

THE FOSSIL COLLECTIONS OF THE INSTITUTE OF GEOLOGICAL SCIENCES

by A. W. A. RUSHTON

ABSTRACT. The Institute of Geological Sciences' very large collections of fossils originate from those made during geological surveying in Britain and are particularly valuable for tackling biostratigraphical problems. The fossils are distributed among various collections: the Type and Stratigraphical Collection is a selection of the best material and is used especially as a reference collection by the Institute's palaeontologists; the micropalaeontological collections are increasingly important, notably for work on boreholes and the continental shelf; the Survey Collection is a large palaeontological and stratigraphical archive. The latter, together with the Boreholes Collection, are valuable for stratigraphical and a variety of other studies. Problems in curating microfossils and borehole material are discussed.

THE Institute of Geological Sciences (IGS) is the largest geological organization in Britain and is a major repository for all kinds of geological material and data. The collections of rocks, fossils, and samples from Britain and its continental shelf are of unrivalled coverage and scope owing to the comprehensive nature of the Institute's work. The collections of fossils are based on those of the Geological Survey of Great Britain and represent the accumulation of specimens amassed in the course of nearly 150 years of surveying (Flett 1937; Pugh 1954). The Survey's map-making emphasizes stratigraphy and it is in this field that the particular strength and significance of the fossil collections lie; the collections are thus a major palaeontological and stratigraphical archive. It is Institute policy to retain the fossils collected in the course of surveying as they are the primary evidence for part of the stratigraphical interpretation shown on the Geological Survey's maps and described in their Memoirs. Though much of the material is not of exhibition quality, it is irreplaceable, as many specimens came from exposures no longer available.

Besides being an archive kept for the benefit of science at large, the fossil collections are working reference collections; they are the most valuable equipment the Institute's palaeontologists have and they are consulted daily in the course of the palaeontologists' determinative work.

The duties of the palaeontologists who use these collections were set out in 1844 by Edward Forbes in the following terms (Wilson and Geikie 1861, p. 378):

1st, The examination and description of the organic remains collected during the operations of the Survey.

2d, The classification and arrangement of the said organic remains, in such order and manner as may most benefit the public, and tend at the same time to advance the interests of geology and the natural history sciences.

3d, The superintendence of the publication of an account of such organic remains, and of drawings and engravings of them.

4th, The communication of information respecting organic remains, etc., whenever the Government may require such information.

5th, The attendance on the field operations of the Survey during a portion of the year, in order to observe the distribution of organic remains, and their relation to the strata, so as to verify and correct inductions drawn in the Museum, and to aid the surveyors in their determinations.

These duties have remained unchanged in essence despite a strong change of emphasis in favour of the final phrase 'to aid the surveyors'. In effect this means that the palaeontologists supply biostratigraphical and palaeoenvironmental evidence to strengthen, interpret, and control the stratigraphy in areas under study. The Geological Survey has ranged throughout the country and at some time or other members of the Palaeontological Unit have studied all fossil groups from every formation throughout Britain; but in practice the chief function of the Unit is to solve biostratigraphical problems, so emphasis has been placed on fossils of greatest practical stratigraphical value. Thus it may be said that the Institute's policy for collecting fossils is generally one of collecting sufficient material to solve particular current problems. However, as an adjunct to the task of refining stratigraphy, the Institute seeks also to build up reference collections from stratotype and other reference sections, both for the use of the palaeontological staff and also for reference by visiting specialists.

THE PALAEOONTOLOGICAL COLLECTIONS

The Institute's fossils are distributed among several collections depending on the origin or nature of the material, or the quality and importance of individual fossils. The Palaeontological Unit manages: (a) The Type and Stratigraphical Collection (including that formerly known as the 'Museum Reserve'); (b) The Survey Collection; and (c) the micropalaeontological collections. However, the Boreholes Collection contains very many fossils, and numerous fossiliferous samples originate from the Continental Shelf Units' collection of cores and samples, together with material from offshore commercial wells; and further material similarly from the Industrial Minerals Assessment Unit's collection of cores.

Type and Stratigraphical Collection (Macrofossils)

This, the best-known part of the fossil collections, contains all the type, figured, and cited specimens in the Institute's care, together with a large selection of typical fossils representative of the fauna and flora of all formations in Great Britain, and also includes a small proportion of foreign reference specimens. About two-thirds are housed in the present IGS headquarters in the Geological Museum (London), but parts are kept at Leeds (Carboniferous and Permian, most microfossils) and Edinburgh (most Scottish fossils) where the palaeontologists who work on those fossils are stationed. The Type and Stratigraphical Collection is primarily a working reference collection and is in constant use by the palaeontologists engaged on determinative palaeontology in support of stratigraphical studies initiated by other units of the Institute and by outside clients. It is important, then, that these collections are situated near the palaeontologists' rooms. The fossils are arranged according to their stratigraphical classification (essentially by System and Series, but more detailed in parts) and within these categories by taxonomic group, with the object of making them of the greatest stratigraphical value. Thus to retrieve a particular specimen one needs to know its age and biological group. The Institute's policy is to curate the Type and Stratigraphical Collections to the highest museum standards with each specimen numbered and catalogued and kept, with its label, in an individual cardboard tray, the trays being stored in cabinets with lidded, dust-proof drawers. It is also part of

the policy to enhance the Collection by adding to it such scientifically valuable or interesting specimens as are collected in the course of field-work or noted during determinative work, or are given to or purchased by the Institute. The manuscript registers of the Collection are up to date but the main published catalogues by Huxley and Etheridge (1865) and by Newton and Etheridge (1878*a, b, c*) are now very old, though more recent catalogues have dealt with parts of the Collection (a list was published by Bassett 1975, p. 770). Further catalogues of type, figured, and cited material are in preparation.

Survey Collection

The largest part of the Institute's collection of fossils is known as the 'Survey Collection', now numbering perhaps three million specimens (excluding microfossils). This is the accumulation of specimens collected in the course of the Geological Survey's mapping activities and borehole programme, for it has for many years been a matter of policy that the Institute will keep for permanent reference the specimens on which a palaeontological report, published or unpublished, is based. The Collection also contains much donated material, of which the British fossils from the Geological Society Collection (presented in 1911) are the most significant. Well-localized material of biostratigraphical value is added to the Survey Collection, with particular emphasis on building up national reference collections from British stratotype sections. Field collections made on IGS projects are supplemented by the acquisition of collections of well-localized fossils, such as those made by university research workers and amateur collectors.

The system of accession to the Survey Collection has to allow any surveying geologist to submit fossils for examination. Thus each geologist is allocated a personal alphabetical code for numbering his specimens serially. When a geologist has collected fossils and numbered them he sends them to the Palaeontology Unit, together with a standard recording sheet giving their precise locality and what is known of their horizon. As the collections are almost all made with biostratigraphical studies in view it is ideally convenient to register and store all fossils collected from one locality together (this is also conceivably of value to students of palaeoenvironments although the collections are not generally in their sense 'representative' or 'bulk collections'). In the Unit the specimens, taxonomically unsorted, are registered in numerical order before being examined by a specialist (for the treatment of microfossils see also below). The specialist names and reports on the specimens, on occasion referring certain specimens to his colleagues or to workers outside IGS; important specimens may be transferred to the Type and Stratigraphical Collection; blocks with indeterminate fossils may be broken up in search of better individuals, or rejected; but the bulk of the material is stored in numerical order in a numbered sequence of dust-proof trays.

In the past this storage has been readily accessible to the palaeontologists but recent demands on accommodation in London and Leeds have meant that less satisfactory arrangements have had to be made whereby the bulk of the storage is some distance away, namely in industrial buildings at Park Royal (London) and at Kippax (near Leeds). The proposed centralization of the Palaeontology Unit at the Institute's new headquarters, sited at Keyworth, south of Nottingham, should again

allow all the collections to be housed adjacent to the palaeontologists' offices, as in Edinburgh.

Retrieval of specimens from the Survey Collection is by way of the registered numbers. The Survey Collection is indexed by registration symbol and by locality, including the county, but is not catalogued taxonomically nor primarily by stratigraphical horizon. None the less, the collections, besides standing as the prime evidence for the biostratigraphical interpretation of the Geological Survey's maps, are frequently consulted by taxonomists searching for material of a particular genus or species, although seeking out the required material is at present very time-consuming. The prospect for computerizing the IGS records, to allow retrieval according to a variety of categories of information, is under review.

Micropalaeontological collections

The IGS micropalaeontologists deal with material from a great variety of sources, but in particular from boreholes, both onshore and offshore, and in consequence the collections have grown rapidly in recent years. The curation of these collections is a flexible but necessarily complex procedure (text-fig. 1).

Each microfossil sample is given a registration number which is applied to that sample through all stages of its preparation and examination. This means that not only the bulk unprepared sample but the prepared residues and the mounted slides all have the same number, and that three parallel curation systems are in current use, one for the reserve collections of unprepared samples, one for the collection of prepared but unpicked or unmounted residues, and a third for prepared slides. Individual fossils are retrieved by the sample number followed by a suffix, which either indicates the individual cell in a particular compartment slide (text-fig. 1) or a stage co-ordinate for a particular microscope.

Samples are registered consecutively under alphabetical registration symbols, each of which is indicative of the general nature of its source; e.g. all samples collected onshore in the United Kingdom have one symbol, and material from confidential commercial offshore wells is registered under another, and so on. A card-index system is being formulated which will allow the samples from any particular geographical area to be identified.

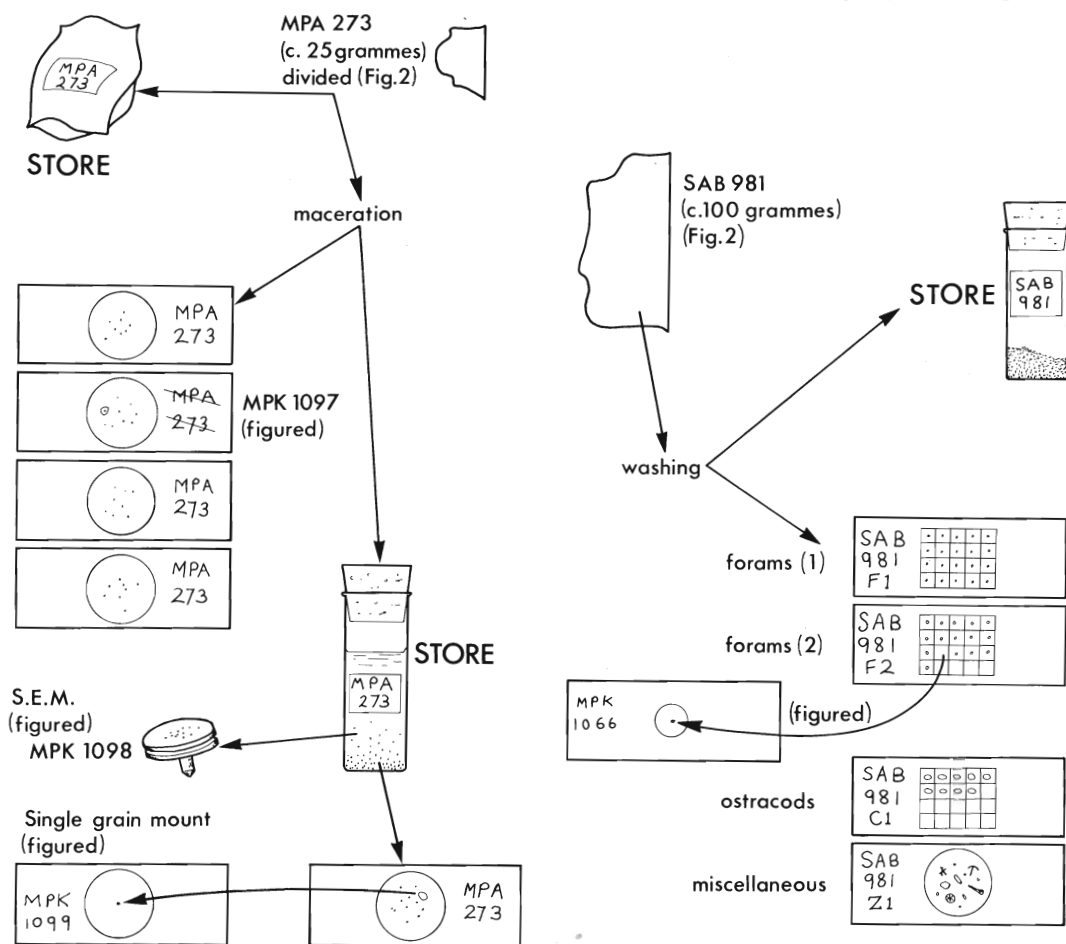
Once prepared, the residues are either picked into compartment slides (in the case of calcareous microfossils) or slides are made (in the case of palynomorphs). All identifications are made on a standard recording-sheet and these are ultimately stored in a records centre within the Unit.

Further aspects of curation for calcareous microfossils and palynomorphs are described separately.

Palynomorphs. Microscopic examination of palynomorphs is carried out by using standard microscope slides. Where possible four slides are made for each preparation. Slides are prepared so as to be as permanent as possible and for this the principal mounting medium employed is a plastic resin ('Elvacite') which seems to be as permanent as Canada Balsam and has the optical clarity of glycerine jelly.

Slides from one sample are stored in metal slide-holders, each accommodating four slides, and these are housed in drawers in a card-index fashion. The unmounted

PALYNOLOGY

CALCAREOUS
MICROPALAEONTOLOGY

TEXT-FIG. 1. The possible curatorial history of hypothetical samples treated for palynological investigation (left) or calcareous micropalaeontology (right). For each treatment one sample number is used for both the reserve material and the slides, but figured specimens are registered under a separate system.

portion of the residue is stored in air-tight plastic-capped bottles, each bearing the sample identification number.

When a palynomorph is to be selected for illustration in a publication two options exist:

1. If the selected individual is mounted in resin on a slide its precise location is established by the stage co-ordinates for a particular microscope, or by means of an 'England Finder' grid. These co-ordinates and the microscope's identification numbers should be quoted on the plate descriptions. In addition it is IGS practice to ring the specimen in Indian ink both on the cover-slip and on the reverse side of the slide to facilitate examination on other microscopes.

2. The alternative method is to prepare a glycerine jelly slide using a drop or two from the reserve of prepared residue, with a view to finding suitable material to illustrate. When a suitable subject is found it can be carefully ringed with a very fine dissecting needle under a low-power objective; the needle is used to lift the small disc of glycerine jelly containing the palynomorph to a clean slide, where it is mounted with beeswax and a cover-slip. The advantages of a 'single grain mount' are that individuals can be positioned carefully to the best advantage and there is no difficulty in locating the specimen.

All figured palynomorphs are numbered in a separate collection with the registration symbol MPK and are stored in consecutive order. The slides containing figured palynomorphs are stored in card-index fashion on metal slide-holders.

Coccoliths are treated much as for palynomorphs.

Calcareous microfossils. The principal difference in the handling of calcareous microfossils, compared with palynomorphs, is that most calcareous microfossils (and also conodonts) are large enough to be manipulated individually whereas palynomorphs (and coccoliths) have usually to be mounted in bulk.

The sample having been washed, sieved, and dried is spread on a picking-tray and individual microfossils (foraminifers, ostracods, conodonts) are transferred to compartment slides, where they are secured to the gummed surface of the slide. All slides are labelled with the sample numbers and protected by celluloid covers. Specimens selected for illustration are transferred to a single-cell slide for curation purposes, and where they can be orientated to the best advantage. Like palynomorphs they are re-registered in the MPK series. The residue of the prepared sample is stored dry in polythene tubes and labelled with the sample number.

Scanning electron microscopy presents certain difficulties, particularly in the curation of figured material. Specimens are mounted on metal stubs for scanning and are treated with one of various coating media. In the case of those microfossils which are large enough to be manipulated individually, the specimens may be returned to their original cell and slide. The alternative is to leave the figured material permanently mounted on the metal stubs and to engrave the registered number of the figured specimen on the reverse, and to store the stubs in special covered containers. Palynomorphs and coccoliths which have been figured by scanning electron microscopy present greater difficulties. As it is impractical to consider removing individuals and also impossible to remove any coating and to recover the specimen, the specimen must remain on the stub. It is normally impossible to relocate particular individuals accurately on a stub which may contain several hundred specimens mounted as a dried smear. In those cases where relocation of the specimen on the stub cannot be guaranteed it is necessary to consider the status of the type or figured specimen involved. It is IGS practice to curate the stub, but also to treat the scanning electron microscope negative as if it were a type because it is the only identifiable link with the specimen itself.

Boreholes Collection

The Boreholes Collection was established in 1927 but has grown particularly rapidly in the last twenty years with the increase of drilling by the IGS. The Collection also contains much material from boreholes drilled by the National Coal Board (and earlier from coal companies), the Gas Council, oil companies, water authorities, local authorities, and commercial companies (many individual borehole specimens are

also included in the Survey Collection and Micropalaeontological Collection). Moreover, in recent years, as a consequence of Government legislation requiring that representative samples from all offshore exploratory boreholes should be deposited with the Institute of Geological Sciences, very large numbers of specimens and samples (in the form of chippings) have come from exploratory boreholes for hydrocarbons in the continental shelf around Britain, and these are mainly stored with IGS Continental Shelf Units' collections at Kippax and at Edinburgh.

The Boreholes Collection, which now includes over a million specimens, constitutes a stratigraphical archive *par excellence*. The Institute stores borehole material at Park Royal (London) and Kippax (Leeds). In Scotland, palaeontological specimens from boreholes sited on the mainland are incorporated in the general collections of the Palaeontology Unit; offshore material is mainly housed at Newbattle Abbey (Edinburgh). To preserve their stratigraphical relationships borehole specimens are registered from the top downwards and stored in depth order. The proportion of fossils in the collection is unknown; from any one boring, fossils may represent practically all to practically none of the collection.

The storage and curation of borehole material may present problems. For example, core has sometimes to be sliced to preserve a particular stratum or structure for permanent reference while providing other material for sampling for fossils or other features. The resulting large pieces of sliced core may be awkward to store in numerical (= depth) order side-by-side with small and possibly delicate specimens such as fossils; yet numerical order has to be retained to allow retrieval of the specimens. The boreholes are indexed by name and by the 1:50 000 geological sheets on which they occur.

Although the specimens be satisfactorily registered and stored they may subsequently be the subject of many and varied studies (text-fig. 2). When such studies have been completed curatorial cross-references must be made in the Borings Department records, for without such cross-references it becomes difficult to ensure that work is co-ordinated and not duplicated. Finally, many borings, especially by oil companies, are confidential, so the records and specimens must be kept in secure conditions.

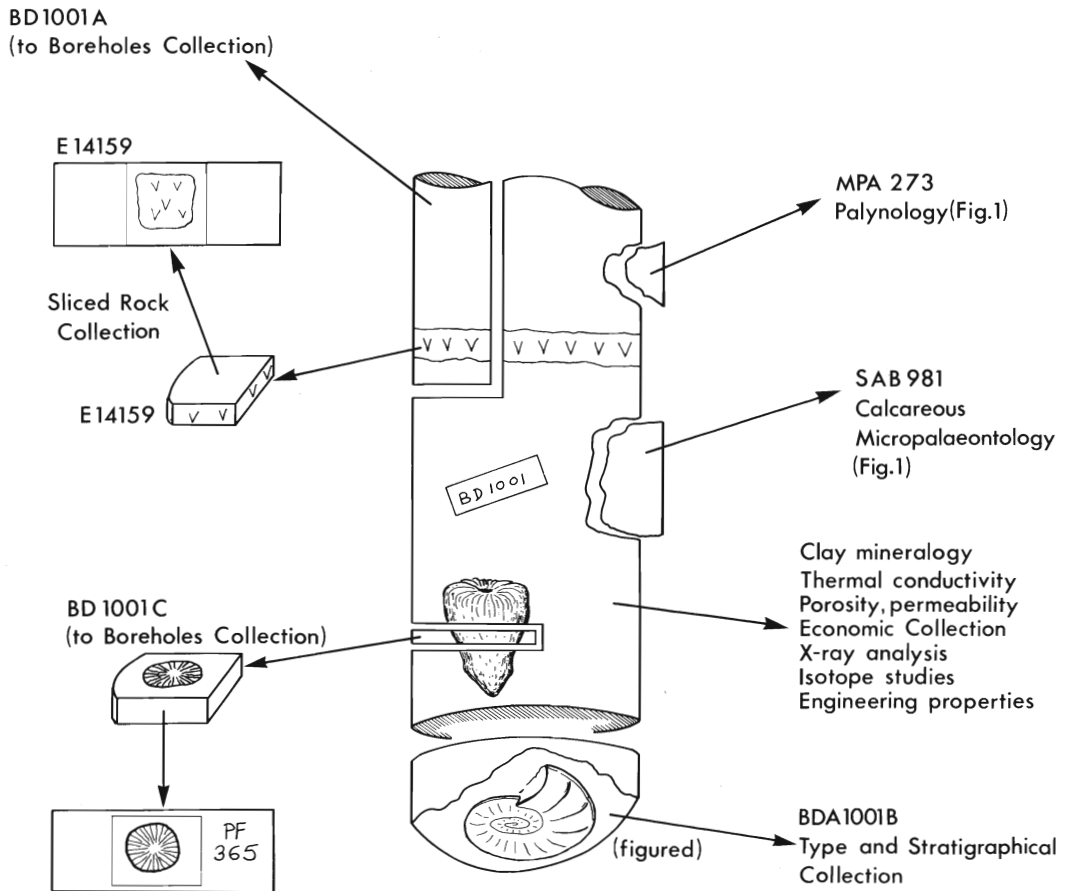
In recognition of the particular problems associated with material from boreholes and of their great value and great bulk, a Natural Environment Research Council working party has recommended the establishment of a National Core Store embracing the existing IGS collections. This store will receive material from future boreholes in Britain, and will be based at the Institute's new site now (1978) being developed at Keyworth.

Enquiries and loans

The Institute's palaeontologists are the curators of the fossil collections and have the responsibility to give research workers access to them (Pugh 1954, p. 595). The time given to this responsibility has to be balanced against the palaeontologists' other commitments but access to the collections is normally freely given subject to the availability of staff. Often there is much gained from the communion between the visitor, who may be an expert taxonomist, and the IGS palaeontologist who is generally well informed on stratigraphical matters.

Specimens may be loaned to accredited workers, or, under their aegis, to students;

WHAT HAPPENED TO BD1001?



TEXT-FIG. 2. A hypothetical piece of core and some of the possible studies which might be made upon it. On the left E 14159 refers to a petrographic specimen and thin section in the English Sliced Rock Collection; PF 365 is a thin section of a fossil in the Palaeontological Unit's collection. On the right the samples MPA 273 and SAB 981 may be treated as shown in text-fig. 1.

but the Chief Palaeontologist has discretion to withhold loans if the specimens appear to be at risk, and especially with regard to type specimens. The wide stratigraphical and geographical range of the samples in the Boreholes Collection makes this a valuable source of material for a wide variety of studies (text-fig. 2). Material may be made available (except from confidential boreholes) on the condition that the determinations on the material are communicated to the Institute and that specimens extracted from the samples, especially type and figured specimens, are returned to the Institute's collection. It is important that results from all these loans are made known to the Institute so that the appropriate annotations may be added to the records.

Fossils on display

Throughout nearly all its history the Geological Survey, and latterly the Institute, has realized its duty to display fossils '... as may most benefit the public ...' (Forbes; see Wilson and Geikie 1861). In the former Museum of Practical Geology in Jermyn Street (1851–1935), British fossils were exhibited in stratigraphical arrangement in glazed table- and wall-cases, displayed apart from the rock and mineral exhibits. However, when the Geological Museum was established at South Kensington in 1935, fossils, chosen to represent average rather than superb collecting quality, were integrated, along with rocks and minerals, in the eighteen exhibits of 'British Regional Geology'. There was also displayed a detailed series of fossils arranged stratigraphically, but this has now given place to a new display (1978) entitled 'British Fossils'.

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DISCUSSION

D. L. Bruton. You have mentioned that the IGS collections are sometimes supplemented with material from university research workers. I am interested in knowing how you acquire material from Ph.D. students. Do you have guide-lines and rules for this or do the specimens simply find their way into your collections by chance?

A. W. A. Rushton. Most commonly this kind of material is acquired through personal contacts with the student or university department; such contact usually stems from a mutual 'special interest' and establishes the Institute as an appropriate repository for the collection. But there is no systematic method of seeking out collections, nor do we have a formal policy for this, though there is no reason why we should not have one in the future.

D. L. Bruton. There appears to be no single policy for museums soliciting stratigraphical collections from outside. Most material is acquired in an incidental manner but perhaps we should advertise our requirements more widely. If so, we should advise donors of the need for a standard of labelling and curating the specimens, and we should recommend them to use a method which could be adapted easily to our particular system of curation.

E. L. Yochelson. It is fairly evident that universities, major museums, and Geological Surveys have different objectives. The differences cut across nationalities. I agree that it is important to establish policy but I think that the differences should be recognized and no 'universal' policy put into effect.

C. H. C. Brunton. Is there any policy for collections made using public money—not only university collections—to the effect that those collections should be housed in a national institution such as the BM(NH) or IGS?

A. W. A. Rushton. In Britain at least, to avoid the loss of such collections, it has been suggested that a clause should be added to NERC research contracts requiring that material be deposited with a recognized repository. A policy of preserving collections made by Ph.D. students and research workers can be seen as an extension of the IGS policy of retaining the material on which their reports are based.

H. W. Ball. At the BM(NH) we agree with the IGS that universities should be urged to formulate a policy regarding student collections, especially those which form the basis for subsequent publications. Such collections contain a great deal of information that can be of use to future generations, particularly when they have been obtained from localities that are no longer 'collectable'.