almost unparalleled 'good press' and are hailed as local heroes when "Collector finds new dinosaur" or some similar headline grabs the public imagination. Have we ever seen the headline "mineral collector finds new mineral"?; despite the fact that the mineral may be as, or even more important to mineralogy than a new fossil might be to palaeontology. There are of course important differences between fossil localities such as coastal exposures where vast volumes of material are being eroded by the tides, and a small vein exposure or spoil heap which may be the sole repository of some rare mineral species or assemblage. There must be many more amateur fossil collectors than there are mineral collectors – accurate numbers are difficult to come by. In the absence of any definitive data, I am going to make an informed estimate, based on attendance at mineral shows, journal circulations and the membership of various mineral clubs and societies that there are no more than perhaps 2,000 mineral collectors. Of these, probably fewer than 300 are what might be considered 'serious' collectors.

Amongst the 'serious collectors', an even smaller number are highly active – perhaps no more than 100. There is a need therefore to establish a dialogue with this group of people in a meaningful way, and to develop an understanding that there are circumstances and places where collecting is 'OK', and others where it is not. Most collectors are open to reason, and are able to see the sense of a logical argument. However, the apparent wholesale curtailment of access for collectors to particular areas has met with stiff opposition and a great deal of ill feeling. This is true not only in the case of open fell-side and mountain areas, but the growing stringency of health and safety legislation which has resulted in formerly tolerant quarry companies reviewing their access policy and a reduced likelihood of collecting groups being granted permission to visit working quarries. The increasingly litigious nature of our society is acting directly against the interests and freedoms of the individual. Why, for example, is it OK for a mountaineer to risk his or her life climbing on a rock face, or a caver to delve into some subterranean passage, but it is not seen as acceptable for an amateur collector to journey underground in the Caldbeck Fells of Cumbria in search of mineral specimens? Some degree of compromise is much needed, but the existing permit system seems over rigorous and has not been viewed as a success by collectors.

Certain mining historical groups appear to have a 'preferred status' with regard to underground access, but with no legitimate purpose other than that they enjoy digging out old workings and recovering mining artefacts. How then does this compare with the interests of the amateur mineral collector?

One of the apparent problems with the collecting of mineral specimens is that people associate money and commercial gain with minerals – a perception that collectors will stop at nothing to make a 'quick buck', but in my experience most collectors are not motivated by commercial greed. In the main, amateur collectors take great care of, and considerable pride in, the material which they collect. Material is circulated and distributed throughout the

mineral collecting community via a variety of routes – sale via dealers or to other collectors, exchange for other material, donation to museums, or via swaps and 'grab tables'. Ultimately this latent resource will be re-circulated yet again as collectors lose interest in the subject or die – witness the high esteem placed on material collected back in the heydays of 18th and 19th Century British mining.

## The positive aspects

Setting aside for a moment the adrenalin rush and thrill of the 'chase', an interest in minerals has taken me to places all over the United Kingdom, which few people will ever visit, and introduced me to mountains, moorland and coast which have fuelled a thirst to learn more about the natural environment in all its aspects. I have been motivated to learn new skills, of chemical and optical identification, of interpreting mineral assemblages, and recording occurrences, even publishing reports in peer-reviewed scientific journals. I have enjoyed many wonderful days out with people who have become good friends over 25 years or more of sharing an interest in minerals, and each time I examine or proudly display a self collected specimen, it brings with it memories of the sights and sounds, the weather and the company of what was a thoroughly enjoyable day out.

Amateur Collectors have made an undoubted contribution to British Mineralogy, not only through active fieldwork, mine exploration, discovery of new occurrences and even species new to science, but also directly via provision of material to museums and research workers. At the practical level, many amateurs are better able to identify or have a sense of the unusual when handling mineral specimens than are professional researchers, who may be more at home dealing with SEM EDAX analyses and X-ray diffraction patterns than appreciating crystals in their natural state.

There must surely be a mechanism for preserving what has hitherto been a generally satisfactory and symbiotic relationship between the professional scientist/curator and the amateur collector.

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# The vital resource – mineral collecting for and by the academic

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The term academic is used here as belonging to or relating to a place of learning. That is a place of research very much of a practical identity. The academic in question is normally a professional scientist or museum curator as such they provide in-depth studies and communicate results.

Mineral collecting encompasses a spectrum of interest and knowledge with important roles for the amateur collector, museum curators, conservation bodies, the academic and the professional dealer. Throughout the history of the mineralogical sciences these have provided in one way or another specimens and stimuli to a range of material sciences. Co-operation and collaboration between all these categories of collector is essential to the continuing health of the mineralogical sciences.

The academic or professional has a very important role within the conservation field, for it is often the academic who gives notification of the geological/mineralogical special interest of a particular site. They are often involved in the study and identification process and take results forward presenting an ultimate communication to both the scientific community and public.

Since earliest days minerals and rocks have provided the raw material for technological advance and the external form of crystals have been a source of study and wonder. The words and illustrations of Georgius Agricola, (De Re Metallica, 1556) provided some of the first studies of mining and processing techniques. Unfortunately very few specimens collected at this time are known to exist in collections today.

In the 18$^{th}$ and 19$^{th}$ centuries most of the specimens that were collected found their way into the collections of ‘gentlemen’. Such collections were housed in the cabinets of ‘curiosities’; as such they were the birthplace of study by the early academics and scientists. Certainly the 18$^{th}$, 19$^{th}$ and early 20$^{th}$ centuries were the most important periods of mineral collecting in the British Isles and many areas of Europe. Today very few metalliferous mines are left for the study of three-dimensional geological/mineralogical sections and it is mostly surface conserved sites that provide the exposures and specimens for scientific study.

Our science is based on observation. To progress our science it is necessary for all collectors to have strict collecting and curatorial aims for their collections whether these be based purely on aesthetic or scientific principles. We must all ask the same questions - do we have enough information on the collected specimen? and do we get enough information from our collected specimens?

The quest for the perfect crystalline specimen may not always be possible and important information may be available in the micro or less well-developed form. Calcite and quartz are common minerals and are often seen by collectors as lacking in interest, however, the many forms of calcite and twin crystals provide much for study. Likewise quartz crystals also provide many crystal features for study. On the positive side studies of many of the

specimens collected by both amateurs and academics have given rise to the description of new chemical elements and to new type mineral species. Responsible collecting can be educational, scientific and recreational.

The collecting of samples whether they are mineralogical or palaeontological in nature are the very basis of the geological sciences. As such these will include the use of collected specimens for field mapping and interpretation especially within the training and education field. The search for ore deposits primarily depends on the collection and analysis of specimens and this is also true of the bigger academic picture, the wider understanding of earth processes obtained from major international projects studying the ocean floor, moon surface and other inhospitable environments.

Several lines of research depend upon crystal surface–fluid interactions, and the development of fluid inclusion studies revolutionised critical studies on ore-forming processes. But such collection of suitable material has at times led to conflict. For example the site of the remarkable macro fluid inclusions in fluorite from Weardale provided inspiration to researchers and curators alike but is not now accessible (Rankin, 1978).

Good practice in collecting, provenancing, storage and curating are of course of the utmost importance to scientific collecting. The academic by the nature of their studies must, where possible, collect from the natural source and if at all possible, in situ, interpretation of formation processes can then be accurately considered. Where sites no longer exist, material in collections become an important source but specimens must be well provenanced. Early dealers in both the Northern and SW Orefields of England were often careful and conservative with their locality information. Only fully authenticated and provenanced material should be used for our research. However, in many instances today we need to fall back onto previously collected material from sites not now available; these are often past mining sites which have been sanitised and where exposure has been obliterated. Here is an instance where field mapping, conscientious note taking and strict curation by past collectors is of paramount importance to the collected resource.

For any major scientific study relating to the geochemical or geophysical analysis of a mineralised area there must be a logical, disciplined methodology of sampling in order to progress an accurate study. Even in such important commercial or academic studies circumstances dictate that collecting must be within the understanding of agreed techniques and permission. Today there are many lines of research for the academic mineralogist to be involved in, many of these progress mineralogical studies within present day requirements.

Mineralogists have always tried to understand the physical and chemical environment under which particular minerals form and to determine the atomic structure and properties of those minerals, such studies continue. Today environmental mineralogical studies are increasingly important and are often concerned with fluid movement and surface interaction. Such environmental studies often require collaboration with the biological sciences that is how mineralogy integrates with the life sciences, leading to application of mineralogy to environmental health and human environments. Increasingly today with the run down of both metalliferous and coal mining, mine wastewater provides an important area of study. Here the minerals ankerite and pyrolusite become important sinks for iron and manganese respectively. Studies of uranium uptake by lower plants and methods of decontaminating smelter and other mining industrial sites from toxic elements are of increasing importance.

The move towards environmental mineralogy has encouraged and maybe re-vitalised the collection of samples. These are not seen by everyone as exhibiting the perfection of crystal form or rarity of associated species, but they constitute an essential resource, to a particular area of study. From the academic point of view we must not see mineral collecting, however enjoyable, as always the quest for specimen perfection but more importantly the accurate provenancing of samples collected towards a specific scientific aim. For the academic this should lead to a further understanding of formation and processes. Where necessary this collecting may have to be conducted within an agreed conservation or other framework.

Back in the laboratory we now have an incredible range of sophisticated instruments in which geophysical and geochemical analyses and mineral properties may be determined. X-ray diffraction studies allow us to recognise the intricacies of the atomic structure. Such information is vital to the scientist and engineer. Even a minute speck of a new mineral species has the ability to reveal a new atomic structure or unique property relevant to use in our modern technology. An insignificant specimen of rather drab and poorly crystalline appearance may provide the key to an important technological advance be it as super conductor, an enhancer for strategic high strength metal alloys or as potential catalyst. For example, studies of the properties of some zeolites (hydrated alumino-silicates, chiefly of sodium and calcium) have been shown to have a framework silicate structure which allows reversible ion exchange and dehydration, properties important to present day industry. The mineral redledgeite (a Ba-Cr-Ti oxide) is recorded as being useful in the immobilisation of heavy metals such as thallium in gold processing. As a final example, recent studies of minor oxychloride minerals of lead, copper and other metals from the Mendip Hills England have provided some remarkably interesting atomic structures with potential for technological use (eg Welch *et al*, 1998).

Mineral collecting and the formation of collections go hand in hand with the major periods of exploitation of deposits of a particular region. In the British Isles metalliferous mining is now at a low point with very few mines open. Indeed some of those that are still open are providing specimens to collections rather than for academic or commercial use. The peaks of collecting reflected scientific curiosity in both the aesthetic crystal formation and also in systematics of mineralogical sciences. Of course with the closure of many metalliferous mines there is increased pressure on those exposures left for study, research and collecting. Conservation of the most important sites, the many important collections and even the academic becomes even more important. With the diminishing mining industry, both for fossil fuel and metalliferous deposits the exposure left become an irreplaceable, vital resource for our industrial, cultural and scientific heritage.

The academic has to plan, deliver and communicate the results of their studies to a public, national and international audience and in so doing they may not be as available as in the past to directly identify or study individual mineral specimens. However, despite the constraints many new species are described every year and many of these lead to consideration for new commercial or industrial applications.

The vital resource then consists of

1. The collected, well provenanced material available in conserved or temporary exposure.

2. The collector who conserves sites, and curates specimens collected.

3. The academic/scientist who provides in depth study and communication of results.

Our science is as robust as it has ever been, new finds, and new ideas spring from the continuing collection of material from the vital resource. It is from this that our fuller understanding of the earth's processes and the potential use of its products can be realised. A conservation strategy for this vital resource provides for the academic mineralogist to discover, record, collect and preserve our mineral heritage.

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# Mineral collecting and museums

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## Introduction

Mineralogy, like the other natural sciences, is based on observation. Apart from mineral deposits, only collections can provide the numerous samples that allow study of the diverse properties and associations of each species. No matter how collections are built up, whether by purchase, fieldwork, donation, or exchange all begin with collecting from source.

## Why have collections?

Most museums and private collectors set acquisition goals. The goals of publicly-funded museums are often different from those of the other parties concerned with mineral collecting and conservation.

Museums have goals that include safeguarding the specimens and also promoting their intellectual and educational values. Access to specimens is an essential element. Specimens in museum collections record presence of species in given localities at a given time, validate past research and are available for research and other educational purposes. Museum collections therefore underpin scientific knowledge by holding in perpetuity the specimens on which it is based. Research enhances the importance of specimens.

Collection policies vary. If one were to generalise, national museums tend to develop globally based acquisition policies. Local authority museums often specialise in their own area whilst university museums reflect their research and teaching. Such speculation is not always true and policies vary with time.

## Does it matter if museum collections do not grow?

Museums need a dynamic acquisitions policy. In 1991, John White, of the Smithsonian Institution wrote that if a collection is to reflect the vitality and the science of society it must always grow. They are fed by streams of specimens generated through mining and construction, natural erosion and the activities of mineralogists. But in building a collection it would be wrong for a museum to knowingly acquire specimens that have been collected illegally, nor tacitly support irresponsible and unsafe collecting.

## Collection growth by purchase

Whilst in St. Petersburg in Sept 1813, Dr Crichton (1763 – 1856), the Scottish physician and mineral collector, after whom crichtonite is named, wrote to Robert Ferguson, after whom fergusonite is named. He refers to a mineral dealer: “His only competitor here is a still greater extortioner….for that the love of mineralogy is every day becoming less general in this country from the impossibility of purchasing a collection. I mention these circumstances in

order to apologise to you for the prices which I have paid for the specimens I have purchased for you."

In 2002 a 5cm specimen containing leadhillite with caledonite, from Leadhills, Lanarkshire, Scotland, with a Bryce Wright label, which dates it to somewhere between 1866 and 1881, was offered at $7,200.

In the same year Argyle Diamonds of Australia sold the year's entire production of 45 carats of pink diamonds for $4.15 million.

Buying minerals has always been an expensive way of building a mineral collection. Museums do not have the money to be major players in building collections by mineral purchase. Visitor attendance at the 2001 Munich Show was 35,000 and at Tucson 46,500 people spent $76.5 million on goods and services. Clearly purchase by the private sector far exceeds that by public sector museums.

## Collection growth by collecting

Often the best use of resources is to collect specimens rather than purchase them.

Some maintain that specimens be left in the ground for the benefit of all. This is largely rejected by museums. One has to evaluate the merits of leaving a specimen *in situ* against the inevitable destruction of the outcrop by the forces of nature or by human intervention such as in mining and quarrying. Against this backdrop of inescapable loss it is difficult to justify a policy of non-removal when central to the whole issue is the safe preservation of mineral specimens. Indeed all non-removal or limited removal arguments are not robust enough to challenge the safe preservation argument. Museums are also mindful of ensuring that a collection has breadth thus permitting comparisons.

Mineral specimens do not reproduce. This is an obvious statement but is central to any policy that aims to preserve specimens. In biological terms preservation of a site that allows reproduction to take place is of high importance. Minerals in contrast are at their safest enclosed in the depths of the earth. Danger increases with the exposure. Mineral protection therefore means not leaving fine specimens *in situ*, but on the contrary removing them and preserving them in a collection. Some contextual data can be lost but this is minimal in the case of loose material, or material on mine dumps. Any 'science' is best done by removing the specimen to a laboratory. Fine specimens left *in situ* may attract the attention of unskilled collectors who might destroy them while attempting to collect. In archaeology a site is developed, then covered over to protect it but in mineralogy weathering and alteration processes will continue to operate.

Indeed the more rock that is exposed for careful examination the better for geological science. There may be reasons for preventing extraction (eg disturbance of habitats, landscape aesthetics) but there is usually no great benefit to geology from such restrictions, and we should not pretend that there is.

A geological site needs to be protected against potentially damaging operations but for most localities collecting is not one of them. Most localities benefit from being worked, and if collectors are encouraged to be responsible in recording and notification, then everybody benefits.

## Museums and private collectors

Commercial and/or self-financing collecting is often cited as a legitimate reason for controls. Various views have been put forward, from outright banning to the establishment of quotas or threshold limits.

Museums take a different view. Very few of the great mineral collections in museums would have attained their level of greatness were it not for commercial collecting. There is more to building collections through commercial dealing than a bag of money. As previously described, a collector may spend vast amounts of money on a single specimen. The reasons for this are economics and convenience.

At this point we have to consider the importance of time. The hobbyist thinks in terms of passing interest, the dedicated collector of their lifetime and a museum of the distant future.

A study of museum archives makes us aware of the crucial role played by the private collectors in preserving mineral specimens over the last 200 years. Peter Davidson (unpublished data) calculated that from 1813 until 1989 about 70% of the mineral collections in the NMS were acquired through donations from private collectors or, in the case of Scottish material, also through collecting by museum staff. Some statistics from Alec Livingstone's book *The Minerals of Scotland*, show that as few as eight Scottish collectors have, since 1960, amassed thousands of Scottish specimens equivalent to 60% of the NMS's Scottish Mineral Collection that took 140 years to accumulate. In his 1994 paper on collections and the information age, the late Joe Nagel, curator at the Geological Museum, University of British Columbia, Vancouver, concluded that the ratio of private to public mineral specimens might exceed 10:1. Given these facts, it is clear that the private collector is the *de facto* curator for most of our mineral specimen heritage.

Very often these private collections are bequeathed to public museums, and are safeguarded and accessible to all. The existence of a commercial trade is almost the only reason why any material from the mines of Caldbeck Fells, Leadhills-Wanlockhead, or Cornwall survived to end up in museum collections. Similar considerations apply to palaeontological dealers. Mary Anning would not have been able to operate under a quota scheme: she would have been arrested.

For museums crucial aspects are the preservation of specimens and the recognition and recording of associated data. Whilst museum staff are trained to accomplish these aims this is less of an imperative for researchers and even less so for recreational collectors. However commercial collectors are acutely aware of the importance of provenance as this can influence the likelihood of a sale, a factor that can sometimes lead to deception.

An argument often voiced is that armies of collectors will deplete sites. It is a common misconception that if there were half as many collectors, there would be twice as many minerals to enjoy. In fact, if the number of collectors were cut in half the result would probably be far less than half the original number of specimens available on the market and for exchange. One benefit of the pressure on known sites is that there is an impetus to discover new ones.

Banning commercial collectors can mean excluding the best and most responsible collectors. Most collectors become involved for the sheer pleasure they get out of collecting and are only too happy to bring material to a helpful museum curator.

The evidence leads to the conclusion that private collectors, including commercial collectors are, by virtue of their huge numbers and level of activity, at the forefront of rescuing minerals from destruction. Modern mineral collectors are more sophisticated, more skilled, better equipped, and better informed than their predecessors. They are also more willing to develop old sites, and find new ones. Museums benefit from the fallout of this activity.

## Active collecting by museums

Museums actively involved in mineral collecting must work to the highest standards, observe protocols and treat others with sensitivity. This means careful avoidance of any action or inaction that might offend a landowner or site stakeholder. It means the most careful removal of specimens, with minimum loss through damage, keeping abreast of local activities that create new exposures, keeping in touch with collectors, and those involved in generating new exposures and doing the detective work necessary in the library, collections and in the field to locate new sites. Finally it means paying meticulous attention to health and safety issues.

Field-collecting curators, by virtue of their personal and institutional standing, are often able to gain access where other collectors have failed. This privilege should never be jeopardised. Curators who themselves collect gain tremendous advantage in scientific understanding that they can pass on to the public and hopefully inspire and encourage new collectors.

There is no point in banning collecting if it is the only way to find out what is interesting about the site. The use of power tools and explosives have often been cited as responsible for the accelerated depletion of a site. In fact controlled excavation using such means has resulted in the discovery of exceptionally fine specimens. The NMS have successfully used these methods.

This type of mineral collecting is not new. Heddle's fondness for the 28lb hammer is legendary and he often used explosives: most notably when he, Patrick Dudgeon and several recruited quarrymen collected superb zeolites from the Faeroe Islands.

## Conclusions

- There are circumstances when the imperative to collect is indisputable, such as: where human activity (eg quarrying, road building) is likely to result in the destruction of desirable specimens and where there are no conceivable or viable alternative strategies to provide professional mineralogists with the means to discover, record, collect and preserve the material that is constantly revealed.
- It is time mineral curators become more involved in directly influencing policies surrounding such activities in much the same way that archaeologists do; a practice that is well understood.
- Collaboration and consultation are of benefit to all.
- The scale of operation is commensurate with the rewards and we should not be afraid to think on a large scale. In this we can learn from our colleagues in palaeontology and archaeology and also commercial collectors.

- Private and commercial collectors are vital to the knowledge bank and museum curators can cultivate a synergy with them. They deserve our thanks and we should not forget them. In 1977, Peter Embrey, mineralogist at the Natural History Museum, acknowledged this when he wrote in his forward to the facsimile of the authoritative Greg and Lettsom's (1858) *Mineralogy of Great Britain and Ireland* that the book owes more to the amateur than to the full-time professional development of the science.
- No Government is ever going to fund mineralogy in a way that could provide anything like the same cover.

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# Mineral collecting and industrial heritage

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## Introduction

We are indeed fortunate that for a small country Britain has substantial mineral deposits, which have proved valuable, never more so than in the eighteenth and nineteenth centuries when we were a major producer of lead, iron-ore, tin, copper and zinc.

Our insatiable search for minerals, whether as a commodity, research material or object of beauty, has led to a huge reduction in some available resources. Despite this, we are still a large producer of industrial minerals such as fluorspar, barytes gypsum, silica sand, salt and limestone. On-going research and exploration over the last thirty years has identified potential deposits of metalliferous and related minerals.

## Old mines

At one time, it was easy to see where the extraction of minerals was being carried out, for example at Wanlockhead (figure 1). Waste dumps, abandoned buildings and equipment were much in evidence. In the last forty years, much of this evidence of mining and quarrying has slowly disappeared due to the recycling of the stone and brick from buildings, landfilling of quarries and the sale of equipment for use elsewhere or for scrap metal.

In 1980 the Strontian Mine in Argyllshire reopened and started producing barite and galena for a short period but closed down again in 1993 and the equipment and most of the buildings were dismantled and sold. The largest building went to Chesterfield where it is in use as a police helicopter hangar. Very fine specimens can still be found, such as harmatome, calcite, strontianite and brewsterite.

In Scotland from the Solway to the Shetlands waste dumps and old buildings still standing can be seen as evidence of our past industrial and mineral mining history. At localities such as Blackcraig and Drumruck in Galloway, at Leadhills in Lanarkshire and also at Wanlockhead in Dumfriesshire, it is evident that mining was undertaken.

The iron ore mine long since disused at the Garelton Hills in East Lothian (figure 2) has produced fine specimens of goethite and botyroidal hematite.
On Islay at Mulreesh (figure 3) and Robolts Hill, evidence of lead mining can be seen and specimens of galena have been recovered.

Lead recovery is also evident at Stromness on the North West shore on the Island of Orkney. Good specimens of galena are available but there is no evidence of any mine buildings. It was mostly surface recovery of the ore.

The Alva Silver Mine in the Ochil Hills produced a bounty of silver in 1715. In addition to the silver, other minerals have been recovered such as chalcocite, malachite, covellite, bornite annabergite and erythite. Silver can still be found by panning in the burn (figure 4).

**Figure 1** Looking northwest towards the New Glenreiff Mine, Wanlockhead, 2001.

**Figure 2** Bob Reekie and Dr Harry Macpherson selecting specimens of goethite at old iron mine, Garelton Hills, East Lothian, 1976.

**Figure 3** View of cottage, old engine house and shaft at Lead Mine, Mulreesh, Isle of Isla, 1981.

**Figure 4** Panning for native silver, Alva, Ochill Hills, 2002.

## Landscaping

Landscaping has also taken its toll. In some areas, coal bings and mine waste dumps have been successfully turned into wooded areas and wild flower and plant sanctuaries for the enjoyment of the public.

Disused sand pits are used for the sport of fishing and old quarries for canoeing and climbing. One such quarry at Ratho near Edinburgh has been roofed over and adapted as a world-class climbing centre.

## Heritage

The Leadhills and Wanlockhead District is one of the foremost mining and industrial archaeological sites in Britain. Both villages are listed Conservation Areas and are also Scheduled Ancient Monuments and Sites of Special Scientific Interest (SSSIs). With resources including lead, silver, zinc and gold, an industry was established which served Britain and Europe.

Collecting has gone on for more than two hundred years and minerals such as susanite, lanarkite, leadhillite, plattnerite and caledonite have been discovered. In the last twenty years other rare minerals have been discovered and identified – macphersonite, scotlandite, mattheddleite and chenite.

The district is a very popular destination for researchers and collectors, both professional and amateur, from many parts of the world.

Gold has always been precious as a commodity, a currency, and an industrial metal. It has been recovered from many parts of Scotland and can still be found and as Scottish gold is of high quality, it is much sought after.

## Wanlockhead

### Engineering

In the eighteenth century, the development of the mines was hampered by the need to find more efficient methods of removing water from the mine workings. The mine owners enthusiastically embraced the emerging steam technology as a means of doing this. Two of the pioneers of steam, namely John Smeaton and James Watt, together with engineers George and William Symington (both natives of Leadhills) and William Murdock were involved in the installation of engines to power the pumps at Wanlockhead.

A number of industrial artefacts can be seen around Wanlockhead, including the famous beam engine (figure 5), driven by water and used to drain the Straitsteps Mine during the nineteenth century. It is a splendid piece of machinery and has been lovingly restored. There are also the remains of the engine house of a Symington atmospheric pressure steam engine (figure 6) that was used to drain the Beltongrain vein at a depth of over 200 metres. The Light Railway from Elvanfoot has also been restored and visitors can take a run up and down the line from Leadhills to Wanlockhead.

## Mining

In 1950, Rio Tinto Zinc appointed J.R. Foster-Smith as mine manager at Wanlockhead with the task of opening up the New Glencrieff Mine (figure 7) which had not been worked for over 20 years. His first impression of the place was of a semi-derelict village surrounded by mining waste dumps and ruins of some engine houses. Together with a team of geologists, engineers and surveyors, the New Glencrieff Mine was prepared for operation. It took two years to prepare the shaft, the audit and drain away the water. A mill was later installed and production of lead concentrates commenced. Unfortunately, it was not to last. The price of lead fell and the mine became uneconomic and was closed down again in 1959.

## Demolition

The Ministry of Defence used the mine buildings in World War II for the engineers to practise demolition work – so the buildings gradually disappeared (figures 8, 9 and 10).

In 1989 several bodies – Dumfries and Galloway Council, Clydesdale District Council, Historic Scotland, Scottish Natural Heritage, the National Museum of Scotland and several funding bodies – carried out a report on the preservation of our heritage. This was adopted and SSSIs were agreed. The Estates were not allowed to remove waste material and the lagoon areas were landscaped in order to prevent wind-blown dust getting into houses, as the children under five years of age had the highest lead count in their blood in the whole of Europe.

Our industrial heritage is vanishing. In 1960, our industries employed large numbers of people, so great value was placed on industrial buildings and objects. In our highly technical age, our industries are closing and buildings and equipment are becoming redundant. This heritage must be preserved for future generations. Collectors of minerals or industrial artefacts, whether professional or amateur, have a duty to conserve both our mineral and industrial heritage. Urgent action by Government at all levels is necessary to prevent its loss.

**Figure 5** 19th C beam engine, Straitsteps Mine, 2002

**Figure 6** Engine house Symington's 1789 atmospheric pressure

**Figure 7** New Glencreiff Mine, Wanlockhead, 1955.

**Figure 8** Narrow gauge railway viaduct, Rispen Cleuch, Leadhills.

**Figure 9** Remains of Meadowfoot Smelter, Wanlockhead. Demolished in 1943.

**Figure 10** Remains of old builds at Mine Hill, Leadhills. Demolished in 1943.

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# Mineral collection on National Trust land

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The National Trust (NT) is an independent land owning charity, with over 3 million members operating in England, Wales and Northern Ireland. Its present land ownership is almost 300,000 hectares and includes over 800 kilometres of coastline.

The activities of the National Trust are controlled by various Acts of parliament. The first of these, in 1907, laid down the purposes of the Trust in the following words; "and whereas the association was incorporated for the purpose of promoting the permanent preservation for the benefit of the nation of lands and tenements (including buildings) of beauty or Historic Interest and as regards lands for preservation (so far is practicable) of their natural aspect features and animal and plant life."

In short, NT policy must balance access with protection and conservation and the key statement within the 1907 Act is 'for the benefit of the Nation', which is seen as fundamental to the work of the Trust and will determine the organisation's attitude to a number of management issues, including minerals.

Our work in West Penwith is representative of the National approach toward property management, involving a broad range of conservation objectives. To protect and enhance landscape, nature conservation, archaeology and to manage for access and recreation

However, the one recurring problem that runs through the core work of the Trust is the problem of managing change. All conservation work has an element of change, be that through grazing habitat for nature conservation which to many constitutes change, in this case generally visual, or through adopting a policy to monitor and if necessary control mineral collecting, change here being in attitude.

1995 saw the start of the St Just project. Designed to celebrate the National Trust's centenary and involving acquisition and consolidation/conservation of Industrial Archaeology. Part of this range of acquisition involved such renowned areas as Wheal Edward, Wheal Owles, Wheal Drea and Wheal Cock, important mineral sites. Through this we have established a good working relationship with the Cornwall RIGS group and local collectors, a relationship based on mutual trust. We have also entered into a programme of walks and talks aimed at local residents and school groups, led by experienced mineralogists. Important days for our own education as well!

The problem remains with the minority cowboy collectors who essentially trespass without permission and who will be responsible, and have been responsible for outright bans imposed by landowners. This single-minded approach has caused many problems resulting in damage to site and the creation of hazards to the general visitor and children, by leaving excavations open. Contact with these people is generally confrontational and reflects an attitude of self interest and lack of care mixed with a series of expletives.

In West Penwith we have applied the Geologists' Association geological fieldwork code, which is a useful general core guide but does not address the issues relevant to mineral

collection. Such being the lack of reference to recognition of designations, the need to record finds, care of ancillary archaeology and notification to landowners.

In addition, all Trust land is subject to the Trust's own byelaws, one of which reads "no unauthorised person shall dig, cut or take turf, sods, sand, clay or any other substance on or from the Trusts property". It is therefore the Trust's view, that this byelaw gives it power to control the collection of minerals. However we endeavour to be reasonable and the question does remain regarding the ability or desire to enforce the letter of the law. Over many years there has been a significant change in approach within the countryside service. No longer countryside policemen, the stick has never been an effective tool of management and no introduction of policy will ever be practical unless it is generated by mineralogists themselves and that a sense of partnership exists.

At present the National Trust has no defined policy on the collection of minerals. However a discussion with the Geoconservation Commission on the 10th October 2001 took place to make moves to introduce a code of conduct for the collection of minerals. There were interesting similarities relating to the conservation and collection of fossils, although it was recognised that the mineral resource may be less sustainable than the fossil one due to the reasons such as small, finite reserves of minerals (often as a result of mining), the cessation of mining and a lack of erosion to expose new material.

It is however recognised that the geological community is very pro-collecting these days, providing it is properly documented, with the rare exception of where the resource is very finite. This is not without justification as amateur collectors have made important contributions to knowledge and there is a limit to what more you find out without excavation.

## In conclusion

The owners and managers of land have potentially important impacts on the conservation of mineral sites, on their collection and on their scientific study. Owners and managers, in conjunction with RIGS groups, are likely to decide land use, subject to any statutory protection, and hence to determine whether sites and the mineral sites in them are becoming damaged.

With reference to the 1907 act:

- There is an argument that the NT should not be giving away, or selling, what we hold for the benefit of the nation, but it can be argued that collecting is for the benefit of the nation if it contributes to scientific knowledge.
- The NT cannot accept commercial collecting.

If we can go away from here with agreement to discuss and conclude certain issues we will progress.

- Breed understanding for the culture of collecting for both landowners and mineralogists alike. From this we will be able to see the way forward.
- Solve the problems of disparity between collectors. The 'them and us' syndrome as seems at present, requires bridges to be built.

- Desire to see the parameters of the science moved forward. We need to find out what we've got. Identify the nature of the sites involved, as there is a case for distinguishing between small, finite and easily damaged sites with those that are larger and more robust. This is proven essential information for all other conservation disciplines.

Due to the diverse make up of mineral collectors and members of RIGS groups it is unlikely that they will ever arrive at a generally agreed definitive policy on their own. Therefore this conference urgently needs to consider and evolve a national policy involving some form of licensing. The content of which must involve:

- The landowner's permission is a fundamental requirement in any fieldwork or collecting policy.
- Be aware of RIGS, SSSIs or any other site status and any restrictions which may apply to it.
- Respect the nature conservation value derelict metalliferous mine sites - Cornish mine sites have revealed a rich and diverse lichen flora of approximately 350 species. A number of which are new, rare or interesting species with very limited distribution in Britain.
- There must be no removal of large quantities. Only collect what you need personally. Two to three specimens of each mineral species should be adequate for individual collectors utilisation.
- Curate specimens correctly. A specimen loses much of its value when not properly located, identified and catalogued.
- Specimen finds need to be recorded. This will enhance knowledge of site and pull together or improve what appears to be fragmented recordings.
- Unnecessary disturbance must be avoided. Do not leave holes or unstable ground that may pose a threat to public safety.
- Develop an ethos of sharing. Unusual finds must be recorded (with Natural History/County museums).
- Publication of paper or memo is required for unusual finds with the major Mineral society journals.

The NT/landowner must be aware of management needs

- Mineral sites require continual monitoring.
- Some sites require active maintenance (management of scrub).

## Acknowledgments

Cornwall RIGS Group - hammering out a policy (in this volume)
H. J. Harvey - policy on fossil collecting
J. Lister - conservation advisor, Devon & Cornwall region
C. Sparrow - Cornwall RIGS group

# Collectors in 21st Century mineralogy [2]

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## Abstract

It is common to hear professional museum curators supporting amateur collectors and mineral dealers, but just how vital are they in 21st Century mineralogy? This paper provides evidence based on the research and collections developed at the Manchester Museum over the past ten years. An analysis of data on contemporary acquisitions shows the vital role collectors and dealers have had in building the museum collection, an important resource used equally by university academics and members of the public. Perhaps more surprisingly, collectors have also made a significant contribution to discoveries, both of minerals new to the British Isles and species new to science.

## Introduction

Anyone familiar with the history of mineralogy over the last two centuries would know that collectors and dealers have made a significant contribution both to the development of the science itself and to the mineral collections held by public institutions. At the beginning of the twenty first Century with increasing pressures on natural resources it is worthwhile trying to determine what value collectors still have to the science of mineralogy. Two factors combine to make this a particularly important discussion. The first is that unlike archaeology or natural history, there are few professional mineralogists in Britain, and even those that there are have relatively little time to spend field collecting. The second is that sites of mineralogical importance, especially those in working mines and quarries are disappearing at an alarming rate.

Most museum curators and many professional mineralogists rely on collectors for new and unusual discoveries, and most readily acknowledge the importance of the work they do. This paper attempts to quantify some of the contributions made by amateur collectors and dealers in the past 10 years to the mineral collection of the Manchester Museum, a large university museum with a significant mineral collection.

## Collections

Curators rely on collectors and dealers for many of the specimens they acquire for public collections. Several pieces of data, presented here for the first time, show that mineralogy is one area of study in which collectors and dealers still play a vital role.

## The Manchester Museum

Numerous museums in Britain hold mineral collections in trust for the public good, and a few of these have specialist mineral curators. The Manchester Museum mineral collection can trace its origins to the Manchester enlightenment of the 1820s. It comprises somewhat more than 20,000 specimens in 17,000 accession lots. Particularly good data is available for

[2] This paper was not presented at the conference.

acquisitions made over the last ten years when there has been a mineralogy curator permanently in post.

Museums acquire specimens by a variety of different routes. The major means are by bequest, donation, exchange, field collection, purchase and transfer (from other museums). Museums also commonly have unknowns in their databases, these are usually old specimens found in drawers, which are accessioned because they are of clear importance, but where the means of acquisition is uncertain. This gives a total of seven categories of specimen acquisition. In the past ten years a little more the 5,200 mineral specimens have been accessioned into the Manchester Museum collections. This process is the formal means by which the museum acquires its objects. It is interesting to analyse various ways in which they have been acquired.

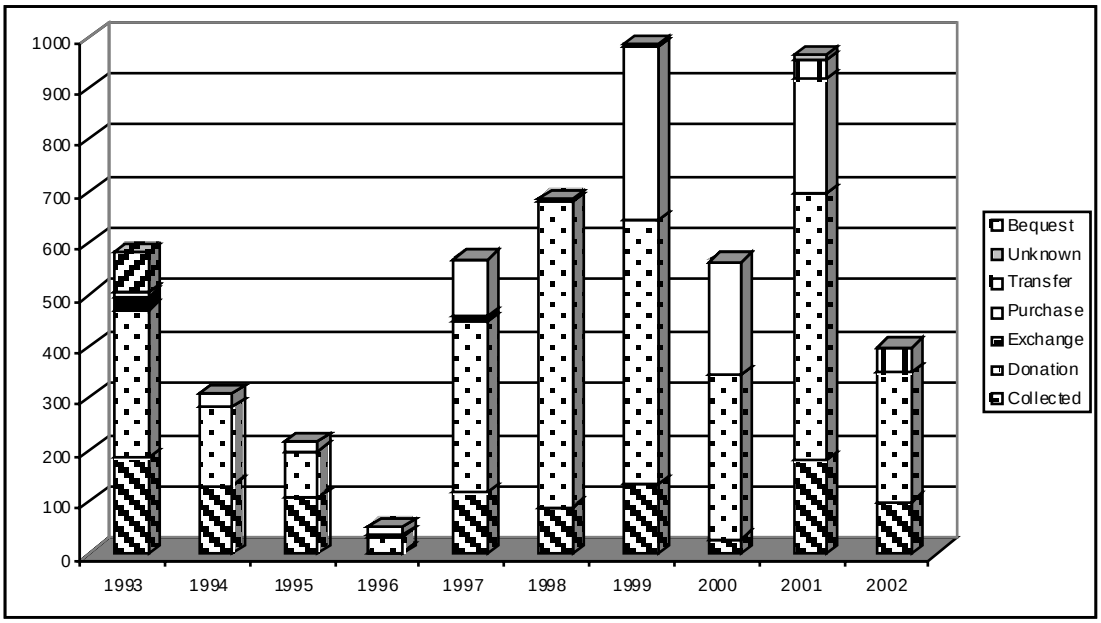


**Figure 1** A year-by-year breakdown of the ways in which minerals specimens were acquired by the Manchester Museum over the last decade

The data of figure 1 show that by far the most important means of acquisition over the period 1993 to 2002 was by donation. Field collecting by museum staff also made a significant impact on the collection in most years. Purchase from both collectors and dealers was important, especially in 1999 and 2001 when new gallery displays were being installed. The remaining means of acquisition, by bequest, transfer and exchange, were of sporadic or minor importance.

The precise role of the amateur collector in the acquisition process can only be assessed by a detailed examination of the data for each specimen. Donations for example might be from a professional mineralogist or a collector, and the same applies to the purchase of specimens. Those specimens field collected by museum staff are acquired professionally by definition, while transfers from university departments are also commonly collections generated academic staff or their students. The data of figure 1 are divided into four categories in figure 2, acquisitions from amateur collectors, dealers, those field collected by the curator and those acquired from professionals.

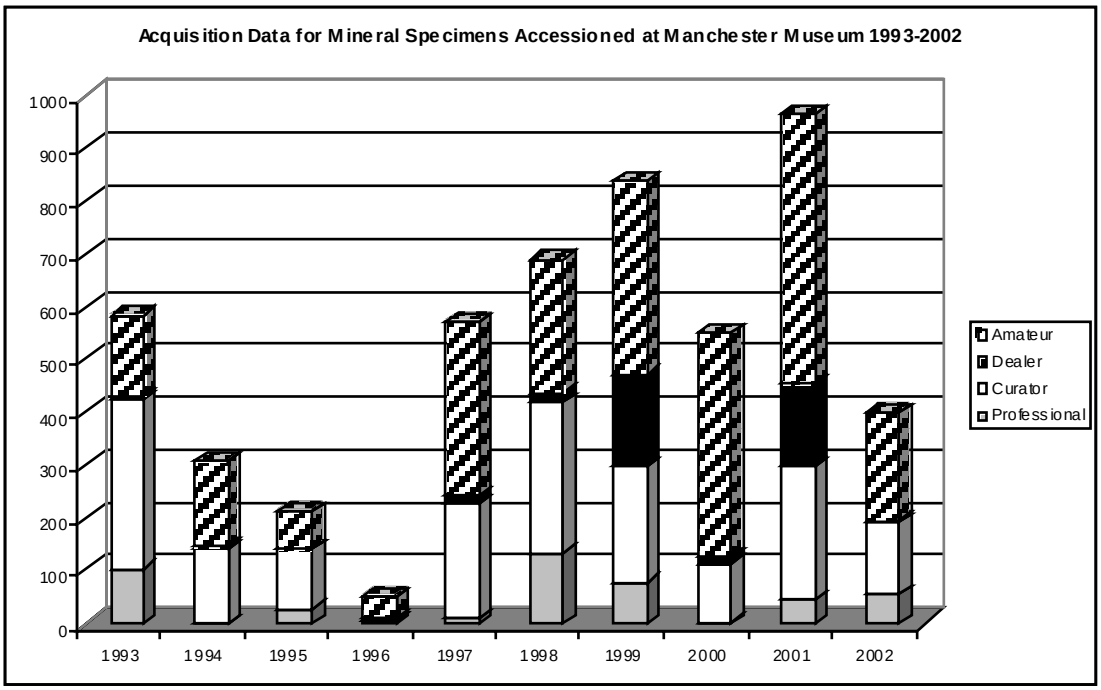


**Figure 2** A year-by-year breakdown of the distribution of specimen acquisitions at Manchester Museum divided according to whether the parties were professional or amateur

An analysis of the data of figure 2 shows that in the last ten years about 49% of accessioned specimens were collected by amateurs, 35% collected by museum staff, 7% purchased from dealers and 9% obtained from professionals. The second and fourth of these categories can be summed to produce a total for professional acquisition of 44%. Almost all of the specimens purchased from dealers appear to have been collected by amateurs so summing the first and third figures gives a total of 56% of acquisitions from amateurs. The specimens detailed above were acquired from 166 different people or organisations. Of these, 114 were amateur collectors, 36 dealers, and only 16 fall into the professional category. The results for amateur collectors are all the more remarkable when compared to the size of the membership of national mineralogical organisations such as the Russell Society of only around 500.

These figures show the value of field collecting by amateurs to the collections of the Manchester Museum. The sample size of a little more than 5,200 specimens is sufficiently large to be statistically significant. If even roughly similar figures apply to public museums across the country, the importance of collectors and dealers in building museum collections over the last decade is clearly demonstrated.

Looking back somewhat further of course, the contribution of collectors to public museums in Britain in the twentieth Century is enormous. Many of the most famous collections in the UK, including that built by Sir Arthur Russell and now at the Natural History Museum, the Richard Barstow collection at Plymouth Museum and the H.F. Harwood collection, split between The Manchester Museum and The National Museum of Wales, owe their existence to the diligence of collectors and the dealers who supplied them.

## Research

It is more difficult to find useful statistical measures of the contribution of amateur collectors to research in mineralogy. The main avenues of research in university Earth Science departments are governed by funding from the research councils. The detailed recording of sites of mineralogical interest, the area in which amateurs contribute the most, does not figure highly in their priorities. It is nonetheless possible to analyse amateur contributions to refereed journals, such as the *Journal of the Russell Society*, to discoveries both of minerals new to Britain, and to discoveries mineral species new to science.

An examination of papers published in the *Journal of the Russell Society* shows that contributions by professional earth scientists tend to occupy more than 50% of most volumes. There is no case of a volume of the journal without amateur contributions, however, and in some part numbers (eg volume 1 part 2) amateur contributions dominate. At the more popular end of the mineralogical spectrum, in the *UK Journal of Mines and Minerals*, most issues have major contributions from amateur mineralogists. At the more academic end, the flagship journal of mineralogy in the British Isles, *Mineralogical Magazine*, which has one of the highest journal impact factors of any mineralogical publication, still has the occasional amateur author.

The contributions of collectors are not always fully detailed or recognised in scientific publications. I will therefore restrict the discussion that follows to those species which I have had some personal involvement. Over the past 15 years or so I have been associated in some way in the identification or publication (in six different journals and one book) of 17 species new to the British Isles. A handful of further species are currently being worked on, but for reasons of confidentiality information about these cannot be disclosed.

**Table 1** Details of species new to the British Isles identified or otherwise associated with work at the Manchester Museum and of the articles in which they appeared. The table attempts to identify the persons who first found the specimens and describes whether they were amateur collectors or professionals. The data is based on notes in lab books and I apologise in advance for any errors.

| Mineral Species | Notes on how specimens were found and where published |
|---|---|
| Abhurite | Sent to Manchester Museum for identification by collector Chris Jewson (Golley and Williams 1995). |
| Anilite | Sent to Manchester Museum for identification by collector Roy Starkey (Starkey and Hubbard 1998) |
| Bechererite | First found in the British Isles in Central Wales by collector Steve Rust (Green, Rust & Mason 1996). |
| Claudetite | Found in the British Isles at Wet Swine Gill in the Caldbeck Fells by collector Mike Leppington. An earlier record from Wheal Sparnon is open to doubt (Leppington and Green 1998) |
| Ericaite | Found at Boulby Mine, Redcar and Cleveland by mine geologist Peter Edey, identified as ericaite (Green and Freier 1996) but now known to be either congolite or trembathite, both of which are new to Britain (Frank Hawthorne, *personal communication*) |
| Gartrellite | Found at Low Pike trial in the Caldbeck Fells by collector Tim Neall (Green and Neall in press) |
| Gearksutite | Found at the Old Gang Mines by collectors David McCallum and Mike Wood (Green in press). |
| Jeanbandyite | Found at Hingston Downs Quarry and Penberthy Croft Mine by collectors John Betterton, Neil Hubbard and Chris Jewson (Betterton *et al*, 1998). |

| Mineral Species | Notes on how specimens were found and where published |
|---|---|
| Natanite | First identified on specimens from Hingston Down Quarry collected by Chris Jewson (Betterton *et al*, 1998) |
| Raspite | First found at Carrock Mine, Cumbria by collector Tim Neall (Neall and Green 2001a) |
| Parasymplesite | First found at Wet Swine Gill, Cumbria by collector Tim Neall (Neall and Green 2001b) |
| Phaunouxite<br>Rauenthalite<br>Smolianinovite | First found at Muckross Mine, County Kerry by collector Stephen Moreton (Moreton *et al*, 1999) |
| Vauquelinite | Identified on specimens found by the late Maurice Grigg, a well known amateur collector, at Greystone Quarry, Cornwall (Weiss *et al*, 2001) |
| Veszelyite | Found by collectors on a British Micromount Society fieldtrip to the Leadhills-Wanlockhead area (Green 1990) |
| Wooldridgeite | Found by collector Jim Wooldridge at Judkins Quarry, Nuneaton (Hawthorne *et al*, 1999). |

An examination of table one shows immediately the influence collectors have had on the discovery of mineral species new to the British Isles. A dozen or so are involved in the discoveries of the 17 species described above while only one came from a professional geologist.

It is the ambition of many collectors to find a mineral species completely new to science. British collectors have made a significant contribution in finding completely new mineral species in the last 25 years. The British Isles contain the type localities for approximately 105 mineral species. Ashoverite, barstowite, bobkingite, brianyoungite, brinrobertsite, chenite, chrisstanleyite, johnsomervilleite, lanthanite-(Ce), namuwite, macaulayite, macphersonite, mattheddleite, mereheadite, parkinsonite, scotlandite, sweetite, symesite, tristramite, vochtenite and wooldridgeite, about 20% of the total, were published in the academic literature over the last 25 years. Amateur collectors had a strong involvement in the discovery of about half of these species, and four, barstowite, johnsomervilleite, parkinsonite and wooldridgeite honour amateurs or mineral dealers. This demonstrates the importance of collectors in the discovery of new mineral species, about half of the total described above would have remained undiscovered without their efforts.

## Conclusion

The data presented above clearly demonstrates the value of collectors both to the development of public collections and to the scientific study of mineralogy. They have played a key role in the development of the subject since the beginning of the eighteenth Century, a role which continues to the present day.

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# Vanishing stones – our disappearing mineralogical heritage [3]

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## Summary

The greatest threats to mineral and fossil localities come from natural processes of erosion and weathering, or from human activities such as mining and quarrying. Collectors have an essential role to play in the preservation of our mineralogical heritage. Here some of the processes affecting mineral localities are reviewed and illustrated with many examples of degraded mineral localities from around the British Isles.

## Introduction

The processes degrading mineral localities can be divided into anthropogenic (human activity) and the natural effects of weathering and erosion. Erosion generally refers to the physical transport of material, weathering to its physical and chemical degradation, although the two work synergistically together. There follows a discussion of each of the main types of degradation process and their impacts on mineral localities illustrated with specific examples.

## Human activity

### Mining and quarrying

Active mining and quarrying destroy minerals all the time. What little is saved during these processes depends on the goodwill of management, or the quick thinking of the workers. As mineral workings are developed on mineral deposits, and systematically extract, crush and process them, it is likely that they are the single most effective destroyers of minerals.

As an example of a mineralogically beneficial mining operation the recent reworking of the Strontian mines may be cited. Collectors and museums recovered many fine specimens, including a species new to the locality, when the mines were opened in the 1980s, spoil heaps and some exposures still exist for future collecting and study. Examples of destructive reworking are Grassington Moor, Yorkshire and Avoca, County Wicklow. At the former most of the old tips were reprocessed for spar in the 1980s, including those of Turf Pits mine, alleged source of rare mercury and zinc minerals (claimed by A.W.G. Kingsbury, cited by Dunham and Wilson, 1985) which may now never be verified (or discredited). At the latter, Ireland's most important native copper and auriferous gossan localities were totally obliterated by giant open casts in the 1960s and 70s.

### Land reclamation and restoration

An unfortunate side effect of today's environmentalism is the attitude that mine tips are eyesores to be removed and open-casts are unsightly holes to be filled in. Most of the mine

[3] This paper was not presented at the conference

sites of northeast Wales have fallen victim to reclamation projects, including many important localities for fluorite and smithsonite. In Ireland, Ardtully mine, County Kerry (green aragonite), Glengowla and Inveran mines, both in County Galway (octahedral fluorite), Barristown, County Wexford (exceptionally argentiferous galena and oxidised ores that have never been researched) and Roury Glen mine, County Cork (beraunite and iridescent goethite) have also been cleared and 'restored'.

Landfill should perhaps also go under the heading above. Examples include Croreagh quarry, County Down, once a titanite and molybdenite locality, and Ballymurtagh mine, County Wicklow, one of the largest of the Avoca copper and pyrite mines.

**Mine sealing**

The act of sealing a mine prevents access for research and collecting. The Forestry Commission did this at many a Welsh site in the 1980s.

## Natural processes

What man does not destroy nature will. Time scales will vary and different processes will affect different sites in different ways. In addition, human activity may make possible, or at least accelerate, natural processes that otherwise would not have been significant. The natural processes of weathering and erosion are covered in standard geology textbooks. These are general phenomena to which mineral sites are not immune. The unusual chemistry of mineral localities does, however, often make them particularly vulnerable to certain weathering processes. There follows a summary of the principal natural processes involved, together with discussion of how they affect mineral localities, illustrated with specific examples.

**Coastal erosion**

The power of the sea is all too familiar to residents of parts of the east coast of England who watch their houses falling off retreating cliffs. The effects on the soft cliffs of East Yorkshire, and the Dorset coast, are well known to fossil collectors. Specimens, whether mineral or fossil, are being destroyed all the time by coastal erosion. Where the matter becomes more contentious is on rocky coastlines, rather than cliffs of soft clay, where erosion rates are much slower. Even here, however, erosion is king as ultimately even the hardest rock exposure will be worn away.

There is no continuous monitoring, or comprehensive surveys, of coastal mineral sites. However, as evidence that destruction of coastal localities is general, and not just specific to a few sites such as Dorset, reference may be made to surveys of coastal archaeological sites. Over 12,000 coastal heritage sites in Scotland are in imminent danger of loss to the sea (Grant, 2001). The situation is much the same in Ireland where, again, thousands of ancient monuments and remains are about to be consumed by the waves (Johnson, 2002; Carter and Johnston, 1982). With global warming, stormier weather and rising sea levels, the situation will only get worse.

A good Irish example is on the coast just north of Ballybunnion, County Kerry. Here, in 1979, the late Richard Barstow collected the extremely rare copper selenite mineral chalcomenite, from an outcrop on the shore. Several follow up visits by others found no

further trace. It appears that either the outcrop has been totally obliterated, or is buried under many tons of shingle and boulders. On one of these visits a little promontory jutting out from the base of the cliff in a neighbouring cove was found to contain an assemblage of rare sulphate and phosphate minerals (Moreton *et al*, 1995). At the time of discovery the promontory was roughly the size of a Transit van. On a return visit a few years later it was reduced to around half this size. Soon it will be gone altogether.

**Frost and clay expansion**

Frost shattering is probably the principal cause of the scree slopes that accumulate below cliffs. Any rock on the surface is vulnerable. In terms of scale, it may range from prising hundred tonne boulders from cliffs to popping crystals off rocks on a mine tip. It is, perhaps, less appreciated that clays can have the same effect as frost, as they expand when wet.

**Flood, rain and running water**

Floods can have a catastrophic effect on mine tips. Examples include the flood that devastated the Greenside mine, Lake District, in the 1870s, the one that washed away half the Roughtengill tips in 1895 and the July 2002 flood that wrecked havoc at the Hilton and Murton mine site. Even in the absence of catastrophic events, the prolonged steady action of running water will still, in accordance with uniformitarian principles, obliterate a tip given enough time. The waste heap of the Burn of Sorrow mine, Clackmannanshire, has been smeared out by years of rain and flowing water. Parts of the tips of Old Luganure mine, County Wicklow, are gradually migrating downstream.

Mine tips need not be beside a stream to be affected. So long as they are on a slope, the run off from rainfall will cause transport of the dump material. In most cases this is very slow on a human time scale but on steep slopes can become a significant factor in the life expectancy of the waste heap. Thus it may take centuries, as with the ancient burial mounds that dot the west of Ireland and which are now flattened out with the stone cists inside exposed, or decades as with the tips slipping down the north side of Glendalough, County Wicklow, or tragically sudden, as at Aberfan.

**Gravity**

In conjunction with the other effects described here, gravity is the reason mines collapse. Unless driven in durable and competent rock, mine levels often do not stay open for long. Even if the rock is strong, stopes will run once their wooden supports have rotted. Probably the majority of British Isles mines have suffered in this way. It means many localities are now lost. A few examples include: Susanna mine, Leadhills (type locality for susannite and lanarkite, home to many other rarities); Burn of Sorrow mine, Clackmannanshire (supergene Pb/Cu/Zn ores, not been researched); Fee Donald, Strontian (strontianite, harmotome); most Pennines levels especially where driven in shale (many former localities for barite, fluorite and witherite); most of the Wicklow lead mines (unresearched supergene assemblage similar to Leadhills but with native silver) and Lackamore mine, County Tipperary (former malachite locality of note). This is an ongoing process as indicated by the recent collapse in Taylors Level, Coniston (Anon, 2003), and the continual clearing of falls in the Nenthead mines, where collapses seem to be happening at the rate of one every few years (Lawson, 1997).

In some of these cases (eg the Wicklow lead mines), the fact that the mines have been irrecoverably sealed by collapse, before they could be properly researched, means that a full understanding of the mineral assemblages and the processes that form them will never be possible.

### Sunlight

Although sunlight is not normally thought of as a destroyer of minerals it will bleach or discolour photosensitive materials. Perhaps the best-known example is the rapidity with which Weardale green fluorite turns irreversibly purple when left exposed.

## Biological activity

Tree roots are notorious for the damage they do to buildings. The forces generated by plant roots are effective at breaking rock. Any exposure with plant growth or any mine tip with grass cover, will be subject to this. Most of the mica 'books' in the mica heap at Little Scatwell mine, Highland, for instance, have been split along their cleavages by the roots of grass and bracken.

Burrowing animals turn over mine tips, especially the more gravelly ones, bringing fresh material to the surface where it is vulnerable to frost and other weathering processes. Limpets have been shown to cause erosion equivalent to up to 30 % of that caused by the weather, on parts of the English coast (Brown, 2000).

The decomposition of organic matter can raise soil carbon dioxide levels up to a hundred fold generating carbonic acid. This attacks and dissolves minerals, especially carbonates. Humic acids also stain and discolour minerals. The polysaccharides deposited by microbes in the interstices between grains expand when wetted. These, together with the physical growth of the organisms, disrupt the rock (Lenton, 1998).

Finally, a locality may become so overgrown that access simply becomes impossible. The brookite locality at Tremadoc, Wales, (an SSSI) is now completely smothered in vegetation. Much of Gold Mines River, County Wicklow, source of the largest gold nuggets in the British Isles, is impenetrable.

## Chemical processes

### Dissolution

Simple dissolution is a significant destroyer of limestone. Rates can be astonishingly rapid on freshly exposed surfaces. For example, in 1947 till was stripped from a limestone pavement in Craven, Yorkshire. By 1960 3 –5 cm of the surface had gone. Nearby, where peaty water was directed onto the surface, runnels up to 15 cm deep developed over the same period (Sweeting, 1966). Whilst this may represent an extreme case, figures ranging from 1 to 10 cm per thousand years are accepted as typical for limestone karst in Yorkshire and the west of Ireland (Jennings, 1985).

Where rainfall is more acid, due to pollution, the dissolution rate can be expected to increase. As any chemist knows, increasing the surface area of a substance by breaking it down, increases the solution rate. The broken rock of a mine tip will, therefore, be dissolved faster

than a solid, outcrop. The process is also enhanced by biological activity (above). It is not uncommon, in old tips, to find specimens where calcite has been slightly etched away by a millimetre or two, but more resistant phases remain. This is frequently observed in the waste of the 17th Century Hilderston mine, West Lothian, for example.

**Oxidation**

One of the most serious forms of chemical degradation from the mineralogical point of view is the oxidation of sulphides and arsenides. The iron sulphides pyrite, marcasite and pyrhottite are notoriously unstable. In mine tips and in natural exposures, the decomposition of these sulphides generates sulphuric acid, which attacks the surrounding minerals. As pyrite is a common component of many metalliferous deposits, pyrite decay has the potential to affect a large number of localities. At Tynagh, County Galway, rotting pyrite boulders abound, their contents now greatly altered and at Avoca, County Wicklow, the problem is so severe it pollutes the water courses. Fresh pyrite is now unobtainable at Magcobar, County Tipperary, which is unfortunate as it used to show important textural features relevant to metallogenic studies.

Cobalt and nickel arsenides are also unstable. Whilst their alteration may produce attractive and interesting, secondary products, it is at the expense of the primary ores. Thus, the decomposition of the primary cobalt ores at Muckross mine, County Kerry has been so thorough as to leave doubts as to the exact identity of the original minerals (Moreton *et al*, 1998/9). Similarly, all that remains of most of the nickel arsenides at Hilderston mine, West Lothian, are earthy masses of annabergite making it impossible to be sure of their place in the paragenesis of the deposit, leaving uncertain the exact nature of the original ore (Meikle, 1994) and preventing the full characterisation of an unknown phase now present only in trace amounts, and which may be a new mineral (Stephenson, 1983). At Alva, Clackmannanshire, the decomposition of the nickel ores has again prevented their positioning in the paragenesis (Moreton *et al*, 1998). In these cases the natural degradation of the material has impaired a full understanding of the metallogenic processes involved in its formation.

**Hydration/dehydration**

Many minerals exist as hydrates. These may lose or gain hydration water on exposure. This may lead to complete disintegration, as with laumontite, slow conversion to other forms, as with torbernite/metatorbernite, or rapid alternation between hydrates depending on whether it is a wet or a dry day, as with phaunouxite/rauenthalite.

## Discussion

Human and natural processes alike are continually destroying minerals and their localities. This is happening 24 hours a day, 365 days a year, every year. Over time every single mineral and fossil locality on the planet will be destroyed totally. So long as they are buried in the ground they may persist for many millions of years but the act of mining or quarrying them, and thereby exposing them, effectively puts them on death row. The same is true if it is natural uplift and erosion that has brought them to the surface.

The destruction extends beyond the aesthetic damage to the pretty crystals beloved of collectors. It extends beyond the alteration of micro-specimens of the esoteric base metal secondaries also beloved of collectors. Whilst these are often the first to go, the destruction

can make it impossible to obtain a scientific understanding of the metallogenic processes themselves.

Much may be learned from the resilient phases, and the common, massive material that survives destruction the longest. Isotope and fluid inclusion studies will still provide students with their PhDs, but if entire primary phases are missing because they have oxidised completely then information has been lost. If underground access is impossible, and the surface tips gone, or degraded, a full knowledge of the deposit can never be had.

This is not to say that the aesthetic or the esoteric should be belittled. Minerals can be objects of great natural beauty. Their appreciation is one of the joys of life and is open to all irrespective of scientific ability. This is just as valid a reason to collect and preserve them as scientific research is. Fortunately, the aesthetic pieces are often not the most scientifically interesting, and vice versa, so there is not always a conflict of interest here. Indeed mineral specimens may trigger an interest in the science of mineralogy. No doubt many an earth scientist began his or her interest with a crystal or trilobite purchased for a few pounds.

As for the esoteric base metal secondaries, these have some scientific merit as they shed light on the mobilisation and precipitation of metals in the supergene environment. This is of importance in the management of toxic wastes, and research on this topic often makes reference to mineral species (eg Scheckel and Ryan, 2002).

Time scales for the destruction vary considerably but, geologically, are insignificant. As is obvious from the examples above, even on a human time scale, the life expectancies of many mine sites and coastal outcrops is short. Part of the problem is unpredictability. A site may persist for centuries, or be destroyed tomorrow. Survival can be a lottery.

Mineral localities are not like rare orchids, or peregrine falcons, which recover their numbers if left alone. 'Leave alone' policies for minerals will not breed new minerals. When a locality is producing material there is only a limited window of opportunity to recover that material while the opportunity presents itself. Very often management or landowners have no interest, and professional earth scientists are too few and too busy to do the job. It is then up to the amateur and the commercial collector/dealer to rescue what they can while they can.

Ireland (north and Republic together) for example, a country with a thriving earth science community and mineral extraction industry, has just half a dozen professional mineralogists (Perry, 1998). They are busy with their own funded research projects and lack the time to explore the country's hundreds of abandoned mine sites, 200 plus working quarries, extensive coastline and 83,000 square kilometres of land surface. It is not surprising, then, that 39 of the roughly 50 minerals new to Ireland found in the last few decades were found by collectors and 16 topographical mineralogical papers on Irish mineralogy since 1980 have been written, or co-authored, by amateurs. Without wishing to labour the point it is worth pointing out that the large quantities of specimens that flooded out of Mogul mine, Silvermines, were almost entirely due to the efforts of one commercial collector. Minerals are only preserved for future generations if they are discovered and collected.

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# The debate

Hannah Townley
English Nature

Peter Doyle of the Geological Society's Geoconservation Commission chaired the debate. The debate was not fully recorded for the proceedings volume, instead delegates were invited to produce a written statement of their views. A brief outline of the general topics covered in the debate is recorded below.

- **The resource**. It was agreed that this includes the mineral sites, the minerals themselves, the knowledge of those who collect or manage the resource (collectors, researchers, curators, landowners and conservationists) and the different repositories for storing and recording minerals (museums, universities or private collections).
- **The value of the resource**. It was agreed that this includes the contribution of sites, specimens, published research and individual's knowledge.
- **Legislation**. This relates to Sites of Special Scientific Interest (*Wildlife and Countryside Act, 1981* and the *Countryside and Rights of Way Act, 2000*), Scheduled Ancient Monuments (*Ancient Monuments and Archaeological Areas Act, 1979*), Regionally Important Geological/geomorphological Sites - the most important places for geology and geomorphology outside statutorily protected land (described in *Planning Policy Guidance Note 9: Nature Conservation, paragraph 17 (England and Wales))*, Areas of Outstanding Natural Beauty and National Parks (*National Parks and Access to the Countryside Act of 1949*).
- **Collection**. This relates to collecting methods, rescue collecting, what site type you are collecting from (mine dump, vein outcrop or quarry), where collected material should be stored and the ownership and curation of such material. Should material be collected or should it be left on site? This area needs further discussion.
- **Threats related to mineral sites**. It was agreed that these include mineral collecting (small-scale), mineral extraction (large-scale), development and restoration.
- **Threats related to collecting specimens**. It was agreed that these include collecting bans, access restrictions and over-, inexpert or thoughtless collecting. Definitions of 'irresponsible' and 'responsible' collecting have yet to be agreed.
- **Dealing with threat**. This area highlights the need for 'joined-up thinking' and dialogue between the different stakeholders, different management needs for different site types (mine dumps, limited vein outcrops, underground workings or opencast workings), awareness of other interests at sites (including industrial archaeology and rare flora or fauna) and the education of the general public and other user groups. Further discussion is needed in this area.
- **Health and safety issues**. This area requires further discussion and relates to access to sites (eg quarries, mines or caves).

# Written statements

Written statements were requested from delegates, expressing their own views on mineral collecting and conservation issues. The statements were submitted both before and after the conference and have been formatted but not edited.

# 1. Mineral collecting and conservation – written statement

Alan Dyer
The Russell Society and University of Salford

In my experience, although collectors may start collecting minerals for their aesthetic appeal, a high proportion move on to learn how to recognize minerals in the field. If they are members of the British Micromount Society they have access to a reference collection; others will establish links to local groups and museums to aid the development of their recognition skills.

Those who are able to develop these skills are then able to appreciate that a specimen found might be a new mineral. Without this progression the discovery of new minerals would be the poorer, and knowledgeable professional mineralogists freely recognize this - as stated at this meeting.

As a zeolite scientist I am very conscious that the whole basis of the current multi-billion dollar zeolite industry arose from a perceptive observation made by an amateur collector. New zeolites continue to be found in the field and the laboratory. This links to the observations made in the talk by Bob Symes, describing the persistent industrial interest shown to these and to many other minerals.

# 2. Mineral collecting in Cornwall – hammering out a policy

P.J. Ealey, M. Hermolle, R. Osborn, P. Seymour, and C. Sparrow
Cornwall RIGS Group

The Cornubian ore field of southwest England is the most intensely mineralised region in the British Isles. Cornwall's mineral heritage is rich and diverse, ranging from mineralisation associated with the pre-granite Devonian strata and greenstones, mineralisation associated with the subsequent intrusion of the granites and the post-granite extensional faulting phase, followed by placer mineral (gold, cassiterite, and titaniferous ilmenite) deposition as a result of subsequent erosion. Not surprisingly, therefore, Cornwall has a long tradition of academic mineral research and mineral collecting by local dedicated amateur mineralogists. The contribution of the latter resulting from their detailed local knowledge has been recognised over the years in a number of academic papers dealing with the complex geological history of mineralisation in Cornwall (Seager, 1971; Halliday and Mitchell, 1976; Power *et al*, 1997; Leboutillier *et al*, 2002). Going further back in history, titanium was first isolated in the late 18$^{th}$ Century in placer deposits on the Lizard (Gregor, 1791).

Given its striking geology and mineral deposits, coupled with landscapes of outstanding natural beauty, Cornwall is a developing geo-tourism centre. This will only accelerate if Cornwall's World Heritage bid for the Cornish Mining Landscape succeeds. A countywide policy regarding mineral collecting needs to be emplaced. A precedent for allowing collecting in World Heritage Sites (WHS) has been set in the recently approved adjacent Dorset Heritage Coast WHS with its world-renowned Jurassic coastal outcrops.

Within the next year sadly there will be only one museum with a genuine Cornish ore mineral collection and that is the Rashleigh (1729-1811) collection, at the Royal Cornwall Museum in Truro. The Royal Geological Society of Cornwall's collection is no longer on view to the public and the Camborne School of Mines (CSM) museum will close to the public when the CSM moves to Penryn next year. Its collection is in fact more worldwide based than Cornish. Moreover several well-known individual local collections over the last 50 years have been sold and dispersed for probate or other personal reasons.

With the almost complete cessation of mining and years of previous collecting in Cornwall, minerals are a diminishing resource in the county. A responsible way forward needs to be found that not only addresses future collecting and geo-tourism but also the partial loss of Cornwall's mineral heritage and its future conservation. An interesting approach is that taken by the CSM in pioneering travelling exhibitions and an Internet website based 'virtual museum', using digital images.

The disastrous events at the SSSIs, Carrock Fell in Cumbria and Hope's Nose in Devon, have their Cornish counterpart, Megilligar Rocks, famous for its pegmatitic crystals, where explosives were used on one occasion to aid the exploitation. English Nature has now emplaced a complete ban on mineral collecting at this locality, which is known to be broken by out of county and probably out of country (commercial?) collectors. There is no doubt that commercial and a few individual collectors have raped and pillaged some outcrops, giving mineral collecting a bad name. However total bans do not achieve their purpose and deter a continuum of local mineralogical expertise. The conference should consider a national policy involving some form of licensing, particularly as regards commercial collecting.

The Cornwall RIGS Group has designated over 100 RIGS, 30% of which are mineral sites, 50% of which lie in the current WHS bid areas. At a preliminary meeting to discuss a group policy towards mineral collecting, opinions ranged from an outright ban to some form of a regulation. Significantly no one advocated a completely unregulated approach. However given the diverse make-up of the group it is unlikely to ever arrive at a generally agreed definitive policy on its own. One point of unanimity, however, would be that the landowner's permission is a fundamental requirement in any fieldwork and mineral collecting policy. Commonly, responsible collectors have established a long-standing relationship with local landowners based upon mutual trust. This benefits the greater mineral collector community in that trusted collectors can take larger groups to sites, if appropriate. However in a few localities cowboy collectors have essentially trespassed without permission, in a few cases resulting in the landowner banning all collecting.

It is important to understand that RIGS Groups do not have statutory powers and rely on the goodwill and cooperation of landowners. Sites approved by the relevant RIGS Group are registered with the local planning authority and subject to relevant policies in the Local Plan to protect the site's interest. The Cornwall RIGS Group is incorporated as an independent

entity within the Cornwall Wildlife Trust, which has developed a nationally much praised records centre (ERCCIS). This Environmental Records Centre for Cornwall & the Isles of Scilly is potentially an important tool in the management of Cornwall's diminishing mineral resource.

A review of the Cornwall mineral-based RIGS indicates that they occur in a number of different settings:

- Mine dumps and spoil heaps
- Underground workings
- Opencast workings, including aggregate and stone quarries
- Natural outcrops, usually coastal

These different settings need to be addressed in developing a mineral collecting policy. What is acceptable practice in a working quarry may not be so on a coastal outcrop. What constitutes responsible collecting on mine dumps and spoil heaps, which need turning over to reveal their content?

Among Cornwall's mineral RIGS, spoil heaps and mine dumps are the most numerous, but only represent a tiny fraction of those in the county, reflecting the abundance and importance of these sites in the Cornish mineral scene. Three sites are locations of rare minerals, sometimes the only occurrence. Other sites have a good suite of more common minerals, designated as of educational value. One site at the famous Geevor Mine, open to the public, was specifically engineered for this purpose. Apart from their mineralogical significance mine dumps and spoil heaps face other conflicting interests.

- Mine dumps have potential economic value as low grade aggregate (hardcore) and whilst still subject to aggregates tax, a number of notifications of removal of such material have recently been received by the Cornwall County Minerals Planning Authority.
- Former abandoned mining sites, in particular bare ground localities, are habitats for bryophytes and lichens, some of which are nationally rare, and invertebrates.
- Uninformed, as regards their mineralogical and biological importance, development of derelict land sites.

It is doubtful in Cornwall that the definition of a mineral collecting policy can be realised without a multi-disciplinary approach. It follows from the above that mineralogical and biological sites in Cornwall need to be ranked independently in importance so that their relative importance can be evaluated.

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# 3. Thoughts on the future of mineral and fossil collecting

Jim Goulding
Southampton Mineral and Fossil Society & The Russell Society

If I wanted to devise a means of preventing amateur collecting in a particular area, I would bring in a complicated system of permits putting the onus on the collector to justify why he or she needed to go to that area. If you make it difficult enough the reaction is likely to be "to hell with it, I will go somewhere else" and maybe a worthwhile mineral discovery would be lost. The permit arrangements that now exist on the Caldbeck Fells stifle all scientific investigation into what mineral species exist on various sites. The rigid regulation of the system is so complex as to make it just not worth visiting the Caldbeck Fells any more, and perhaps this is the intention.

We have been told that the permit system was brought in because of the great damage that had been done to the famous sites. Members of our society visited all the famous sites about a month before the ban on collecting came in and there was hardly any serious damage to be seen. Of all the many sites visited only Mexico Mine had some holes dug into it. Richard Barstow did dig a trench there some years before and many beautiful pyromorphite specimens became available to collectors at shows. Nobody complained in those days. Of course, there is always a chance that commercial interests could destroy sites to obtain specimens and this does need to be prevented.

During our visit to the Caldbeck Fells I did see very severe damage to the fell-sides, not by mineral collecting but by hill climbing by 4 × 4 vehicles and trial motorbikes.

As a mineral collector I have three objectives. One is to look for specimens of minerals new to my collection from a particular site. Two is to try and find new species, not yet recorded from a particular site. Three is to replace the quality of an existing sample with one of higher standard. The replaced specimen can then be passed on to another collector, who may not yet have a sample of this material. For this it is necessary to have ease of access, without having to justify the reason to visit some site by having an imagined research programme.

We feel that the system operated by the Dorset Heritage Coast authorities is excellent in that collecting is encouraged, but they do like to know of any worthwhile finds. Digging into the fragile cliffs is forbidden for environmental and safety reasons. I believe that commercial

collecting is not permitted. This seems to be a sensible basis for a future code of conduct for collecting throughout the UK. Of course, permission must always be sought before entering any site. Any digging at a particular site must be filled in before leaving. Leaving holes at any open country site can be dangerous to animals.

Much of the discovery of new species at sites throughout the country has been greatly helped by large numbers of amateurs taking home specimens for microscope investigation. A great many major discoveries over the last two hundred years came from amateur collecting. One has only to think of Sir Arthur Russell as typical example of an amateur mineralogist of that time who made a major contribution to our scientific knowledge of minerals and left a magnificent collection to the nation.

# 4. Further thoughts from the Salford Conference on Mineral Collecting

Jim Goulding

Having listened to all the various presentations, all with very relevant aspects of minerals and geology – it seems difficult to reconcile many of the opposing views on some aspects of our subject. It is agreed that some geological sites of importance should not be spoilt by collecting, while others are sites where collecting could take place without endangering the educational value of the geology. An overall ban on all collecting is not the answer and would result in many new species not being found. I personally do not believe that collectors are irresponsible morons. At the conference I did suggest that very important sites could be labelled as being for educational purposes and to ask people to respect the area and not collect there. This seemed to be greeted with some derision – suggesting that such a label would attract collectors to a site. I do not accept that serious collectors would behave in this way. If I saw such a label on a site requesting that it should be left alone for future groups to study, I would not consider even touching it – even if it contained some interesting minerals. Surely this is a question of changing attitudes by education.

There has been an unfortunate attitude by Local Authorities to old mine sites and dumps in the past, which has resulted in 'tidying up' valuable and finite mineral specimen resources. These priceless old sites and dumps have been bulldozed and the material used as hardcore. This has happened many times in Cornwall and there are doubtless many fine mineral specimens under local roads. The area has been tidied up and grassed over. At least two very famous sites have been converted into caravan parks after the removal of valuable dumps. This must not be allowed to happen again, and one thinks of Penberthy Croft mine dumps as being vulnerable in this respect. In Mid-Wales farmers were given grants to improve their roads and paths. Valuable dump material was used as hardcore and all the old dumps were removed. The result was that good examples of minerals could be seen in roads and paths on farmland.

The destruction of mineral sites has done more damage to our knowledge of minerals than any collecting. Where possible, old mine dumps should be left in place and collecting should be permitted. A code of collecting conduct should be drawn up to prevent over-collecting by a greedy minority. I am sure that the majority of collectors do already observe this rule. I feel that with education it should be possible to bring in a new attitude to collecting in which

individuals only collect a limited number of specimens of one mineral species, abide by any notices put up at particular sites and to leave sites in good condition by in-filling any holes dug. Any important mineral discoveries should be reported to the relevant authority.

# 5. Personal views following on from the Conference 16 April 2003, Salford

Dave Wellings & Lynda Garfield
The Russell Society, Wales and West

## Minerals to collect

The indications from the conference were that (active) quarries and mines are our most important current and future sources of collectable minerals. However it seems that quarry management is not aware or is indifferent to this; their aim is to quarry rock, not cater for or look after collectors.

Discussion is therefore urgently needed, at a local level between local collectors and local groups and local quarry management, and at a national level, between the major bodies (English Nature, CCW etc, Russell Society etc) and the industry associations (Quarry Products Association etc).

## Health and Safety

Health and Safety (H & S) and insurance issues are a major threat to mineral collecting. The liabilities that committee members and field leaders take on, in an increasingly litigious society, are not currently fully understood. Two of the societies we belong to have spent a great deal of time on these issues over the last year, and we are still not sure of the full implications. So why should we bother to help? Unfortunately this could well result in fewer people putting themselves forward as committee members and field leaders, in turn threatening the very viability of mineral groups and collecting trips. As quarry managers tend only to allow recognised groups to collect, if these start disappearing, what future will there be for collecting?

How silly the situation can be is perhaps illustrated by this - if a society organises a walk along a beach under a cliff we may be held responsible if an accident occurs, however a person can do the same walk at some later date and have a similar accident, whose fault is it then?

It has been reported to us that one geology teacher in West Wales, rather than take his class to a geological site and risk prosecution if anything goes wrong, now videos the site and shows it on TV to his class.

The Russell Society has already been refused entry to a few sites in South Wales on the grounds of health and safety. At one site a coal tip was being landscaped; we were told that in the days of the Coal Board there would have been no problems regarding access. But the company concerned would not allow us entry under any circumstances, even on Sundays when the site was effectively closed down. Coal tips and their minerals are becoming quite a rare commodity in South Wales; the minerals will only exist as collectors' items and museum

collections in the near future. Perhaps we should be collecting like mad from the remaining coal tips?

One of our colleagues, a trainee quarry manager, has warned that access to quarries may not continue for long because quarry managers do not want the hassle imposed by health and safety regulations, and the potential problems that would arise if an accident to a visiting group were to occur. As this threatens our major sources of minerals, again, urgent discussion is needed between collectors and industry.

## Conservation and responsible collecting

The need to collect responsibly came loud and clear from the majority of those present at the conference. What is meant by 'responsible collecting' needs to emerge from very widespread discussion. Only then will 'responsible collecting' be acceptable to as many mineral collectors as possible, after different views have been aired, heard, criticised, compromised. Inevitably there will always be some people who will not adhere to any acknowledgement of good practice or code of practice which might emerge; unfortunately these are the few who spoil it for the many. The point is – we need to engage as many collectors as possible, as early as possible, in any discussion. This will require a concerted and careful effort by all those concerned, from a local level in local groups onwards.

As a general comment most new collectors do collect at first in excess, but at some time realise that they have a storage problem at home. At this point they perhaps think a bit more on what they are going to collect. It is not unusual for long-term collectors to leave a site with nothing unless they have found new or better examples of what they already have. But there are always people who will remove material for swaps or sale to other people for financial gain. How we deal with the excesses of these people we do not know. If most of our collecting is from quarries, where the material would have been destroyed anyway, perhaps this does not matter so much and perhaps a local museum may benefit as well. But it will matter for other sites if their action diminishes the mineral resource, which is often the case.

## Collectors

Several people at the conference raised the need to encourage young people into mineral collecting. These are our future, to whom we need to pass our mineral resource onto, including our knowledge. But there is a noticeable absence of young people interested in mineral collecting, indeed the average age seems to be in the 50–60 range; are they all watching TV or playing computer games?

At the moment, young people are not allowed in quarries. We need to think how we can encourage them. There are no easy answers, but given that quarries are our major source of minerals, the future does not seem very promising.

Quite a few mineral groups spend time at shows and other public events telling young (and old) about minerals. If groups start declining, as indicated above for, say, the knock on effects of health and safety issues, will this public awareness raising be able to continue? It is very important that young people get the message.

If mineral groups decline, for whatever reason, there could be a downward spiral. Being totally pessimistic, the hobby of mineral collecting could be killed off, general awareness could diminish, and questions about even the need for SSSIs and RIGs could be questioned.

Perhaps we should look at how people first get into mineral collecting. Can we learn from this? Can we find out how young collectors currently get into collecting?

It was raised that aesthetic mineral collecting should be considered as valid as any other collecting, on its own merits, regardless of any other interests. But do we not have to consider that any action undertaken inevitably has consequences which we have a responsibility to consider? So aesthetic collectors need to be mindful of scientific considerations, and vice versa. This is getting into philosophical realms, but there are some fundamental points here which need further discussion.

We (well, at least the majority) already accept that we cannot pick wild flowers without seriously depleting the resource. But then, legislation had to be introduced to protect this resource. Is this the way mineral collecting may go, or can we learn from history and act responsibly now and avoid legislation? Unfortunately one of the lessons learnt from history is that we do not learn the lessons that history can teach us.

We do need to pass on information. Alas the mineral collecting fraternity is poor at this. Worries that someone else will go to a favourite collecting spot and take everything. A lot of information about our mineral resource does actually get lost, as a result of relatively selfish motives.

## Caldbeck Fells

There has been a great deal of debate about this site and the need for a permit system. Many of us in South Wales are aware of the regulation, but not many of us have been there. So if we wanted to visit this site and collect some minerals on a one off visit, what reason would we give for a permit? From comments we have heard, we understand that the site is only open for collecting to a few well-favoured people. Whether this is true or not, the comments we have heard are not favourable.

As distant observers, it does seem that there has to be room to allow some serious ‘enthusiastic collectors’ to carry on a tradition of collecting which is not necessarily for immediate research. There is a wealth of knowledge and expertise among a few serious collectors. Without this being passed on and allowed, valuable knowledge and expertise will be lost for the future. In other words, allow wider collecting under the licensing system.

# 6. Cavers and mineral collecting

David Webb
Conservation Officer, Derbyshire Caving Association

Many collectors have at one time or another ventured underground, and I thought it appropriate when considering the future for the mineral resource in our caves and mines that the views of a regular recreational caver should be aired, and that we too should be accepted as stakeholders in the management of our mineral heritage and in the shaping of future policy.

Cavers will often spend a great deal of time and effort negotiating access agreements and otherwise facilitating and protecting access for visitors with differing interest in the sites. Here in Derbyshire we are actively engaged in positive conservation measures in the production of Conservation Plans and documents (*A Cave and Mine Conservation Audit for the Masson Hill Area, Webb 2001; Cumberland Cavern and Wapping Mine, Barnatt and Webb 2002*) and in the regular site maintenance and Conservation Monitoring of our unique mineral resource. These measures are carried out voluntarily, and frequently go unrecognised by the wider band of users.

For many years now cavers, chiefly in Derbyshire and the Dales, have witnessed first hand the damaging activities of a minority, and this element is well known to, and was condemned by delegates at the conference. But there is a problem here in that the protected status afforded by SSSI designation is known only to a handful of users of cave and mine sites and even fewer know to which sites these apply. Consequently they may be completely unaware that the site is protected. And so as a first step the DCA has provided assistance to English Nature and site owners at 'problem sites' such as Wapping Mine, in erecting signs both outside and within the system to make all users aware of the SSSI status of the site and of the legislation that therefore applies.

The conference has proved helpful and informative to me personally and I enjoyed meeting and chatting to other delegates, some of whom admitted to being cavers in another life! We share a common interest in the natural world beneath our feet and I believe that we can work together towards managing and conserving what remains of our underground mineral heritage. Future generations need to be able to enjoy observing and studying minerals in their natural setting and context, and we should unite to heighten awareness of its value to both cavers and collectors.

# 7. Mineral collecting as a hobby

H. Critchley BSc

Most people attending this conference will know of and will already have views on mineral collecting *per se*. I want to add my mite in the shape of my personal approach to the subject. I am not saying whether it will be thought right or wrong, but I can only say it has worked for me.

My interest in minerals was first aroused by seeing teaching specimens in the Geology Department at University and very impressive ones - though limited - in the museum of my

home town. I could only marvel at the beauty - and regularity - of the shapes produced by nature over a very large number of years. However, it was only later in life, when I had to teach earth science to secondary school pupils that I realised I should do something about my interest and sense of wonder, and, with my wife who is also a teaching chemist, joined the local mineral society.

Once this step had been taken, we were introduced to the joys of mineral collecting, and after nearly 20 years of collecting I have an even greater sense of awe because of the specimens I have had the privilege to view and collect over this period of time. Perfect or imperfect, macro or micro, the number of different forms, twinning in a variety of ways, replacement (pseudomorphs) or coated and then dissolved out sometimes to be replaced by a completely different mineral (epimorphs), it does not matter. Each specimen is unique in the same way that any work of art is unique and deserving of being preserved and receiving adulation. The fact that I now know something about the mechanisms involved actually increases the sense of wonderment that these specimens exist because of, or despite, certain conditions in the earth's crust/mantle.

When I find specimens in the field I feel a close empathy with the men - or women - who removed them from the ground and saw the crystals for the first time and maybe, at the risk of their job, took some home to show them to the family, or to be able to look on them whenever they wanted, because they were inspired by them. Maybe, if I find them underground, I realise that no one else has ever seen that specimen, which had taken such a long time to be formed in the earth. Nature still outstrips mans' imagination and there is always something new to find.

Despite all this however, my scientific brain takes over and - I think - I am a responsible collector. Material which I cannot identify, is sent to the local museum/university, specimens are donated, again to the local museum, and it is always the hope of a collector that he will at some stage find a mineral that is new to man. (There is still that possibility, as about 20 new ones are discovered each year - mostly found by amateurs though they usually are identified by willing professionals). Specimens are also preserved and curated at home

Unfortunately the mineral sections of most museums are being reduced in size in order to make way, for what some people think, are more spectacular dinosaurs. To me, they do not have the same sense of wonder that minerals have, but I think the only way back for museums is to try and beat them at their own game by the use of large spectacular groups of crystals to form an introduction to a more fascinating branch of science. Unfortunately most minerals sections seem to concentrate on the uses of minerals or a systematic display, neither of which has the ability to rouse this sense of wonder. I saw an example of this former approach in the Museum of Earth and Man in Sofia, last year where the main hall was filled with giant quartz crystals of different varieties, which certainly was very inspiring. The systematic and special displays were kept for the upstairs balconies, for people who could manage to drag themselves from the main display.

I realise that they are a finite resource, though some minerals are still being formed by the action of water and oxygen on tips and others are being destroyed to make these, this process can be extended underground by the action of ground water seeping through and sea water where the minerals veins touch the coastline. But even, so called, stripped sites can still produce very interesting mineralisation, especially with the aid of a stereomicroscope. It should be realised that most new minerals have been found by amateurs, and submitted to

professionals for identification (as most professionals only rarely get time to get into the field to study sites in some detail), and that without the amateur many of the new minerals would not have been identified. Thus professional and amateurs should be more tolerant of each other, realising their interdependence.

The worst damage to tips, by far, is done in the name of Health and Safety. Landowners are concerned about aspects of insurance while collectors are on their land and, as a result, forbid or strictly control access but worse still often get rid of the material - usually by spreading it out over the land or removing it entirely - then covering the land with a layer of top soil. It is then lost forever. This is usually done out of fear, and they use the cheapest means possible to get rid of such a liability. These are the people whose actions should be controlled, not the collector. To the collector it is a valuable resource and museums benefit as a result! I cannot blame the landowners entirely, but surely there must be another way. Not only do collectors lose out by this sort of action but it also destroys the inheritance of the local population. No longer will parents be able to point out to their children that this was where granddad or dad worked, or teachers use it as a valuable resource and part of their heritage is lost. I should point out here that a few enlightened landowners do value the mineralogical inheritance that they possess and even go out of their way to help collectors, but there are many (and these include some large landowners who should know better) who only want to landscape these sites.

Maybe something will arise out of this conference, which will help. I feel that the briefs of landowners should be to take care of the land they own and see in what ways interested parties eg groups of school children, visitors or collectors, could have access. Arrangements to visit these sites should be as simple as possible to help people gain access rather than to keep them out. Some quarries indeed have won awards for opening their sites to visitors for geological and mineralogical work as well as displays and conducted tours showing how the quarry functions (It being vital in National Parks to gain acceptance from the locals and visitors alike if they wish to keep their licence). Such sites are an asset, and visitors can put money into the local community in a variety of ways. This could be the difference between life and death to many a community.

Some landowners complain about the selling of specimens collected on their land - no doubt wishing that they were the recipients of that money - and do not seem to think about the planning, thought, expertise and care that went into the collecting. Do they realise that by banning, or severely restricting access for collecting that they are often responsible for the trade in specimens which goes on, and the rise in prices of the specimens. Also some collectors, by the nature of their work, or lack of time or money, geographical location or health find it impossible to visit a site to collect, and resort to adding to their collection by buying specimens. It could also be that certain specimens are only available by buying, eg Chinese specimens, so that any collector who wishing to add to, say, their fluorite collection would have no option but to buy a Chinese one. This means inevitably that dealers in minerals are essential for access to these minerals. These dealers will hope to make some money out of them as in many cases it is their livelihood, and we should not despise them - as many professionals or landowners do - as they are fulfilling a need. I feel they should be regarded as antique dealers are, and valued for their expertise at the very least. It would be difficult for museums to acquire the spectacular specimens referred to earlier if they were not bought from dealers, or had not been bought in the past. Museums often find it impossible to buy spectacular specimens these days because of a lack of money and they have to rely on lesser specimens, which they can afford or have been donated by collectors. This can be self-

defeating, as it is those spectacular specimens, which can and do, bring visitors into the museum. Most private collections will inevitably find their way into museums or universities as their owners pass on; so most material finds its way to where, most people acknowledge it should be, and provided the collection had been well curated and documented, it will have been all the better for being in the hands of a dedicated amateur collector.

The arguments for and against mineral collecting will go on long after this day, even as they have raged for the past few years. I can only hope that conferences such as this will result in enlightened professionals at universities, museums, and that those in charge of our countryside, including English Nature, will welcome responsible collectors, knowing that they and their local communities will see the benefits, however indirectly. While the collectors help them, and science, by bringing new specimens, species and hopefully the odd spectacular specimen to light, thereby helping to preserve some of our greatest works of natural art, which will be a joy to many people for a long time to come.

# 8. Written statement

Roy Starkey

The meeting provided a useful forum for airing some widely differing views, but the time available for discussion was not really adequate to pursue any particular thread. The key points which emerged seem to be that amateur mineralogists and collectors need to take greater account of other resource users when considering their own interests and activities, that collectors see only a small part of the whole picture, and that institutions *per se* are not 'anti-collecting'. Better-informed collectors will be better able to contribute to future policy, and wider publication of 'sensitive' sites such as SSSIs would go someway to assisting this.

It must be acknowledged that pressure on certain sites has been a problem, but equally there may be other sites where collecting might be actively encouraged - even to the extent of the land or site owner facilitating some mechanical turning over of dumps to expose new material for examination. Health and Safety concerns will continue to dominate granting of permission for access - particularly in working quarries and underground locations and any help which the authorities can offer here will be greatly appreciated.

There was much talk of 'responsible collecting' and this concept needs to be explored more thoroughly. It is possible, for example to envisage working quarries where removal of any material will potentially safeguard a resource which would otherwise be consigned to the crusher; a small outcrop or exposure where removal of any material would effectively destroy the resource (and should therefore be protected and respected), and mine tips where whilst the resource may be safe for the time-being there is a constant threat of obliteration or removal. In each of these instances different behaviours and approaches would be appropriate. In this regard it was reassuring to hear some of the speakers advocating that a 'one size fits all' policy was not appropriate to preserving the interests of the various user groups.

Perhaps the biggest contribution that the amateur collector can make to the future of mineral collecting is to join in the debate. Either individually or via some body or society the collector must make his voice heard and recognise that there is a need to adapt to changing circumstances, to listen and to lobby effectively, and to make sure that collectively we get our

act together. There is an opportunity for collectors to self-police the hobby to some extent, we must be bold and get involved in helping to formulate a policy for the future.

# 9. Mineral collecting: an inclusive approach

Sara Chambers
Royal Cornwall Museum

Britain has a long history of academic, professional and amateur mineral collecting, witnessed by the wealth of collections residing in our academic institutions and museums, notwithstanding the collections currently held in private hands.

Mineralogical sites are by their nature transient, being subject to erosion, weathering and obscurement by soil and vegetation. They are constantly eroding to a lesser or greater extent with or without man's assistance and therefore each site represent a finite resource.

Surely the aim of all individuals and bodies who have an interest in promoting and developing our understanding of earth science is to ensure that our geological resources are used to best advantage. Inclusivity not exclusivity should be our objective in this instance. In the case of mineralogically interesting or important sites this means ensuring that the site and its contextual mineralogy is exposed to the widest, most appropriate audience for the longest period of time. In my opinion, two principles should be used to achieve this goal:

- Careful site management will prolong the life of a site for as long as is reasonably achievable (a variation in the use of the 'ALARA' acronym). It will help to ensure the availability of the site for future generations of interested individuals and earth scientists.
- Responsible collecting, carried out by individuals with a knowledge and appreciation of specimens, will enable the contextual mineralogy of a site to be far better understood and 'preserved' than if severe collecting restrictions were imposed or if unregulated collecting were allowed to take place. Whether collecting for academic research or for specimen inclusion into museum or private collections, collecting has a vital role to play in the inclusive management of geological sites. We are all aware of the long-term circulation of mineral specimens between collectors, dealers and museums. Specimens originally carefully collected and meticulously curated into a private collections are very likely to pass through or into the public museum domain at some point in time, witness the majority of the UK's finest museum mineral collections, many of which are founded on superb private collections.

The difficulty lies in applying these fine principles. Legislating for and enforcing site management and responsible collecting remain problematic. However, legislative and fiscal mechanisms do exist which could be harnessed to promote access to and management of mineral heritage sites: these include for example the *Countryside and Rights of Way Act (2000)* and agricultural subsidy/compensation schemes similar to 'setaside'. Collector licensing, comprising a mandatory code of practice and a permit scheme would promote good practice and help to constrain the more 'aggressive' collectors. Any modest revenue generated could be used to fund the policing and management of sites and potentially provide a subsidised liability insurance/indemnity scheme.

As a first step however, increased awareness, understanding and communication between interested parties would provide a foundation on which to build for the continued best use of our mineralogical heritage.

# 10. Mineral collecting in the Republic of Ireland

Matthew Parkes
Geological Survey of Ireland

Conservation, access and responsible collecting at mineralogical sites in the Republic of Ireland operates within an entirely different framework to that of the UK and this paper is intended to provide a clear and current position statement for any mineral collectors who might wish to visit and collect in the future. Sadly, many UK visitors to Ireland do not even seem aware that it is an entirely independent country with its own political and legal framework, which although similar through inheritance, is now more European focused than ever before. It is also rapidly changing and potential visitors are advised to seek up to date guidance in relation to mineral collecting before any planned visit. Traditional easy access and welcome to sites has become constrained, and the recent activities of a very small minority of commercial mineral dealers have caused serious public concerns as well as jeopardising the situation for responsible collectors.

The Irish Geological Heritage (IGH) Programme of the Geological Survey of Ireland (GSI) has as its primary function, the identification and selection of the most important geological and geomorphological sites, for designation as Natural Heritage Areas (NHA). This is crudely analogous to the Geological Conservation Review (GCR) of England, Scotland and Wales and the Earth Science Conservation Review (ESCR) in Northern Ireland. NHAs are similar to SSSIs, but the GSI has no statutory role in relation to the designation process, only the scientific selection process. Designation and management of all nature conservation sites was undertaken by Dúchas The Heritage Service. After Departmental reorganisation in 2003, designation and management functions are now within the National Parks and Wildlife Division (NPW) of the Department of Environment, Heritage and Local Government.

The Wildlife Amendment Act 2000 gave formal legal status to NHAs, although they had been operational as 'Proposed' for about 7 years previously. They represent the primary national unit of nature conservation. Although not primarily designated for any geological reasons, the habitats defined by European Directive, underpinning the Special Areas of Conservation, often include significant geological interest or geodiversity as a foundation to the biodiversity. The IGH Programme includes efforts to identify for NPWS those features and sites of importance within SACs. The SACs have existing formal legal protection, but some NHAs have yet to be designated by due legal process, including most geological sites. It is a rolling process, and current designated sites may be determined from the Departmental website www.environ.ie. However, where GSI has identified a site as a candidate NHA, mineral collectors should obviously treat it with appropriate respect even if designation has yet to take place.

Mineralogy is one of 16 themes of the IGH Programme, and an expert panel has met to prepare a candidate list of sites. This first step of the process is almost complete, as it is now is for most of the themes, and by the latter half of 2003, we should have a clear picture of all candidate sites for geological conservation purposes. Not all candidates will be selected for NHA status, where only the minimum sites to fully demonstrate a geological theme will be

selected. However, those that are designated for their mineralogy will be the best, and some will have restrictions on collecting as part of their management to conserve the geological heritage. This will particularly apply to unique, exceptional or restricted mineral occurrences.

Other important sites will be promoted as County Geological Sites (CGS), somewhat analogous to RIGS sites. By inclusion within the planning system, as scheduled sites in County Development Plans they will be effectively protected from inappropriate developments but they will have no legal protection or management except where locally developed by landowners, communities or Local Authorities. It is now being recognised by many Local Authorities, particularly through their Heritage Officers, that they have a responsibility to address geological heritage and they are important partners in both protection and promotion of geology and geological sites to a wider audience. As particularly accessible parts of geology for the non-professional, both mineral and fossil collecting are likely to be in the future spotlight at county level.

Access to sites is a key issue in Ireland. Until quite recently a visitor would receive a clear welcome and have no problems accessing rural land anywhere in the country, except perhaps in some border areas. This traditional open access situation has changed and mineral collectors should be aware of this. Reasons for the changes are many, as Ireland had 'modernised' within Europe, and greater pressure has come on the land for development. Despite an Occupiers Liability Act, designed to address third party liability concerns, many landowners are reluctant to allow access to their land. As with any activity on private land, there is no substitute for courtesy and respect, in seeking the permission of the landowner to visit and to collect minerals if possible. In most cases, subject to any restrictions at designated sites, this permission will still be given.

Another significant difference to the UK lies in the National Parks. All National Parks in Ireland are actually owned by the State and managed for nature conservation, and therefore any mineralogical sites within these areas, such as old mining districts at Glendalough in the Wicklow Mountains or Ross Island in the Killarney National Park are subject to strict restrictions on collecting activities. Furthermore, old mine sites are encompassed within the archaeological protection of the National Monuments Act, with very stringent controls and significant penalties. Any excavation at any old mine site, and this could include scratching about on spoil heaps with a shovel, by law should be undertaken under the supervision of a licensed Archaeologist.

Mineral rights per se, rest almost entirely with the State, and exploration licences and mining licences are issued by the Exploration and Mining Division of the Department of Communications, Marine and Natural Resources. Anyone contemplating a small mine for minerals, on any commercial scale would have to address a comprehensive range of issues with the regulatory body. The GSI has a role in promoting the minerals industry nationally, and to that end keeps important databases of mineral occurrences and mining records. It has published numerous reports on particular areas and topics which may be of interest to mineral collectors, including some joint publications with the Geological Survey of Northern Ireland, covering cross-border geological areas. [The Environment and Heritage Service and the GSNI should be consulted in relation to mineral collecting in Northern Ireland].

The GSI and the IGH Programme fully recognise that mineral collecting is a stimulating and worthwhile activity practised by many people for its intrinsic interest, and that there is often a scientific gain through new knowledge of mineral occurrences and associations. 'Amateur'

mineral collectors can contribute greatly to the scientific work of the geological profession, and to geological conservation. However irresponsible collecting can cause an unacceptable loss of our shared mineralogical heritage.

Irresponsible collecting includes:

- that done without express permission of landowners, or relevant agencies;
- collecting undertaken in contravention of relevant legislation;
- collecting without proper recording and curation of specimens;
- overcollecting;
- damaging use of tools or machinery to extract minerals and destroy the contextual outcrop;
- collecting done unsafely, where residual debris or loosened rock poses risks to other people or property.

In summary, the IGH Programme recommends that any mineral collectors contemplating visits to Ireland should:

- always seek permission from landowners beforehand and respect their wishes;
- avoid collecting at any designated sites where restrictions are in place;
- seek advice or guidance from the GSI, National Museum or other geological organisations as appropriate;
- make themselves fully aware of the relevant legislation;
- co-operate with Irish or other geologists where possible to undertake collecting as part of a structured research project;
- always try to publish significant new data in appropriate mineralogical journals or the Irish Journal of Earth Sciences for example;
- co-operate with the National Museum of Ireland, and enhance their mineral collections by donation where suitable;
- use existing collection resources for research and identification purposes;
- contribute to GSI databases of mineral occurrences where new data is gained;
- focus collecting on sites where minerals are legitimately being destroyed by mining or quarrying, but only with the permission of the operators where it is given.

Whilst it is not the intention of this statement to deter potential UK based collectors from visiting Ireland, it is hoped that sufficient information has been covered to allow responsible collecting to be undertaken by anyone, without creation of problem sites with conflicts of interests. GSI can be consulted and contact details are available on the website www.gsi.ie

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# 11. The wildlife value of mines and mine dumps

Andy King and Kate Jeffreys
English Nature, Roughmoor, Bishops Hull, Taunton, Somerset TA1 5AA

Mines and mine dumps have long been recognised as having high geological value; they often contain suites of rare minerals which yield important scientific data on metal ore formation and metallogenesis, and they continue to provide an important resource for research and education.

Perhaps less well known is the fact that sites such as disused mines, spoil dumps or old colliery workings can also be very important for wildlife – such sites will typically have been relatively undisturbed for a considerable period of time and effectively left for nature to 'take its course', rather than being subject to the landscaping techniques typical of late-20th Century industrial or residential development. A general 'rule of thumb' is that the longer a site has been abandoned, then the greater the wildlife interest will be, although this is influenced by a number of factors such as the long-term presence of unusual habitats (such as bare ground or rock) characterised by rare and unusual assemblages of 'pioneer' and other species.

Cumbria and Cornwall provide particularly good examples of the wildlife benefits associated with 'derelict' mines and dumps. The mining of ore metals in these counties has left an indelible mark on their landscape, heritage and culture, and the by-products of mining have left a legacy of worked areas with concentrations of copper, zinc, lead, arsenic and antimony. Due mainly to their mining history, these areas have escaped reclamation for agriculture; for example, in Cornwall such sites now represent some of the last remaining and substantial areas of semi-natural habitat in the county. Many Cornish mine and mine dump sites contain areas of heathland, a nationally declining resource with valuable faunal and floral communities. They also contain areas of bare open ground which are a particularly important and scarce resource for invertebrates, including rare beetles and mining bees, as well as for mosses (bryophytes); those sites with shallow ephemeral pools may provide excellent conditions for rare dragonflies and protected species such as great crested newts.

The presence of heavy metals in mine dumps has led to the evolution of plants that are genetically different to those growing on normal soils, and especially to metal-tolerant populations of common grasses. More recently these sites' unique value to lower plant biodiversity, especially mosses and liverworts, has become better understood. A number of bryophyte species found on abandoned metalliferous sites are nationally or even internationally rare, such as the Cornish Path Moss[4], and may be restricted solely to 'metal contaminated' conditions (Holyoak, 2000). The presence of these metallophyte lower plants is reliant upon the fact that such areas have existed undisturbed for a considerable period of time and their conservation requirements are extremely sensitive. The flora growing on

[4] Cornish Path Moss *(Ditrichum cornubicum)*
Cornish path moss is endemic to the UK and has been confined to only one site in Cornwall since 1963. It is a pioneer species characteristic of path and track edges and is unable to compete with larger plants. The moss occurs in three locations within a site covering approximately three square metres of old mine spoil, which is enriched with copper minerals. The moss is listed as endangered by the IUCN and critically endangered by the GB Red List. It is protected under Schedule 8 of the *Wildlife and Countryside Act (1981).*

unshaded, metal-rich soils around mine sites is often a seral stage that is eventually replaced by taller vegetation which shades out the interesting bryphytes. Fortunately, colonisation by vascular plants is slowest on areas with the highest metal levels, and it is these areas which typically support the rare bryophytes. However, it is important that areas of metal-rich land remain bare and available to allow the successional spread and prevent decline of these bryophytes.

Lichens are also often important colonisers occurring on spoil heaps and mine buildings and adit walls, themselves often mineralised (Purvis & Halls, 1996). On these sites even the remaining mine 'infrastructure' has nature conservation value: mine shafts and adits provide important roosting sites for bats especially in winter, and abandoned mine buildings also provide nesting sites for birds such as Raven and Peregrine (Spalding *et al*, 1996).

In summary, mines and mine dumps are often of very significant value for geological and wildlife interests. Their successful conservation now, and in the future, depends on all those involved in their management and use recognising and appreciating this range of interests. Responsible and sustainable collecting includes the need to look after the wildlife values of such sites, as well as furthering our understanding and appreciation of their mineralogical interests.

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# List of delegates

| | |
|---|---|
| Shirley Adrian | |
| D M Alderson | |
| Bislim Boshnjaku | Institute of Geological Research, Tirana |
| John Brookes | The National Trust |
| Linda Campbell | University of Salford |
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| Laura Cox | The Staffordshire Wildlife Trusts |
| Harry Critchley | |
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# Appendix - Collecting codes and policy statements

# 1. Lake District National Park Authority – Caldbeck and Uldale Commons – Minerals Policy

This policy covers the area of Caldbeck and Uldale Commons in the ownership of the Lake District National Park Authority and that part of Caldbeck Commons owned by Dalemain Estate.

## Introduction

The Caldbeck Fells are a significant component of the Lake District National Park and are important for their landscape, cultural, environmental and recreational value. Various features of archaeological, geological or ecological interest have been given statutory protection. The Lake District National Park Authority (LDNPA) owns a substantial part of the Caldbeck Fells, comprising the majority of the Caldbeck Common. Dalemain Estate own the remaining part of Caldbeck Commons including the Carrock Mine area. The LDNPA and Dalemain Estate are concerned to conserve and protect the varied interests of the Caldbeck Fells while assisting visitors to appreciate and enjoy the area. As part of this work, the LDNPA has worked with partner organisations to produce management proposals for the area that have been published as the 'Skiddaw Management Plan' (1997). This document outlines many of the current conservation issues on the Skiddaw Massif and includes options for future management.

For some time the LDNPA has been concerned that uncontrolled collection of minerals on the Commons has been causing damage. The concerns are that:

Large quantities of minerals are being removed without adequate justification in terms of research and furthering knowledge. There is a danger that the minerals resource will become exhausted if the current rate of collection and removal is not checked;

Important archaeological sites, principally remains of early mining, are being damaged;

Landscape damage is being caused by excavation.

Recent monitoring of the situation by the LDNPA has indicated that some of the damage has been caused by commercial collectors seeking good mineral samples for their businesses. This is an activity that the LDNPA is particularly keen to prevent and the police have been involved in the last year. However the scale of casual amateur collection is also causing damage and the LDNPA has decided that the time has come to formulate a policy on mineral collection on the Commons. To this end a policy on minerals collection has been developed by the LDNPA in conjunction with English Nature, the British Geological Survey, the Cumberland Geological Society, the Cumbria RIGS Group, the Russell Society, the British Micromount Society and Dalemain Estate. This policy will apply to the LDNPA's property on Caldbeck and Uldale Commons and that part of the Caldbeck Common which is owned by the Dalemain Estate.

## Policy

A permit system will operate to regulate collection of minerals on the Caldbeck and Uldale Commons in the ownership of the LDNPA and that part of Caldbeck Commons in the ownership of Dalemain Estate. The attached map shows the land covered by the policy.

Application for a permit must be made via the LDNPA, Blencathra Centre office, by the end of December of the preceding year in which people wish to collect. [for 2000, applications should be submitted by March 31st].

The issuing of permits will be undertaken by a small group comprising English Nature, The LDNPA, The British Geological Survey, a representative from the collecting groups and Cumbria RIGS. This will be carried out in January of the year the permits are to apply. [for 2000 in April].

The wider group, (comprising: the LDNPA; English Nature; The British Geological Survey; RIGS; Cumberland Geological Society; Norfolk Minerals and Lapidary Society; Russell Society; British Micromount Society; Federation of Lapidary and Geological Societies and Manchester Museum), will review this system of application and permits in the year 2001, and in subsequent years as required.

No charge will be made for this permit procedure.

The permits will be restricted to those undertaking accredited research and educational programmes. All applications must therefore include a clear statement on the research aims and objectives. Information must also be supplied concerning:

i. Collecting methods
ii. Location(s) of collecting
iii. Date(s) of collecting
iv. Arrangements for analysis, storage and publication of material.

The permits will be issued to an individual and must be carried by the individual on the fells as the National Park Rangers, Voluntary Wardens or police will wish to view the authorisation. Failure to do so could incur a fine up to £500 under the byelaws. An individual eg, a secretary of a club may apply on behalf of several other individuals, but these must all be named in the application and must carry individual permits as above.

The permit procedure will be widely publicised and summarised at access points.

## Accredited research and educational programmes

The individual must provide a detailed and reasoned description of the research programme for which a permit is being sought. This must clearly state research goals, aims and objectives and must also detail description on ALL of the following:

i. Methodology
ii. Timetable
iii. Locations for collecting.
iv. Amount of material to be removed (in particular the panel will be examining the

reason for which finite and irreplaceable material must be removed from the Caldbeck fells.

v. Publication of results.

Applicants must also supply the name(s) and addresses of a referee for the application and a named individual who has the ability to verify the identification of the collected minerals.

## Methods of collecting

The following conditions will apply to all collecting:

- No power tools or explosives to be used.
- Only small hand tools (geological hammers, trowels) to be used ie, no pick axes, sledge hammers or spades.
- No breaking into turf.
- No vehicles.
- No access to underground workings – this needs a separate application, justification and authorisation from the National Park Authority.
- No damage to or sample collecting from *in situ* vein outcrops or exposures material.
- Collecting by raking over the surface of mine spoil tips should disturb as little material as possible in order to prevent damage to archaeological remains. [A maximum depth of 4-6" is specified as a guideline].
- Disturbed material should be returned to its original location.

## Collecting locations

Some areas of archaeological, geological or ecological sensitivity will be restricted and will be indicated in the application form material.

Permit holders are asked to keep out of the fenced areas, which are safeguarding mine and air shafts.

The locations need to be identified initially by the applicant in order to secure a permit.

## Dates of collecting

Specific dates for collecting should, where possible, be provided in the application. However, in some circumstances the LDNPA may agree to the permit holder giving 14 days notice of a visit. In all cases the total number of visits will remain as specified in the application.

## Further conditions of permit

The permit system will require a record of the actual visit, where any material is stored and the published papers (journals) if relevant. It is expected that an interim report should be filed within three months of the visit followed by a final report at a later date. Groups which

do not provide feedback on their site visits will be looked on unfavourably for future permit applications.

## Storage, display and ownership

Any rare or significant mineral specimens that are identified will be donated to an appropriate museum. Any other minerals may be retained by the collector subject to consent of the National Park Authority or Dalemain Estate. It is not expected however that material should be collected for financial gain.

## Amateur collecting and educational visits

The LDNPA recognises the interest and potential contribution of amateur collectors to furthering knowledge of minerals in the Caldbeck Fells. Therefore, in addition to the permit system for collecting as part of accredited research projects, a series of weekend collection sessions will be organised each year. These will be arranged by the National Park Authority in conjunction with the Minerals societies and will be open to a limited number of individuals by application.

The LDNPA also recognises the educational importance of the geology and minerals of the Commons and that educational establishments will continue to wish to make visits. In order to assist with this and to obviate the need for removal of material for teaching purposes, the LDNPA will make available teaching collections containing a sample of minerals from the Caldbeck and Uldale Commons.

# 2. The West Dorset Fossil Collecting Code of Conduct

## Developing a code of conduct

A Working Group of landowners, conservation organisations, museum curators and local fossil collectors has developed this Fossil Collecting Code. The Group was established in order to address growing conflicts of interest with regard to fossil collecting along the West Dorset coast. The Group recognises the essential need for fossil collecting to continue. However, it also recognises that collecting must be carried out in such a way as to satisfy all those with an interest in our fossil heritage.

This Code, though specifically aimed at professional and dedicated amateur collectors, also applies to all those who come here to collect fossils, whether for study or recreation. The safest and best advice, particularly for inexperienced collectors and educational groups, is that they should restrict their activities to the beaches alone. Advice to this effect is provided by interpretation signs, leaflets and the services of the Charmouth Heritage Coast Centre.

The Code has been developed by The Jurassic Coast Project (Dorset County Council), English Nature, The National Trust, Dorset Heritage Coast Project, Charmouth Parish Council, Charmouth Heritage Coast Centre, Dorset and Somerset Museum Services and local fossil collectors.

Full details about the code and recording scheme are available at: www.charmouth.org

## The geology and fossils of the West Dorset coast

The West Dorset coast contains one of the finest exposures of rocks from the Lower and Mid Jurassic Period to be found anywhere in the world. High erosion rates, particularly in the winter, ensure a plentiful supply of fossils onto the beaches. This coast is one of the best sources of marine Jurassic aged fossils in the world and numerous important finds have been and continue to be made here. Not surprisingly it has been designated by English Nature as a Site of Special Scientific Interest (SSSI) for its geology, fossils and landslides. It also forms part of the Dorset and East Devon Coast World Heritage Site based on the wealth of earth science interest exhibited between Exmouth in East Devon and Studland in Dorset.

## The Dorset and East Devon Coast, England's first natural World Heritage Site

The coast between Exmouth in East Devon and Studland Bay in Dorset has gained World Heritage Site status because the cliffs and foreshore so superbly display 185 million years of the Earth's history in just 95 miles of coast. The rocks are from the Triassic, Jurassic and Cretaceous periods of geological time and although there are thousands of places around the globe where such rocks are found, this is the best place to see them exposed in a near complete and accessible sequence. There are also nine internationally important fossil sites including the Lower Jurassic rocks around Lyme Regis and the Fossil Forest near Lulworth. Furthermore, the coast contains superb examples of coastal processes including the landslides of East Devon and West Dorset, Chesil Beach and the Fleet and the 'classic' Lulworth coast.

The geology, fossils and geomorphology contained within the coast fulfil the UNESCO criteria for designation as a natural World Heritage Site but there are other unique and important aspects to support the case. This coast has provided, and continues to provide vital evidence for the development of the Earth sciences. The history of research relating to this coast reads like a 'who's who' of geological science and to this day, important research and fossil discoveries continue to be made. Finally, the coast is clearly of huge educational importance and lies within a landscape that owes its great beauty and diversity to the underlying geology.

## Fossil collecting

On the rapidly eroding West Dorset coast, fossil collecting is essential if specimens, some of which may be of great scientific value, are to be saved from damage or destruction by the sea. Collecting also offers an opportunity for people to learn about the ancient past and to contribute to our understanding through the discovery of new finds or the development of scientific study.

However, it is important that fossils are collected both responsibly and safely.

Fossil Collectors want to be able to collect fossils freely. For many it is both a great learning experience and recreational activity. Most collectors, both amateur and professional, have a deep-seated interest in palaeontology and a wish to contribute to the development of the science. Professional collectors have most time and a great deal of local knowledge, but they need to sell their finds in order to earn a living.

As a general rule, Landowners own the fossils on or under their land. The National Trust is the principal landowner along the West Dorset coast. The Trust is a registered charity charged with preserving places of Historic Interest or Natural Beauty for the Nation to enjoy. All along the West Dorset coast it seeks to preserve the landscape and nature conservation interests and to provide public access over its property so far as that is consistent with its preservation.

English Nature is the Government's statutory advisor on conservation including the Earth sciences. It designates National Nature Reserves and Sites of Special Scientific Interest and promotes sustainable management of these sites.

Museum curators and Researchers are keen to secure key scientifically important specimens for recognised collections as part of the nation's heritage and to provide a collection upon which scientific research can be based. Curators and researchers seek to ensure that the maximum associated scientific data is gathered when specimens are collected. Some researchers require access to strata and specimens *in situ* in order to undertake their work.

## Objectives of the Code

The interests of all those involved with fossil collecting on the Dorset Coast need not be mutually exclusive, indeed many interest groups can assist each other so long as each party is aware of, and accepts the interest of the other. The proposed fossil collecting Code of Conduct is an attempt to balance those interests.

The primary objectives of the code are to:

- Promote responsible and safe fossil collecting.
- Restrict the excessive digging or 'prospecting' for fossils along fossil rich strata
- Clarify ownership of the fossils.
- Promote better communication between all those with an interest in fossils from the West Dorset coast.
- Promote the acquisition of key scientifically important fossils by recognised museum collections.

## Area covered by the Code

The area covered by the Code is land in National Trust and Charmouth Parish Council ownership between Lyme Regis and Hive Beach at Burton Bradstock. The Code will be reviewed by the Working Group as required.

## The Fossil Collecting Code of Conduct

**Health and safety**

The following is a general list of practical advice aimed at all types of collector including professionals and amateurs, educational/academic visitors and the general public including holiday makers and local people.

- Always consult tide tables before collecting. It is advisable that you go collecting on a falling tide. A particular hazard is the beach immediately east of Lyme Regis, which is cut off shortly after low tide. It is advisable to walk to Lyme on a falling tide only.
- Always advise someone of where you are going and at what time you can be expected to return.
- Be vigilant and exercise common sense in the vicinity of any cliffs. Cliff falls tend to occur suddenly and without warning. Avoid cliff bases.
- Avoid walking on, and keep clear of, visibly moving rock falls and mudflows. Note particularly that the seaward edges of mudflows may be covered by shingle and can be particularly treacherous.
- If you are using a hammer or other tools, it is advisable to wear safety goggles.
- Exercise common sense when considering what clothes and safety items to wear and take with you.
- Collectors should not descend the cliffs using ropes to get to a particular level under any circumstances.

For professional and experienced amateurs collecting from cliffs, undercliffs and the foreshore, the Code provides as follows:

1. There should be no digging *in situ* in the cliffs (except in special circumstances- see 4. iv.)

2. Collectors should adopt a common sense approach to their activities and not expose themselves to excessive risks. They should cease immediately on becoming aware that their activities present a risk to a third party.

3. Collectors should take particular care in connection with the following features:

   - Unstable cliffs, especially in areas where recent cliff falls have occurred or are ongoing.
   - Mudflows and landslides.
   - Tides, rough seas and poor weather conditions.

4. Cliff excavations: Collectors wishing to extract fossils from the cliffs should use the following procedure:

   i. Obtain the landowner's permission before taking any action to excavate any part of the find [subject to iv. below].

   ii. Prepare a Risk Assessment (RA) for the excavation to identify the hazards that may arise in the course of the excavation, and the precautions that should be adopted, to protect the collector and others in the vicinity. This should then be discussed with the landowner.

   Items that the RA is likely to cover are as follows:

   - To cordon off the area of working.
   - To ensure, as far as practicable, the stability of the surrounding area during the excavation.
   - Effective communication among all parties involved in the excavation (including the landowner), and a procedure for dealing with accidents or problems arising from the work.
   - To ensure as far as practicable that the site is safe when left unattended, and that appropriate signing etc is in place.

   This list is by no means exhaustive and collectors should satisfy themselves that all risks have been assessed.

   iii. Keep the landowner informed of progress with the excavation, and advise when completed.

   iv. In the event of a fossil being located which is at immediate risk of being lost or damaged, the collector may proceed at once with the excavation provided that he gives full consideration to the risks and takes appropriate action to alleviate them, and is satisfied that the work will present no risk to any third

parties. The collector should notify the landowner at the next available opportunity

## Key Scientifically Important Fossils Recording Scheme

There are two categories of fossils recognised within the Recording Scheme; Category I, Key Scientifically Important Fossils, and Category II for fossils of some (but not key) importance.

Category I fossils include new species or those specimens which may represent new species, fossils which are extremely rare such as the Charmouth dinosaur *Scelidosaurus* and fossils that exhibit exceptional preservation.

Category II fossils include vertebrates such as reptiles and fish, partial or complete, especially where the horizon of origin can be identified. Nautiloids and certain ammonites together with unusual assemblages of fossils are also included.

A full list of both categories can be found at the end of this document.

1. To comply with the Code, all Category I fossils are to be recorded and certain restrictions apply to their disposal (see 4. and 5. below). To comply with the Code it is not obligatory to record Category II fossils although it is strongly recommended. No restrictions apply to the disposal of Category II fossils. All Category I records should include an identification of the specimen (if known), a photograph, the exact location of the find together with the scientific horizon (if known), the date of the find and any other related observations. The name of the collector will be kept with the record but may not be available directly within public records depending upon the wishes of the individual.

2. The Charmouth Heritage Coast Centre will photograph the specimen and the record will be kept in paper form and on an Internet site. The Centre will, as and where necessary, act as an intermediary between collectors and other interested parties.

3. Where a specimen is being recovered over a protracted period, it should still be recorded but the exact location of the site may be withheld in order to protect the finder's interest until the specimen has been fully recovered.

4. The preparation of Category I specimens should only proceed after consultation with appropriate academics or museum curators unless preparation is clearly straight forward or work needs to be carried out urgently.

5. Under the Code, collectors who intend to sell their Category I specimens will offer them to registered museums for a period of six months. If no purchase has been agreed by this time, the collector will be free to offer the specimen elsewhere. The recording scheme should be updated accordingly. There will be occasions where different collectors will find parts of the same Category 1 specimen. In these circumstances it is acceptable for one of the collectors to purchase the complementary piece or pieces.

6. Those individuals with private collections that contain Category I specimens are encouraged to make provision for the ultimate placement of such specimens within registered museums.

7. The scheme offers a channel of communication for curators and researchers to convey their interests to collectors. The Charmouth Heritage Coast Centre staff will convey this information to collectors and generally promote communication between all parties. The web site, www.charmouth.org, now has the facility to send e-mails to those who 'sign on' notifying each new record made on the recording scheme.

## Fossil ownership

At present the Code applies to National Trust and Charmouth Parish Council land only. Both landowners wish to make clear their ownership of these fossils but they are willing to see ownership transferred to those collectors who follow the Fossil Collecting Code of Conduct and record their key scientifically important fossils.

Maps of land ownership will be provided at the Charmouth Heritage Coast Centre and the Code will be promoted to other landowners along the West Dorset coast.

Please note: Those collectors who do not follow this voluntary code, particularly by digging or prospecting *in situ* in the cliffs, or failing to record Category I fossils, may be regarded as stealing the fossils, and appropriate legal action may be taken against them.

## Key scientifically important fossils

The Jurassic rocks exposed on the West Dorset coast contain abundant and extremely diverse fossils. Therefore the following lists aim to provide general guidance only and are not to be regarded as fully comprehensive. Wherever there is doubt about the scientific importance of any fossil finds, collectors are recommended to contact the relevant fossil group specialist(s) for assistance.

**Category I fossils**

Fossils which certainly represent new species. These can belong to any taxonomic group – vertebrate, invertebrate or plant.

a) Fossils that are thought to represent new species. Again these can belong to any group - vertebrate, invertebrate or plant. (Subsequent work may indicate that some of these are not in fact new species and provided that they do not fall within 1c) or 1d) below, they may be 'downgraded' to Category 2 fossils).

b) Fossils that are extremely rare. Although not necessarily new species they are nethertheless clearly of great scientific importance. Examples include: dinosaurs, pterosaurs, sharks and rays, (near) complete insects and arthropods (crustaceans, crabs), recognisable leaf fronds and plant cones etc. This subcategory includes forms which are very rare in certain stratigraphic levels if found *in situ* or where the stratigraphic horizon can be identified satisfactorily; for example, fossil echinoids or gastropods are rarely found within the clay dominated Lower Lias strata.

c) Fossils which exhibit exceptional preservation. For example, ichthyosaurs (or other vertebrates) showing skin texture, uncrushed skulls which could provide data on brain size or other physiological aspects etc. Among invertebrates, fossil cephalopods (cuttlefish, squids, ammonites or belemnites) showing traces of gill structures, arms and hooks etc are of key scientific importance.

**Note:** Some fossils from the Lias, such as ichthyosaurs, are not uncommonly found with traces of soft tissues preserved. These would not be regarded as Category I unless there are soft part features preserved which are particularly rare or exceptional. The same may be true for certain invertebrate groups, such as belemnite 'ink sacs', which are not that uncommon in the Black Ven and Belemnite Marls.

## Category II fossils

| | |
|---|---|
| Reptiles: ichthyosaurs and plesiosaurs etc.<br><br>**Fish: including sharks, rays, coelacanths, bonyfish etc.** | Fossil remains, especially fragmentary, isolated, bones or scales etc, may be relatively common in some beds. The stratigraphical range of many forms is poorly known and any data may be important to relevant specialists. It is recommended therefore that collectors do record significant, recognisable finds if found *in situ* or where the stratigraphic horizon can be identified satisfactorily. |
| **Arthropods: insects** | Relatively scarce fossils, mainly recorded from the woodstone/flatstone horizons. Many insect remains are indistinctly preserved, but given their scarcity, any recognisable forms are worthy of recording. |
| **Molluscs: belemnites** | Extremely common fossils especially in the form of isolated belemnite guards. It is not anticipated that these would be recorded, unless a particular bedding-plane concentration ('belemnite battlefield') or similar fauna was collected. |
| **Molluscs: ammonites** | One of the most common and characteristic fossils from the Dorset coast occurring throughout the section. Many of the usual taxa are abundant and comprise the 'bread and butter' specimens for commercial, amateur and tourist collectors. It is not anticipated that these forms would be recorded, although any unusual species or particularly large/mature shells showing apertural details etc are worthy of inclusion in the database. |
| **Molluscs: nautiloids** | A neglected group of fossils, occurring throughout much of the succession. It is not expected that these would be recorded, though exceptional specimens (eg bedding plane assemblages or others yielding palaeoecological data) are worth considering for inclusion on the database. |
| **Molluscs: bivalves** | An abundant group of fossils, occurring throughout much of the succession. It is not expected that these would be recorded, although exceptional specimens (eg bedding plane assemblages or other preservations yielding palaeoecological data) are worth considering within the database. |
| **Brachiopods** | As bivalves above. |
| **Echinoderms: crinoids and starfish** | A group of considerable interest to collectors, especially specimens from the 'Pentacrinite' and 'Eype Starfish' beds. There are many specimens of these in public collections and it is not anticipated that specimens would normally be recorded. However, exceptional accumulations of crinoids attached to drift wood etc, or of brittle stars, are worthy of recording on the database. |

## Contact information

Charmouth Heritage Coast Centre, Lower Sea Lane, Charmouth, Dorset DT6 6LL Tel 01297 560772. The web site can be found at www.charmouth.org and includes records of key important finds

Permission to undertake excavations should be sought from the National Trust:
The National Trust, West Dorset Office, The Court, The Street, Charmouth, Dorset, DT6 6PG. Tel 01297 561900.
Head Warden: Rob Rhodes mobile 07747 756549.
Property Manager: Patrick Woodford mobile: 07768 065362

Or; Charmouth Parish Council, The Elms, The Street, Charmouth, Dorset DT6 6LN tel. 01297 560826

For wider queries about the Code, contact: Richard Edmonds, Earth Science manager for the World Heritage Site, Environmental Services Directorate, Dorset County Council, County Hall, Dorchester DT1 1XJ Tel 01305 224477 e-mail r.edmonds@dorset-cc.gov.uk,

Last updated March 2003

ENGLISH NATURE

English Nature is the Government agency that champions the conservation of wildlife and geology throughout England.

This is one of a range of publications published by:
External Relations Team
English Nature
Northminster House
Peterborough PE1 1UA

www.english-nature.org.uk



Cover printed on Character Express, post consumer waste paper, ECF.

ISSN 0967-876X

Cover designed and printed by Status Design & Advertising, 2M, 5M, 5M.



Front cover photographs:
Top left: Using a home-made moth trap.
Peter Wakely/English Nature 17,396
Middle left: $Co_2$ experiment at Roudsea Wood and Mosses NNR, Lancashire.
Peter Wakely/English Nature 21,792
Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
Paul Glendell/English Nature 23,020
Main: Identifying moths caught in a moth trap at Ham Wall NNR, Somerset.
Paul Glendell/English Nature 24,888

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