

This article was downloaded by: [FU Berlin]

On: 03 November 2011, At: 05:19

Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Diatom Research

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tdia20>

USING THE EHRENBERG COLLECTION

David Lazarus^a & Regine Jahn^b

^a Museum für Naturkunde, Humboldt Universität zu Berlin, Invalidenstrasse 43, 10115, Berlin, Germany

^b Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin, Königin-Luise-Str. 6-8, 14191, Berlin, Germany

Available online: 31 Oct 2011

To cite this article: David Lazarus & Regine Jahn (1998): USING THE EHRENBERG COLLECTION, *Diatom Research*, 13:2, 273-291

To link to this article: <http://dx.doi.org/10.1080/0269249X.1998.9705451>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.tandfonline.com/page/terms-and-conditions>

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

USING THE EHRENBURG COLLECTION

David Lazarus

¹ *Museum für Naturkunde, Humboldt Universität zu Berlin,
Invalidenstrasse 43, 10115 Berlin, Germany*

Regine Jahn

² *Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin,
Königin-Luise-Str. 6–8, 14191 Berlin, Germany*

The Christian Gottfried Ehrenberg Collection at the Museum für Naturkunde in Berlin holds type specimens and original material for thousands of taxa of microscopic organisms. Ehrenberg did not explicitly designate types for his many taxa, or label types in his collection. This, and the rather complex, sample oriented organisation of the materials makes using the collection more difficult. Nonetheless, through the use of unpublished taxonomic and geographic index volumes compiled by Ehrenberg's daughter Clara, by examination of unpublished notations made by Ehrenberg on his original drawings, and by examination of other documentation in the collection it is usually possible to locate both the original type specimen and unprocessed original material for new studies. Clara Ehrenberg's index volumes have now been scanned and placed onto a CD-ROM which can be ordered from the senior author.

INTRODUCTION

Christian Gottfried Ehrenberg (Fig. 1) was one of the most important early workers on the taxonomy of microscopic organisms. He introduced thousands of new species names, and hundreds of new genera. Shortly before his death in 1876, his entire collection of samples, microscope preparations, drawings, and professional correspondence was transferred to the Royal Prussian Academy of Sciences at Berlin, and then incorporated in the 1880's into the collections of the newly founded Museum of Natural History in Berlin. For a period of 45 years, the Museum was, until the re-unification of Germany in 1990, a part of Eastern Germany. For a variety of reasons, both political and financial, the Ehrenberg collections were relatively inaccessible to the scientific community during these years and thus seldom used. Nor was it possible during these many decades to carry out major new curation of the collections. Thus the collections are today almost unchanged from when they were first deposited more than a century ago.

¹ david.lazarus@rz.hu-berlin.de

² RJ@zedat.fu-berlin.de



Fig. 1. C.G. Ehrenberg as a young man. Frontspiece from Moltrecht (1995).

Because Ehrenberg, unlike many of his contemporaries, did not send out duplicate material to colleagues, our understanding of his taxonomic names must be based on his publications, and on these preserved original materials. Although Ehrenberg's illustrations were, by the standards of his day, excellent, they have not for many decades met the standards set by modern imaging techniques, and do not provide the morphologic detail that is revealed by them.

Thus, as for many decades the collection was not readily accessible, there is a long pent-up need for a thorough re-study of the original materials. Fortunately, although now quite old and fragile, the various components of the collection are still quite usable. Furthermore, due in large part to extensive organisational work on the material by Ehrenberg's daughter Clara (Fig. 2), it is generally possible even today to identify and examine the original type specimens and associated sample materials.



Fig. 2. Ehrenberg's family. Clara Ehrenberg, the youngest of C. G. Ehrenberg's daughters, is the second from the left (standing). She was also his assistant, and played a major role in organising and indexing the collections. Her index volumes and object labels today are the primary means for locating material in the collections. (Photograph courtesy Dr. Landsberg, Museum für Naturkunde, Berlin).

This paper is a companion paper to an earlier one which provided a general description of the collection objects themselves (Lazarus 1998), and concentrates on a detailed description of the documentation that is associated with the collection. This consists of three main types: labels on objects in the collection; associated primary documents such as letters sent to Ehrenberg by collectors of original samples; and secondary labeling and numbering systems for objects together with index volumes, created and compiled by Clara Ehrenberg. Each of these types of documentation are described in the sections below. Due both to the complex organising principles used for the sample and microscope preparations, and also due to the primarily sample based style by which Ehrenberg worked, it is not always easy to locate the materials one wishes to study. One aim of this paper is to provide a guide to using the documentation to effectively navigate in the collection.

Workers who have not been able to visit the collections themselves have also been severely hindered by not having access to most of the secondary index and cross-reference documentation created by Clara, as none of these documents were ever published. A second aim of this paper is to describe these highly important documents, and to make them available for the first time to the world scientific community. Clara's index volumes have now been scanned, and the images transferred to CD-ROM format. The CD-ROM is available from the senior author for a modest materials and handling fee. Details of how to order the CD-ROM are given at the end of this paper.

HISTORY OF THE COLLECTION

Ehrenberg fully realised the importance of preserving actual material which would serve as the vouchers of his published observations (Ehrenberg 1837, 1862, 1875; Jahn 1998), and thus was careful to retain his samples, microscopic preparations and other materials for examination by future researchers. The first part of the collection – the dried preparations of organisms (“Troddenpräparate”) of biological materials – were demonstrated to the Royal Prussian Academy of Sciences at Berlin as early as 1835 (Ehrenberg 1837), while the entire collection, including the micropaleontological materials, was given to the Academy a few weeks before his death in 1876 (Jahn 1998). Until quite recently the “Troddenpräparate” were stored separately from the micropaleontological preparations at the Museum für Naturkunde, but with the establishment of a curatorship at the Museum specifically for the Ehrenberg Collection these separate parts were united.

Understanding these materials however requires some insight into how Ehrenberg worked. Unlike modern taxonomic researchers, who carefully select materials likely to contain specific low-level taxa of interest, Ehrenberg was a surveyor of a newly discovered world. He examined samples of a wide range of materials, and from an equally wide range of environments and geographic locations, with the goal of revealing the diversity, distribution and geologic history of our world's microscopic life-forms. Although today the distributional aspects of his work are seldom referred to, anyone using his publications, or working with his collections, is very much aware of the numerous distributional tables accompanying his taxonomic observations. This aspect of his work is still important insofar as it gives us insight into his working methods. Ehrenberg worked, so far as it can be determined, on a sample by sample basis – either samples collected by himself, or those sent to him by other researchers. There was, it seems, no major attempt to partition his working time into special studies of particular taxonomic groups, or even particular geographic regions. Samples were seemingly studied largely as they became available. As his observational data accumulated, he attempted to periodically summarise both the distributional and taxonomic aspects in his many publications, but the sample based nature of his studies were always the major framework in which he worked, and in which his collections were organised.

Thus, the basic unit, or starting point for Ehrenberg was always a sample, and all other objects and information generated by him are primarily linked to it. Researchers who today wish to use the collection should thus first try to identify, not only the taxon, but also the samples of Ehrenberg that are of interest for examination. There are various ways to do this when the information is not directly available, which are described later in this paper.

MAJOR PARTS OF THE COLLECTION

Although the Ehrenberg Collection contains many types of materials, three – the samples, the micas, and the drawings – contain the primary scientific information. Each of these collection components has its own special structure and special labeling characteristics.

Labeling

There are some general characteristics of the documentation of the collection that should be noted. Given the age of the collection, it is of course no surprise that all of the documentation is handwritten, not typed, and in the now somewhat archaic script of the preceding century. Most of the labels on actual objects bear Ehrenberg's own handwriting, with supplemental writing by Clara. The index volumes are entirely in Clara's hand. These differences are significant as, frankly, Ehrenberg's own hand (in the old German style called Suetterlin) is rather difficult to read, while in contrast, Clara wrote in an elegant, very readable latin script. Throughout the collection, both writers used several abbreviations. These include Monatsb. or Mb for Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, Abhandl. or Abh. for Abhandlungen der Königlich Akademie der Wissenschaften zu Berlin, and Mikrog. or Mg for his monographic work "Mikrogeologie". In referring to his publications, Ehrenberg and Clara both normally used the date when the report was first presented (orally) to the meetings of the Royal Prussian Academy of Sciences at Berlin. The date when the report appeared in print as part of the Academy volumes is frequently a year or two later. The latter date is the one to be used for establishing questions of priority. This, the year actually printed and published (ignoring any preprints), is given at the beginning of most of the volumes of both the Abhandlungen and the Monatsberichte, although for a few of the earliest relevant volumes of the Monatsberichte this information is missing.

Samples ("Proben")

Samples (Fig. 3) were the starting point for Ehrenberg's specific studies. Some he collected himself, many were sent to him by scientists and interested laymen from locations worldwide. Not all of the samples used by Ehrenberg in his researches have been preserved, but Locker (1970, 1980) has estimated that perhaps half of the microscope preparations are still represented by a sample in the collection.

The samples mostly have a uniform numbering system, apparently created by Clara, running from 1 to 4,960. Most, but not all of the numbers assigned to samples actually exist in the collection, although no list exists indicating precisely which sample numbers are missing from the numbers assigned. The samples are stored in three cabinets, two cabinets with various sized drawers (numbered 1–60), and one with only shelves, used for very large samples that do not fit into any of the drawers. The variety of holders used for the samples is indeed amazing. Everything from envelopes and twists of paper, to boxes and jars: even wine bottles were used. Because of the size differences, samples are not strictly in order within the drawers, but were often just put where there



Fig. 3. A drawer of samples in the Ehrenberg Collection (drawer no. 8, primarily material from South America). Note the variety of containers: wood and metal boxes, glass tubes, paper envelopes, etc.

was still room for them to fit. This sometimes makes checking for the presence or absence of a particular sample difficult. A new inventory of the samples collection has been started to solve this problem, but will take some time to complete.

Most samples in the collection are labelled as well with the name of the locality and a publication citation. Many have the name of the collector, if it was not Ehrenberg himself. Many of the samples contain subsamples, which may even themselves consist of smaller samples. There is no uniform method in the way numbers were assigned to this hierarchy of sample units. In some cases each subsample received a number, and the holder is labelled with a number range. In other cases only the larger unit was given a number, and the different sub-samples are not separately numbered. In these latter cases it is sometimes not clear which particular subsample was used to prepare a mica, and thus which subsample is the one which contains original material from which new types can be selected. Cross checking subsample location names (when present on the subsamples as labels) with other information can usually resolve this question.

Micas (“Analyse”)

Ehrenberg’s mica preparations, which hold the actual holotypes, are now stored trays in special cabinets at the Museum für Naturkunde, and label information for the micas is being entered into a database. However, most existing references to the micas, including Ehrenberg’s publications, and Clara’s index, refer to the system (or systems) developed by Ehrenberg.

For the bulk of the collection (Cases 1–50) holding micropaleontological materials summarised in his *Mikrogeologie* (Ehrenberg 1854), “Kästen” (cases) – fat book sized boxes – held a dozen or so numbered “Bücher” (cardboard folders), which in turn each held 10–20 (normally up to 16) strips (Fig. 4). Strips (which had no special name in Ehrenberg’s system) were made by glueing up to 5 (rarely more) round mica discs to a thin ribbon of mica along one edge of the discs. Each mica disc holds the actual material examined by Ehrenberg, embedded in Canada Balsam on one side of the disc. Ehrenberg generally made several micas from each sample studied. The contents of the cases are arranged in approximate geographic order, with “exotic” regions such as Australia, Africa etc. coming in the low case numbers, European locations in the middle numbers, and German localities in the higher numbers. Each case cover, each folder in each case, each strip within the folder and each mica on the strip have labeling. The case labels are particularly important as they were written by Clara and are thus quite legible. They give, in numerical order by folder, the geographic locality name(s) of the samples used to make the mica preparations held in the folder. The folders themselves have very brief labels on their spines. Labels within the folders next to individual strips often refer to localities or give the names of colleagues who provided Ehrenberg with the material investigated. This hierarchy of labels is often very useful in confirming which strip or strips corresponds to any particular sample or published description. Lastly, Ehrenberg noted the names of the taxa observed on each mica in a set of ruled areas below each strip. Letter codes such as “w.” or “bl.” preceded taxon names that were marked on the mica by coloured paper rings (Jahn 1995a).

The last five cases (51–55) have a somewhat different type and arrangement of material. Cases 51 to 53 have drawers, each of which has several actual glass slides. Most of the slides are either rock thin sections or simple strewn slides with a cover slip. The last two cases – 54 and 55 (Fig. 4c) – were preparations from living material (“Trockenpräparate” = dried specimen between 2 micas), and were particularly used in his *Infusionsthierchen* monograph (Ehrenberg 1838). These hold drawers, each filled with numerous mica holders – rather thick rectangular frames with up to 6 micas embedded in holes cut out at regular intervals. The contents of the two cases are arranged, in contrast to the sample organisation of the rest of the collection, taxonomically by major group, and alphabetically by genus name within each group. The mica holders are numbered using roman numerals separately for each major group.

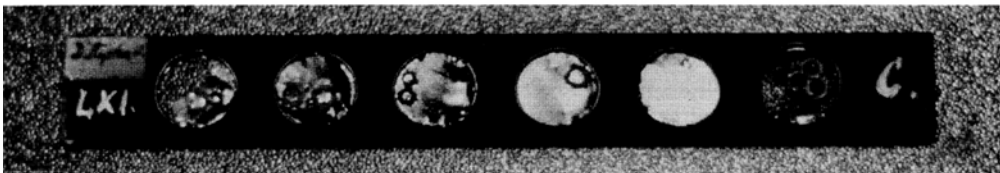
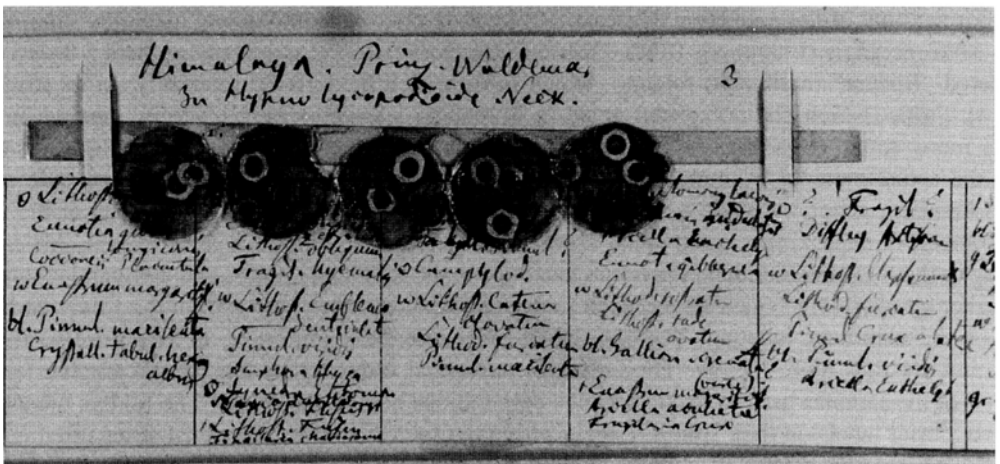
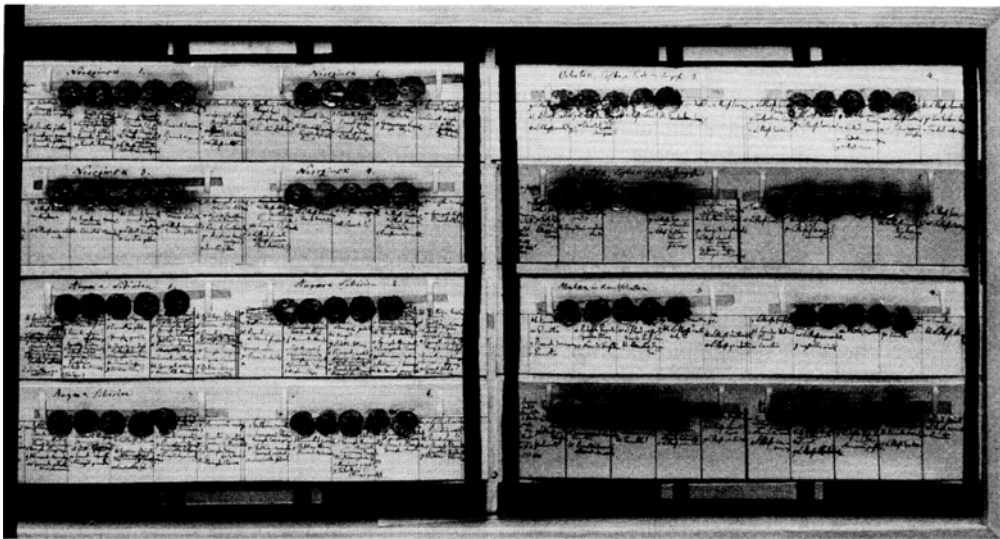


Fig. 4. (Top) A folder holding strips of Ehrenberg's mica preparations. (Middle) Close up view of a strip. Note the labels under the strip giving taxa names and letter codes to the coloured rings. (Bottom) A holder with micas from the "Trockenpräparate".

Ehrenberg's micropaleontological preparations on mica discs present a particular problem for modern users. In addition to examination problems due to the mounting method itself (Lazarus 1998), they are also organisationally awkward. They were arranged and referred to in a hierarchy of mica, strip, folder, and case, rather than in a simple direct referencing system. In many cases, the only cross-reference is to a higher organisational unit (typically folder), thus making the identification of the actual mica of interest more difficult. Another problem is the strip mounting method. The mica discs were mounted deliberately on strips by Ehrenberg to allow examination of both sides of the specimens. However, the balsam layers on the micas are nowadays much too fragile to safely handle this way, or to permit removal of the mica from the strip backing, so the mounted material on the mica discs must be examined by manipulating an entire, rather unwieldy and fragile strip. Experiments with temporary holders to make this work more convenient and safer are planned. Also, because the strips are only loosely inserted in the folder backing paper, it is easy for the strip to become irreversibly separated from the labeling that identifies it. Despite these problems, the experience of recent visitors to the collection has shown that one can in most cases safely manipulate the preparations, and find the actual type specimen on the mica disc. For example, information from other sources, such as the drawings collection, can often be used to identify the precise mica desired.

Drawings (“Zeichenblatt”)

Ehrenberg's extensive collection of taxonomic drawings are, together with the samples and micas, an important source of basic information on Ehrenberg's taxa. Each drawing (Fig. 5) is approximately the size of a US letter sheet of paper. They were usually made with a fine grey pencil, and occasionally coloured afterwards with what appears to be watercolour. Observations were always made at 300X magnification in the microscope, and the drawing scale was marked in fractions of “Paris lines”, where 1 Paris line = 2.256 mm (Jahn 1995b). There are 3,011 numbered sheets, held in 17 slip-boxes. These are mostly taxonomically arranged, although 4 boxes are geographically arranged drawings of mixed taxa from samples. The first seven boxes hold drawings of diatoms, boxes 8 and 9 radiolarians, box 10 foraminifera, and the remaining boxes miscellaneous other taxa, plus the geographically ordered sheets. Within each larger taxonomic category the illustrations are arranged by generic name. The drawings vary in content – some are primary drawings of single taxa or genera, some sheets are composites of different individual taxa from many different observations, and some (particularly in the taxonomically arranged boxes) are apparently collages of cut-outs from publications rather than original drawings. Drawings, particularly those in the geographic boxes, often contain portrayals of an entire field of view in the microscope, and thus may show a complex mixture of many different types of organisms – more than 100 individuals may be found on a single sheet, with diatoms, radiolarians, sponge spicules and even small rock fragments appearing in the same illustration. Obviously, a simple ordering of such latter drawings by a single taxonomic name is of limited value.

Ehrenberg did not attempt to create a unique, atomic numbering system for all of these individual specimen illustrations. However, for many of these he did use a number on the drawing sheets to refer to specimens that were included in his publications. The published numbers do not always correspond precisely to those on the figures but agree closely enough in most cases that they are an aid to identification. Furthermore, on many of the sheets he added next to each specimen a short code, such as “9.α.w.”. These are a cross reference to the mica preparations – strip number 9, first mica, white coloured ring. These notations thus link the actual specimen stored in the mica collection to an illustration, which usually was the basis for the publication of a new name. They are the only known method to identify actual type material when (as is usual) there is more than one mica for a given sample. To date, these notations have neither been published or indexed, but can be

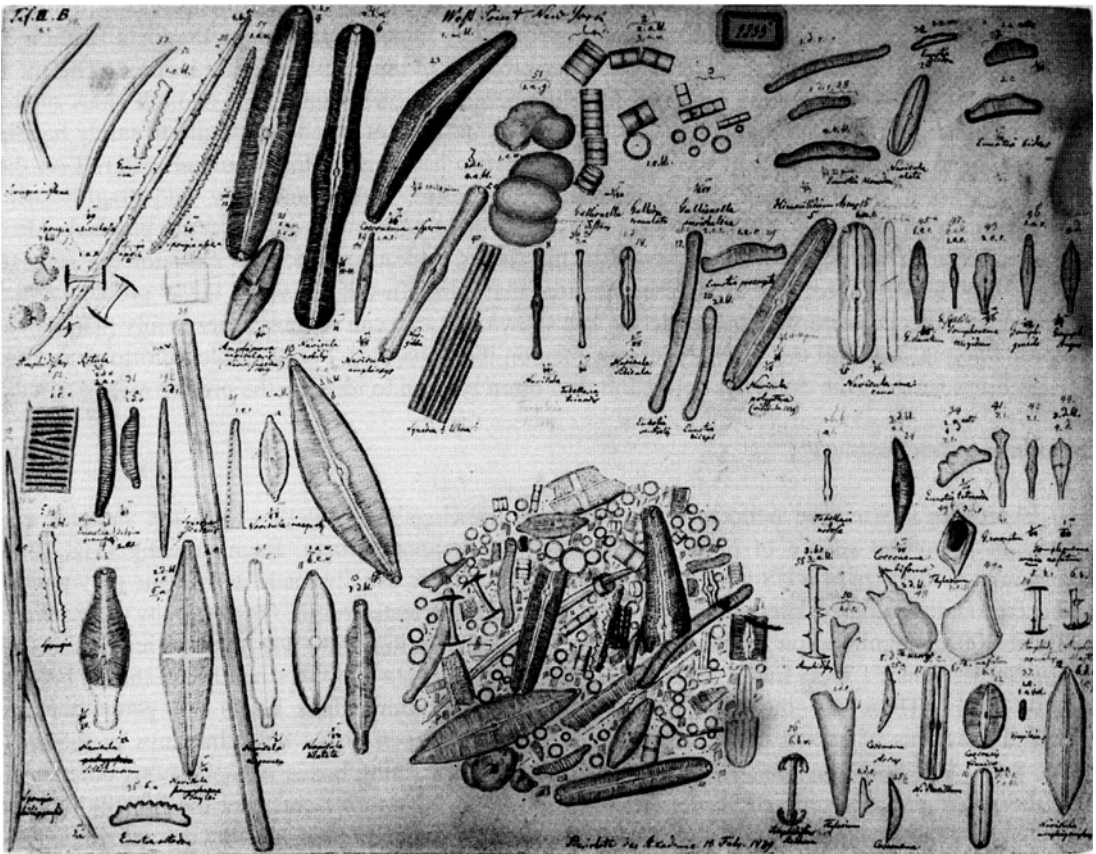


Fig. 5. Example drawing from the Ehrenberg collection. Note the codes cross referencing the individual drawings to specific micas and ring-marked specimens.

seen on the original drawing sheets. The drawings are of great importance not only for this reason, but also because in many cases Ehrenberg never published an illustration for a species name, although he had indeed made a drawing of it. Such drawings are of particular value, as they are part of the original material and therefore nearly of type status.

The Mikrogeologie Index volumes

The bulk of the Ehrenberg Collection consists of the 50 cases and several thousand samples devoted to geologic preparations, summarised in his great “Mikrogeologie” monograph (Ehrenberg 1854). Two special index volumes for these materials were created by Clara Ehrenberg, and are currently essential tools in order to locate materials in the collections.

Australien.

lauf. Zahl.	N. Prob.	Ort	Verf.	Proz.	Analys.	Di.
17.	x 16.	Stams River. Phasa. Mt. 1843 p. 158. Mg. p. 7. 3. 9.	II	3.	10.	9.
18.	x 63.	West. Kuchelland im. Sauer. Pulchraura. Erde. Proef	II	3.	5.	
19.	x 18.	Larlingrange. Proef 1847.	I	10.	11.	
20.	x 19.	Port. Leheroll. Proef 1847.	I	7.	10.	
21.	20.	King George Sound. Linnus. Mt. 1843 p. 158. Mg. p. 7. 3. 10.	I	7.	10.	10
22.	x 21.	Prinzip. Royal Harbour. Pflanzenanhang. Mg. p. 8. 3. 11.	I.	7.	10.	11
23.	x 22.	Plantagenet. Erdprobe. Mg. p. 8. 3. 12.	I.	7.	20.	12.
24.	23	Bassano Range. Schomburgk. Seidlich. nat. Fr. 1861. Juni. ^{14. Nijlen v. 3. Febr. (11)}	II.	1.	20.	
25.	x 24.	Adelaide. Murray Fluss. Schlamme. Schomburgk. 1861. ^{14. Nijlen v. 3. Febr. (10)}	II	1.	10.	
26.	25	Adelaide. Lyndoch Valley Beck. Schomburgk. 1861. ^{Bassano Range. 25. Febr. v. 3. Febr. (10)}	II	1.	10.	
27.	26	Adelaide. Macrossand der Feiste. Schomburgk 1861.	II	1.	10.	
28.	27	Adelaide. 100 miles landwaerts. Schomburgk. 1861. ^{Bachschlamme. (14)}	II	1.	10.	
29.	x 28.	Adelaide. 50 st miles landwaerts. Brackwafer. Schomburgk. 1861. ^(11. 12)	II.	1.	10.	
30.	29	Adelaide. Sandy Beck. Schomburgk 1861. ^(13. 32)	II	1.	10.	
31.	^{hij. Nijlen} pag. 219.	Bassano Range. Greenock. Beck. Schomburgk. Seidlich. nat. Fr. 1861. Juni.	II	6.	20.	
32.	30.	Sawler Fluss. Schlamme. b. Tanunda. Schomburgk 1859. ^{Seidlich. nat. Fr. Juni.}	II.	6.	20.	
33.	13.	Melbourne. Sauerf. Schlamme. v. Paganmayer 1862.	II	2.	20.	
34.	x 136.	Haas. jemburg. Schlamme. Proef. 1847. p. 73. ^{13.} Melbourne. Bad. Yarra Yarra. Alka. Phasa. 1854.	II.	7.	21.	

Fig. 6. Sample page from the Geographic index volume.

The Geographic Index volume (Fig. 6)

This volume (316 p.) consists of several parts, and actually contains 3 different indices. The main part of the volume is the Samples index, which lists in numerical order most of the samples studied or held by Ehrenberg. The numbering is, strictly speaking, done via a "running number" sequence internal to the index volume itself, but this corresponds rather closely to the numbers found on the samples themselves. The ordering is also approximately geographic, with the same large scale sequence used for the mica cases. Within each major division however there is no obvious ordering other than the numerical sequence. Pages 5–190 cover the bulk of the samples actually studied by Ehrenberg. The remaining pages contain shorter, separate lists of Greensands (p. 197–200), the curious category known as Edible Earths (p. 201–204), "Morpholiths" (pseudo fossils, published as plate 40 in the Mikrogeologie), an appendix of additional studied samples (p. 210–216), and a rather substantial section devoted to unstudied samples (p. 217–256). Lastly, there are two short indices: a Locality index, which lists localities by name in alphabetical order, each referenced to a page number in the main Sample index; and a cross reference listing of the numbers used internally in the index volume to the numbers actually given on the samples themselves.

The main sections listing samples have the following items of information: the running index number; the actual sample number; the sample name; citation of where published, including any sample number used in the publication, page, plate etc.; Case and Folder for corresponding mica holder, and "Analyse", a number between 1 and approx. 100 which gives the number of micras made by Ehrenberg from the sample.

The main use of this index is to locate materials when one is beginning only with a locality name, frequently from a publication. To use this index, one consults the Locality index, and finds the actual entry on the page indicated. The entry indicates which folder will have relevant micras, and which publication will have other relevant information, including details of the sample and the taxa that Ehrenberg found.

The Taxonomic Index (Fig. 7)

The second major index created by Clara Ehrenberg is the Taxonomic index. This volume (261 p.) has a comparatively simple format. It is arranged by larger taxonomic group, and within each major division, alphabetically by genus and species name. Pages 3–119 cover diatoms ("Polygastern"), pages 120–147 radiolarians ("Polycystinen"), pages 148–195 foraminifera ("Polythamnien"), and so on, through other protists, invertebrates, and ending with miscellaneous other categories including vertebrate materials and land plants.

Entries in the index include the taxon name; citations to the original publication of the name, original publication of diagnosis, publication of illustration; drawing number; locality name; and case and folder reference to the micras. It should be noted that the publications listed are usually, but not always the first ones to use the name. Thus the information given regarding initial publication is a useful starting point, but should be confirmed by an independent source to insure that one has indeed correctly identified the type of the name of the species. Another complicating factor is that the taxonomic names used in the index are not always those originally given by Ehrenberg himself. In at least some cases, the name used in the index is the one that was valid when the index was made. One should therefore check for a taxon not found where expected under earlier/later names as well.

Other sources of information

In addition to the major index volumes described above, several other types of information are available about the contents of the collection.

A separate index of dried preparations from living material ("Trockenpräparate") (Fig. 8) lists, for each major taxonomic group, and by alphabetical order by genus and species within each group, the specimens that are the basis of his earlier monograph "Infusionsthierchen" (1838). This list is a simple summary of the material itself which is stored, in the same order, in Cases 54 and 55 as described above.

There are six bound volumes of notes on taxa synonyms made by Ehrenberg (and thus difficult to read), taxonomically organised and consisting of taxon names and citations to the literature, his own and that of other researchers. Although now obviously very much out of date, these volumes were probably the precursor of the taxonomic index created by Clara, and thus may be useful in tracing a name that does not appear in Clara's index, to a synonym that does.

Fig. 7. Sample page from the Taxonomic index volume.

6.	Easter-Hemung of <i>Diaparsis</i> publici Abbildung		Händ- Küchmang auffenbarde Prägnanz
<i>Notinius</i> H. (Cass.)			
<i>biplanarius</i>	Mbl. 1854 p. 238		
<i>bisotnarius</i>	Mbl. 1854 p. 238		
<i>curvatus</i>	Mbl. 1872 p. 213	Mbl. 1876 T. VI p. 19	16 Mbl. T. 19. S. 9
<i>lirius</i>	Mbl. 1844 p. 75	Mg. T. 21 f. 49	204. Iran. K. 11 B. 5. 6
<i>rudonarius</i>	Mbl. 1872 p. 213	Mbl. T. 19. S. 9	
<i>ebians = Dilyoncha</i>	Mg.	Mg. 1854 S. 23 f. 51	17 Pallanietto. K. 20 L. 6
<i>furcatus</i>			1752
<i>heptagonus</i>			Kante. K. 51 L. 7
<i>lanecarius</i>	Mbl. 1844 p. 139	Mbl. 1844 p. 199	1914 Süd Pol. Selpa. K. 1 L. 9
<i>noovandenarius</i>	Mbl. 1872 p. 213	16 Mbl. T. 19. S. 9	
<i>Pentasterias</i>	Mbl.	Mbl. 1859 p. 149 Mg. T. 35A xxvf. 1.	18 <i>Alpina</i> K. 51 B. 9
<i>quinarius</i>	Mbl. 1844 p. 165	Mbl. 1844 p. 76 Mg. T. 19 f. 46	2180 <i>Alpina</i> K. 20 B. 11
<i>Plota</i>	Mbl. 1844 p. 60	Mbl. 1844 p. 76 Mg. T. 21 f. 50	20 Iran. K. 21 L. 5. 6
<i>septenarius</i>	Mbl. 1843 p. 103	Mbl. 1854 p. 207	1998 <i>Iran</i> K. 7 B. 11
<i>usfurcatus</i>	Mbl. 1854 p. 66	Mbl. 1854 p. 207 Mg. T. 33 B. f. 2. 13	194 <i>Wland. Ocean.</i> K. 27 L. 3.
<i>lirius</i>	Mbl. 1858 p.	Mbl. 1859 p. 150 Mg. T. 33 xv f. 1	19 <i>Alpina</i> K. 13 B. 10
<i>sol</i>	Mbl. 1843 p. 103	2180 <i>Alpina</i> K. 13 B. 11	
<i>Stella</i>	Mbl. 1838 p.	Mbl. 1840 p. 209 Mg. T. 22 f. 53	20 <i>Pallanietto</i> K. 20 B. 6
<i>Tetrasterias</i>	Mbl. 1844 p. 68	Mbl. 1844 p. 76 Mg. T. 18 f. 62	17 <i>Virginia</i> K. 23 L. 11.
<i>vicinarius</i>	Mbl. 1872 p. 213	Mbl. 1872 T. 11 p. 11	16 Mbl. T. 19. S. 9.
<i>Notino cyclus</i>			
<i>Bohar nahr</i>	Mbl. 1840 p. 213	Mbl. 1843 p. 163	2180. 2139 <i>Stückstedt</i> K. 36 B. 11
<i>Aldebaran</i>	Mbl. 1840 p. 203	Mbl. 1843 p. 163	21 <i>Stückstedt</i> K. 36 B. 11.
<i>Alexander</i>	Mbl. 1843 p. 318	Mbl. 1843 p. 258.	1983 <i>Concursum</i> K. 6 L. 9.
<i>Antares</i>	Mbl. 1841 p. 204	Mbl. 1840 p. 204	22 <i>Quakoon</i> K. 16 B. 7
<i>Aquila</i>	Mbl. 1840 p. 209	Mbl. 1840 p. 204	23 <i>Engens</i> K. 18 B. 2
<i>Nocturus</i>	Mbl. 1840 p. 203	Mbl. 1843 p. 163	24 <i>Stückstedt</i> K. 36 B. 11

Downloaded by [FU Berlin] at 05:19 03 November 2011

6X	1 <i>Dictyodes truncata</i> & <i>Pellonetta</i>	1 <i>Diffagus acuminata</i>
2	—	2
3	—	3
4	—	4
5	—	5
6	—	6
6X	1 <i>Dictyodes</i> <i>Pellonetta</i> & <i>Dict. n. l.</i> de <i>Thompson</i> bei <i>Proteridione</i>	—
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—
6X	1 <i>Dictyodes</i> <i>scabata</i> <i>Dict. n. l.</i> de <i>Thompson</i> 2 <i>Dict. n. l.</i> de <i>Thompson</i> <i>Proteridione</i>	1 <i>Diffagus elongata</i> , <i>Dict. n. l.</i> de <i>Thompson</i>
2	—	2
3	—	3
4	—	4
5	—	5
6	—	6
6X	1 <i>Dictyodes</i> <i>scabata</i> <i>Dict. n. l.</i> de <i>Thompson</i> 2 <i>Dict. n. l.</i> de <i>Thompson</i> <i>Proteridione</i>	—
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—
6X	1 <i>Dictyodes</i> <i>scabata</i> <i>Dict. n. l.</i> de <i>Thompson</i> 2 <i>Dict. n. l.</i> de <i>Thompson</i> <i>Proteridione</i>	—
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—
6X	1 <i>Dictyodes</i> <i>scabata</i> <i>Dict. n. l.</i> de <i>Thompson</i> 2 <i>Dict. n. l.</i> de <i>Thompson</i> <i>Proteridione</i>	—
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—
6X	1 <i>Dictyodes</i> <i>scabata</i> <i>Dict. n. l.</i> de <i>Thompson</i> 2 <i>Dict. n. l.</i> de <i>Thompson</i> <i>Proteridione</i>	—
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—

Fig. 8. Sample page from the "Trockenpräparate" index volume.

North Atlantic Telegraph.
 (Temporary Offices)
 62, Moorgate Street, London, E.C.

26th 18th 1861

To Prof. Ehrenberg
 My Dear Sir, I send with this
 many specimens collected for you during
 the late North Atlantic Telegraph Expedition
 steamer Fox.

The Fox was purchased and fitted
 out by the promoters of the proposed telegraphic
 and sent to select the landing places for the
 cables. The Bulldog was sent by the British
 Government to take the deep sea soundings
 for the proposed telegraph. The Fox however
 also took deep sea soundings, all of
 which were taken under my direction.
 I accompany the Fox. Dr Mallard
 was on the Bulldog -
 I send with this a schedule

No. 1

2nd Expedition

Direct Soundings taken on approaching Nordhavn, some show
 light 2 1/2 to 9.10 pm Depth 103 fathoms
 Spindle cast

Sept 1st. Near Nordhavn Aug 23rd at 4.30 am
 35 fathoms (Springs or shells)

Sept 2nd. Near Nordhavn Aug 24th at 7.30 am
 35 1/2 fathoms (Shell (Springs or shells))

Sept 3rd. Near Nordhavn Aug 25th at 5.30 am
 30 fathoms (Springs or shells)

Sept 4th. Near Nordhavn Aug 26th at 7.30 am
 29 fathoms (Springs or shells)

Sept 5th. Near Nordhavn Aug 27th at 5.30 am
 28 fathoms (Springs or shells)

Sept 6th. Near Nordhavn Aug 28th at 6.30 am
 27 fathoms (Springs or shells)

Sept 7th. Near Nordhavn Aug 29th at 5.30 am
 26 fathoms (Springs or shells)

Sept 8th. Near Nordhavn Aug 30th at 6.30 am
 25 fathoms (Springs or shells)

Sept 9th. Near Nordhavn Aug 31st at 5.30 am
 24 fathoms (Springs or shells)

Sept 10th. Near Nordhavn Aug 31st at 6.30 am
 23 fathoms (Springs or shells)

Sept 11th. Near Nordhavn Aug 31st at 5.30 am
 22 fathoms (Springs or shells)

Sept 12th. Near Nordhavn Aug 31st at 6.30 am
 21 fathoms (Springs or shells)

Sept 13th. Near Nordhavn Aug 31st at 5.30 am
 20 fathoms (Springs or shells)

Sept 14th. Near Nordhavn Aug 31st at 6.30 am
 19 fathoms (Springs or shells)

Sept 15th. Near Nordhavn Aug 31st at 5.30 am
 18 fathoms (Springs or shells)

Sept 16th. Near Nordhavn Aug 31st at 6.30 am
 17 fathoms (Springs or shells)

Sept 17th. Near Nordhavn Aug 31st at 5.30 am
 16 fathoms (Springs or shells)

Sept 18th. Near Nordhavn Aug 31st at 6.30 am
 15 fathoms (Springs or shells)

Sept 19th. Near Nordhavn Aug 31st at 5.30 am
 14 fathoms (Springs or shells)

Sept 20th. Near Nordhavn Aug 31st at 6.30 am
 13 fathoms (Springs or shells)

Sept 21st. Near Nordhavn Aug 31st at 5.30 am
 12 fathoms (Springs or shells)

Sept 22nd. Near Nordhavn Aug 31st at 6.30 am
 11 fathoms (Springs or shells)

Sept 23rd. Near Nordhavn Aug 31st at 5.30 am
 10 fathoms (Springs or shells)

Sept 24th. Near Nordhavn Aug 31st at 6.30 am
 9 fathoms (Springs or shells)

Sept 25th. Near Nordhavn Aug 31st at 5.30 am
 8 fathoms (Springs or shells)

Sept 26th. Near Nordhavn Aug 31st at 6.30 am
 7 fathoms (Springs or shells)

Sept 27th. Near Nordhavn Aug 31st at 5.30 am
 6 fathoms (Springs or shells)

Sept 28th. Near Nordhavn Aug 31st at 6.30 am
 5 fathoms (Springs or shells)

Sept 29th. Near Nordhavn Aug 31st at 5.30 am
 4 fathoms (Springs or shells)

Sept 30th. Near Nordhavn Aug 31st at 6.30 am
 3 fathoms (Springs or shells)

Sept 31st. Near Nordhavn Aug 31st at 5.30 am
 2 fathoms (Springs or shells)

Fig. 9. Sample letter from the letters collection.

Most samples sent to Ehrenberg, particularly from abroad, were accompanied by a letter (Fig. 9). Some 800 of these are preserved in a separate letters collection, and contain useful information on the origin of the samples (Lazarus 1998). Currently the letters are bound together in bundles and have only a basic index (created by Clara), organised alphabetically by author and year, and giving a short one line description of the contents. The letters themselves are in several languages, and differing degrees of preservation. Most are however still quite usable.

Lastly of course are Ehrenberg's many publications, which are the starting point for most researchers wishing to use the collection. Given that the indices to the collection were largely created by Clara after the event, Ehrenberg's publications do not give a direct citation of the collection index numbers. However one can locate materials by using locality names or other information, as described above.

NAVIGATING THE EHRENBERG COLLECTION

As the above sections illustrate, the Ehrenberg collection contains a great deal of documentation which should permit, in principle, quick and easy access to any desired material. Things are not however always that easy in practice. Of the various objects in the collection, only some have direct cross-reference indices, and these are sometimes arranged in an order that is inconvenient (the numerical ordering used for the Sample index). Some of the more essential data (specific references to type micras) is either not present or is scattered throughout the primary materials (e.g., as notations on the drawing sheets). There are however enough cross-referencing links so that one can, by using several of these information types together, usually find the precise material needed. To make using the documentation easier, a sketch of the links between information types (a "road-map") is provided as Fig. 10.

CLOSING COMMENTS

Restoration work on the Ehrenberg Collection involves physical work on the materials, sorting out Ehrenberg's publications, and much else besides. Here we comment only on possible ways by which the indexing of the collection can be improved.

The Ehrenberg Collection, although moderately complex, is in principle not all that different from other collections of microfossils. Accessing more modern collections is generally much easier as the individual primary objects of interest are uniquely identified, and cross-references between the objects can be done with great speed and flexibility through the use of computerised databases. For example, Fig. 11 shows a database structure that would be appropriate for the contents of the Ehrenberg collection. Comparison of figures 10 and 11 reveals major differences. These differences are partly due to the lack of a simple, unique code or number based identification system for many of the objects such as micras in the Ehrenberg collection, or for supporting data such as locality names, and in part due to the restrictive nature of any paper based index. Future work on the indexing of this collection is expected to focus at first on capturing the information as it currently exists. In the long run however it will be desirable to develop and implement the necessary new primary coding systems – e.g. for individual micras – that will in turn allow the creation of a modern database system for the material.

Scientists wishing to use the Ehrenberg Collection are always welcome. Limited requests for documentation from the collection can be provided by mail or e-mail by contacting the senior author. For more extensive researches, it is recommended either to obtain a copy of the scanned indices CD-

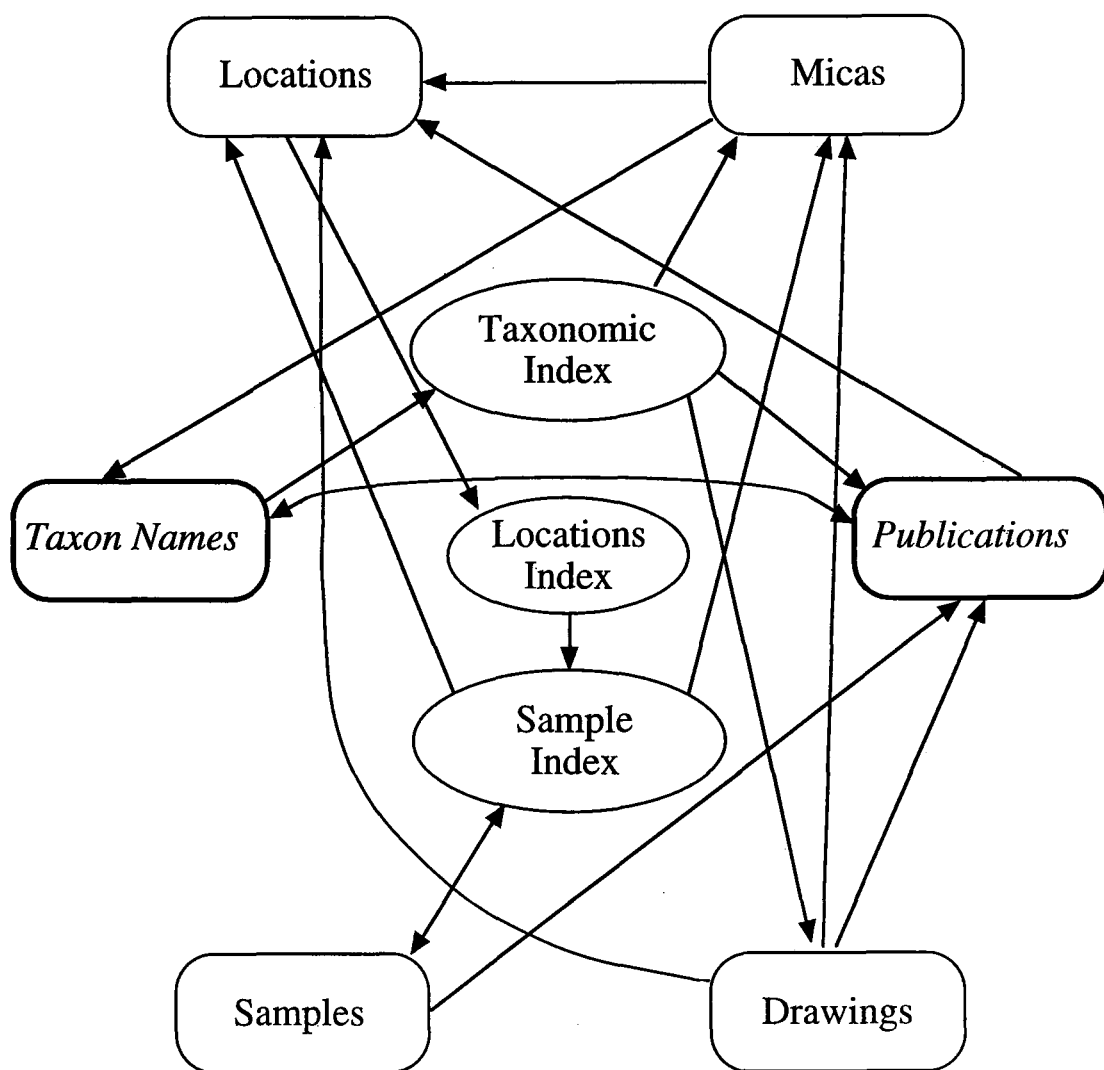


Fig. 10. Road map to the Ehrenberg Collection. Primary categories are shown as rounded rectangles, Clara's handwritten indices as ellipses. Lines show where information exists on objects within a category that reference objects in another category. Arrows show the direction of the linkage. For example, the one-way arrow pointing from "Samples" to "Publications" indicates that publication info is often found attached to samples, but that publications do not usually directly reference samples. Users of the collection typically begin either with a taxonomic name or a specific Ehrenberg publication (heavy lined rectangles). To locate the original sample associated with a particular section of a publication, one uses the location name to find the sample number in the locations index. To locate a type specimen one uses the taxonomic name and the taxonomic index to identify the approximate micas, and to locate the drawing of the taxon which in turn gives more precise information on which mica contains the type.

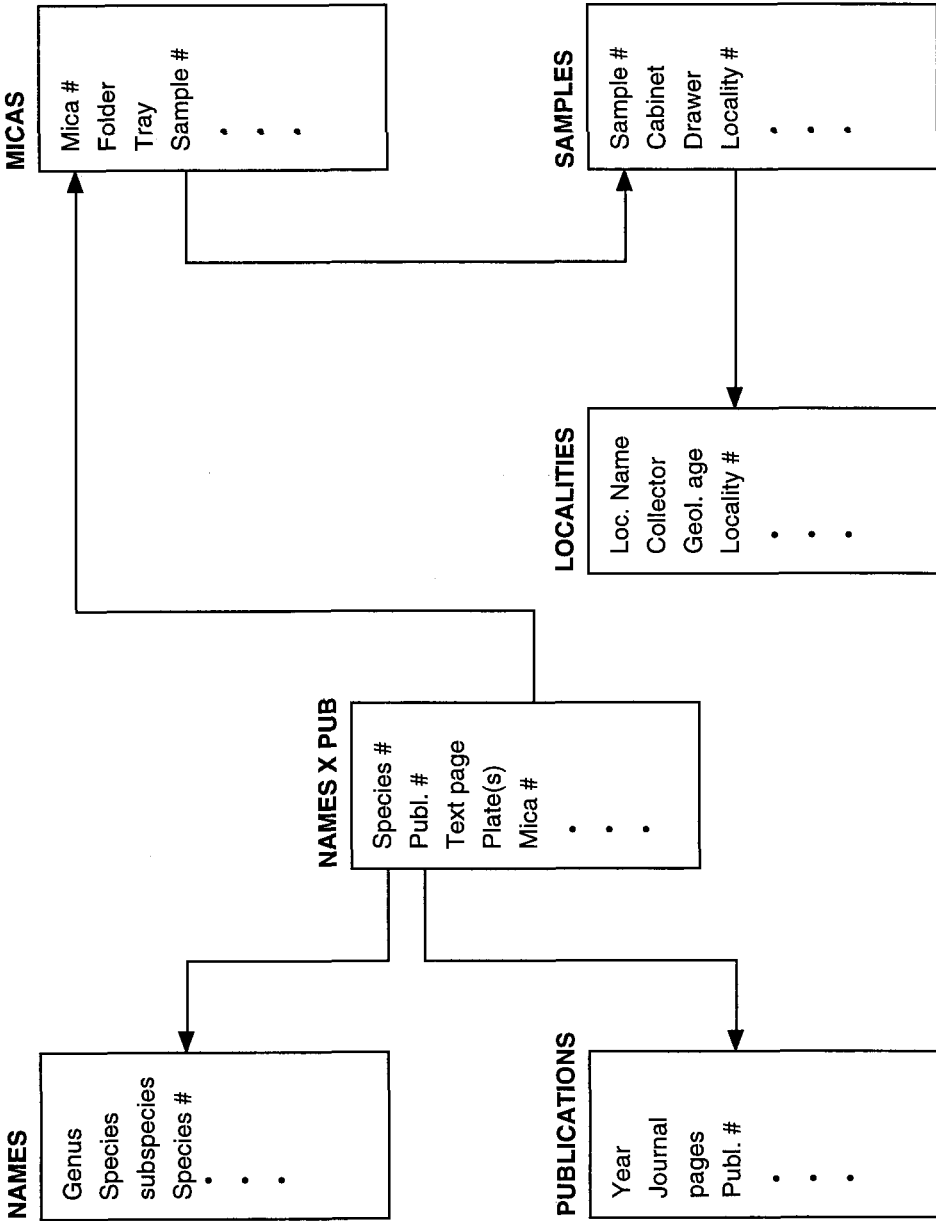


Fig. 11. Possible (simplified) database structure for Ehrenberg Collection. Each box in the figure represents a data table, with field names (incomplete) listed inside the box. Links between tables are shown by arrows. Each primary object type in the collection is identified with a unique number or code, and only information directly associated with that type of object is stored with it as a data table. All associated information is referenced by entering the code of the object in the relevant related category. This structure is essential to the construction of a modern "relational" type of database system, and thus will require labeling all primary objects in the collection with unique codes and/or assigning them to non physical entities, such as taxon names.

ROM, or to visit the collection in person. Visits should be arranged beforehand by contacting the senior author, who can advise on facilities and accommodation. Due to the fragile nature of the materials, only small subsamples of sample material can be sent out on loan – all other original materials must be examined in person at the Museum.

NOTES ON THE CD-ROM SUPPLEMENT

A CD-ROM supplement to this paper is available from the Museum für Naturkunde. The CD-ROM contains scanned images of all pages of the 3 index volumes described in this paper: the Geographic Index, the Taxonomic index, and the “Troddenpräparate” Index. These files are in “TIF” format and are small enough (300 dpi, 1 bit; <1 Mb) to be readable on almost any computer. The CD-ROM also holds example images of other parts of the Ehrenberg Collection, including drawings and letters. These are also TIF files, though some are large enough (full colour; >10 Mb) to require a relatively recent vintage computer. Lastly, the CD-ROM contains computer-readable tab delimited text files (Macintosh high ASCII format) with preliminary data on the micas, entered into the nascent database system that is being developed for the Collection. The CD-ROM should be ordered from the senior author. A voluntary contribution of \$US 20 / D Mark 40 (or the equivalent in Euros) to cover reproduction and shipping costs is requested.

REFERENCES

- EHRENBERG, C. G. (1837). Mittheilung einer sehr einfachen Methode zum Festhalten, Vergleichen und Aufbewahren der feinsten und vergänglichsten mikroskopischen Objecte. *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin* **1835**, 141–149.
- EHRENBERG, C. G. (1838). *Die Infusionsthierchen als vollkommene Organismen. Ein Blick in das tiefere organische Leben der Natur*. 548 pp., 64 pl. Leopold Voss, Leipzig, Germany.
- EHRENBERG, C. G. (1854). *Mikrogeologie. Das Erden und Felsen schaffende Wirken des unsichtbar kleinen selbstständigen Lebens auf der Erde*. 374 pp. Leopold Voss, Leipzig, Germany.
- EHRENBERG, C. G. (1862). Über die seit 27 Jahren noch wohl erhaltenen Organisations-Präparate des mikroskopischen Lebens. *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin* **1862**, 39–74.
- EHRENBERG, C. G. (1875). Die Sicherung der Objectivität der selbstständigen mikroskopischen Lebensformen und ihrer Organisation durch eine zweckmässige Aufbewahrung. *Monatsberichte der Königlichen Akademie der Wissenschaften zu Berlin* **1875**, 71–81.
- JAHN, R. (1995a). Ehrenberg's marked species on five mica. *Iconographia Diatomologica*, **1**, 101–107.
- JAHN, R. (1995b). C. G. Ehrenberg's concept of the diatoms. *Archiv für Protistenkunde*, **146**, 109–116.
- JAHN, R. (1998). C. G. Ehrenberg: The man and his contribution to botanical science. In: *Christian Gottfried Ehrenberg (1795–1876): The man and his legacy* (D.M. Williams & R. Huxley, eds), 14–29. Special Publication of The Linnean Society, Academic Press.
- LAZARUS, D. B. (1998). The Ehrenberg Collection and its curation. In: *Christian Gottfried Ehrenberg (1795–1876): The man and his legacy* (D.M. Williams & R. Huxley, eds), 31–48. Special Publication of The Linnean Society, Academic Press.
- LOCKER, S. (1970). Mikrofossilien aus der Sammlung Christian Gottfried Ehrenberg. *Wissenschaftliche Zeitschrift der Humboldt-Universität zu Berlin, Mathematisch-Naturwissenschaftliche Reihe*, **19**, 186–189.
- LOCKER, S. (1980). Christian Gottfried Ehrenberg (1795–1876) und die Mikrogeologische Sammlung. *Zeitschrift für geologische Wissenschaften, Berlin* **8**(2), 231–238.
- MOLTRECHT, C. (1995). *Christian Gottfried Ehrenberg: Leben und Werk eines Delitzscher Naturforschers*. Delitzsch. Druck- und Verlagshaus Delitzsch GmbH. 32 pp.