

# Earth science collections of the Natural History Museum Bern (NMBE) – a review

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## **Abstract**

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The earth science collections of the Natural History Museum Bern (NMBE) are reviewed with the aim to facilitate access for research and educational purposes and to increase knowledge about the contents. The most important collections include the mineral collection dominated by Swiss Alpine fissure minerals and minerals from the Lenggenbach quarry (Valais), and the collection of fossils from Switzerland (Jura, Molasse, Swiss Alps) and of corals. The types of information and services available for the collections is described, as well as current acquisition policies and research objectives. Information about integrated collections and curators is presented in tables. A bibliography of papers dealing directly with the collections is given.

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## **1. Introduction**

The purpose of this paper is to present a review of the collections as a sort of first order index to facilitate access by external researchers and other users. The collections and their contents are summarized, but no detailed specimen lists are given.

Despite their large information content, museum collections tend to be relatively little used. This is partly due to a lack of knowledge about the contents and

the possibility to use such collections. It is also partly a result of incomplete documentation which can greatly reduce the scientific value of single specimens and of collections as a whole.

Minerals, rocks and fossils are collected by researchers, institutions and private persons with intentions ranging from research, admiration of nature and collectionism to purely commercial purposes. Generally, natural history museum collections should preserve natural objects of a wide variety for future use. Because the nature of possible future use is predictable only to a very limited degree, documentation should be as complete as possible. Curators should follow clear guidelines regarding the variety of materials to be integrated in earth science museum collections. In the process of sample acquisition, at least the following points should be considered: uniqueness (possibility and cost of replacement), research potential, educative value, completeness of documentation, compatibility with the museum's specialization, historic importance. The research potential of any object is extremely difficult to predict. It is practice in our department, therefore, to integrate those samples into the collection that fit into the general acquisition policy, are well documented and sufficiently rare so that replacement is not easily possible.

Rock, mineral and fossil specimens from museum collections can be used for a number of purposes: research (earth sciences, material sciences, environmental sciences, history), exhibitions (in the museum and externally), teaching (from elementary school to university grade), commercial applications (advertising). With documentation being added over time, the historic importance of the collections increases. The main purpose of earth science museum collections and the justification for their long-term curation are the preservation of research potential and cultural heritage.

One of the prime objectives of museum collections must be to provide materials for scientific research. Easy access to documentation of a high standard is mandatory to reach this goal. Considering the costs of long-term curation, the generation of ideal conditions for an effective research use of large collections and also the promotion of such use is a must. Research on rocks and minerals can cover all fields in the earth sciences and related disciplines. Modern, process-oriented earth scientists are field-oriented and usually prefer to do research on material collected and documented by themselves. Nevertheless, museum collections can provide important additional materials because the diversity of specimens represented in such collections cannot be found elsewhere or may actually be unique, e.g. in the case of samples from now inaccessible sites, abandoned mines and concreted tunnels for instance. Examples of recent research-oriented use of NMBE specimens include:

- crystallographic mineralogy (e.g. reference material from type localities)
- reference material for cathode luminescence investigations
- experimental geochemistry including environmental geochemistry
- stable and radioactive isotope geochemistry, including rare gas geochemistry
- topographic mineralogy and mineral paragenesis
- experimental physics (e.g. optical spectroscopy)

- standard materials for electron microprobes and ion probes
- reference material for research on building stone conservation
- gemmological reference material
- palaeontological specimens, mostly used for comparative taxonomic determination purposes. An increased use of palaeontological specimens in palaeoecological and geochemical (including isotopic) research is foreseeable.

Traditionally, research use of museum specimens has been largely in object-oriented studies such as crystallography, crystal chemistry as well as in topographic mineralogy. Recent developments in the earth sciences are characterized by a strongly growing importance of process-oriented studies where background information on samples is often crucial, rendering a high standard of documentation ever more important.

The kinds of specimens collected also may undergo a certain shift over the years. While minerals, gems, fossils and meteorites are dominating existing collections, less spectacular rare materials of high research potential should also be included (speleothems, cave sediments, hot spring deposits etc.).

Earth science departments at natural history museums are in many cases institutions where knowledge about the occurrence of minerals, rocks and fossils is gathered in context with curatorial activity. Only the advent of computerized databases allows an effective management of such information.

In future, world-wide computer networks such as the Internet will allow access to individual museum catalogues. A few searchable catalogues are already available on the Internet. The major challenges in building up high quality electronic catalogues are the establishment of primary databases and a standardized selection of data to be integrated into the accessible catalogues. Also, the question of whether directories of collections or whole inventories should be made available via the Internet is currently being discussed.

## **2. Origin and history of the earth science collections of the NMBE**

### **2.1. Institutional organization of the NMBE**

The NMBE grew out of a curiosity cabinet located in the City Library of Bern since the end of the 17th century (Strahm 1945). The museum was officially founded in 1832 but remained at the library location until a new building was opened in the Hodlerstrasse in the centre of Bern in 1882. After the final separation of the *Burgergemeinde* (municipality of burghers), the state of Bern and the political municipality of Bern in 1852 (treaty of separation; *Ausscheidungsvertrag*), the *Burgergemeinde* kept responsibility for the NMBE. The present building in the Kirchenfeld area was opened in 1934. Construction of a large extension and remodelling of the existing facilities started in 1993 and is planned to be completed in 2001. The NMBE is an institution of the *Burgergemeinde* Bern but receives about 25 % of its current annual budget from the state (Canton of Bern). The NMBE is institutionally affiliated with the University of Bern. The history of the museum was reviewed in detail by Huber (1982).

## 2.2. History of the earth science collections

The origins of the NMBE earth science collections can be traced back to 1694 when a collection of natural curiosities was installed at the City Library by Johann Rudolf Zeender. Unfortunately, this collection was lost. The oldest objects of the NMBE are three large quartz crystals found in 1719 at the Zinggenstock, Grimsel area, confiscated by the state of Bern as tax compensation and given to the City Library on February 15, 1721. These crystals are still on display today. The first important collection to be integrated was that of Gabriel Albrecht von Erlach (1739–1802) who had to sell his collection to the Helvetic Republic to pay war taxes. This collection was given to the City of Bern in 1803. The earth science collections expanded greatly in the years 1869–1887, mostly due to donations by a few individuals and their heirs: Friedrich Bürki-Marcuard (1819–1880), Edmund von Fellenberg (1838–1902) and Anton Gottlieb Simon (1780–1855). The history of the collections has been reviewed in detail by Stalder (1982 a,b). The curators naturally had a strong impact on the collections resulting from their respective fields of interest. The names of the curators, their terms of responsibility and their main fields of interest are listed in Table 1. A list of the most important collections which have been integrated is given in Table 2.

Table 1: Curators of the NMBE earth science collections

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Jakob Samuel Wyttenbach (1748–1830):	Took care of collection in the library's gallery, first president of the board of trustees
Daniel Rätzer (1770–1808):	First curator, 1802–1808, mineralogist
Bernhard Rudolf Studer (1794–1887):	Curator ± 1820–1870, professor of geology, University of Bern (Molasse basin, Alps, mapping)
Isidor Bachmann (1837–1884):	Curator 1871–1884, professor of geology, University of Bern
Richard Armin Baltzer (1842–1913):	Curator 1884–1889, professor of geology and mineralogy, University of Bern (Aar massiv, Quarternary)
Edmund von Fellenberg (1838–1902):	Curator 1889–1899, mining engineer (mineralogy, geology of the Aar massif)
Ernst Kissling (1865–1936):	Curator 1903–1907, geologist (Molasse basin)
Eduard Gerber (1876–1956):	Curator 1907–1956, geologist (Molasse basin, Quarternary, palaeontology)
Hans Adrian (1890–1979):	Curator 1956–1962, retired oil geologist (mineralogy, conservation of natural beauty)
Hans Anton Stalder (*1925):	Curator 1962–1990, first full-time curator (Alpine mineralogy, fluid inclusions)
Beda Anton Hofmann (*1960):	Curator since 1990 (mineralogy, geochemistry, biogeochemistry, meteoritics)

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Table 2: Important collections integrated in the NMBE earth science collections

Collector	Year of acquisition	Contents	Areal specialization	Remarks and references
Armstutz, Gerhard Christian (**1922)	1953-1996	ores, minerals	worldwide	typical ore samples from many deposits
Baltzer, Armin (1842-1913)	1969-1971	minerals	worldwide	
Bertossa, Antonio (1918-1996)	1848-1851	minerals	Rwanda	mainly pegmatite minerals
Brunner, Carl (1823-1914)	1869-1880	fossils	Prealps	
Bürk-Marquard, Friedrich (1819-1880)	1869-1880	minerals, fossils	Switzerland	
Chabaud, Alfred (1869-1940)	1912-1932	minerals, meteorites	Mexico	
Charpentier, J. F. W. von (1728-1805)	1803	minerals, rocks	Germany	part of the von Erlach collection, catalogue preserved
Ernskillen, Lord	1863/1870	plant fossils	England (Carboniferous)	
Erlach, Gabriel Albrecht von (1739-1802)	1803	minerals, rocks, ores	worldwide	first major stock of NMBE collections
Exchaquet, Charles François (1746-1792)		ores and rocks	French Alps	
Fellenberg, Edmund von (1838-1902)	1881	minerals	mainly Eastern Europe	main donation of >3000 minerals in 1881 assembled around 1777,
Funk, Johann Friedrich II (1745-1811)	1957	marble samples	Swiss Alps	Rutsch & Stalder (1970)
Gross, Guido		Alpine quartz	Swiss Alps	original catalogue preserved
Grossglauser, Hans (1902-1967)	1967	Alpine quartz	Swiss Alps	
Guthnick, Heinrich Josef (1800-1879)		minerals	worldwide	
Hugi, Emil (1873-1937)	1938	minerals	Kammegg, Oberhasli BE	
Kipfer, Alexander	1970-1987	Alpine minerals	Switzerland and worldwide	
Mösch, Casimir (1827-1898)	1896	fossils	Swiss Alps	
Mühlenthaler, Fritz (1884-1941)	1941	minerals	Switzerland and worldwide	
Ooster, Wilhelm Alexander (1816-1893)	1868	7000 fossils	Swiss Alps	original catalogue preserved
Quiquerez, Auguste (1801-1882)	1851	rocks and ores	Switzerland and worldwide	very important fossil collection (Pfister 1982)
Rothmayr, Willy Werner (1913-1990)	1992	minerals	Swiss Alps	Kürsteiner et al. (1990)
Rothpletz, Ingenieur	1925	minerals	Jura	
Schaeck, Theodore Charles André (1856-1911)		minerals	Simplon tunnel	
Simon, Anton Gottlieb (1790-1855)	1880-1920	minerals	Switzerland and worldwide	Stalder (1981)
Studer, Bernhard Rudolf (1794-1887)		rocks	Switzerland, mainly Alps	
Taddei, Carlo (1879-1969)	1926	minerals	Tessin, Switzerland	
Tscharnner, Franz Ludwig (1768-1805)	1983	minerals, ores	Europe	original catalogue (1784) preserved; Stalder (1984)
Vittoz, René	1960	gemstones	worldwide	
Wälti, Greti	1976-1996	Alpine minerals	Furka base tunnel	
Wattenwyl, Louis von	1928	minerals	worldwide	
Wenger, Otto Paul (1919-1981)	1991	minerals	worldwide	original catalogue preserved

After a slow development between 1900 and 1950, the mineralogical collections started to grow at a rapid rate of approximately 500 samples per year around 1956 when H. Adrian became responsible for the collections. This growth rate has stayed nearly constant since then. Further specialization is intended to slow down growth in the near future in order to conform to space limitations and to maintain a high scientific standard.

The oldest palaeontological objects date back to at least 1803, when D. Sprüngli gave his fossils collection to the museum. The collection grew through the collecting activities of the curator B. Studer and the donation by C. Brunner in the first half of the 19th century. Of outstanding importance is the extensive collection of the private scholar W.A. Ooster, donated in 1868, which mainly consists of fossils from the Swiss Alps. Collecting activities of the curators E. Gerber and T. Pfister (assistant curator of palaeontology) from 1907 to the present time have furnished well documented material, mainly from the Upper Marine Molasse (Burdigalian) of Switzerland.

### **2.3. Participation in the Lengenbach Syndicate**

The NMBE is a member of the Lengenbach syndicate (Arbeitsgemeinschaft Lengenbach, AGL) since its inception in 1958. Currently, three museum institutions (Basel, Bern, ETH Zurich), the municipality of Binn and two private partners are members of the AGL. Since 1958, the AGL exploits the famous Lengenbach sulphosalt deposit located in the Binntal, Valais, Southwestern Switzerland (Hofmann et al. 1993), which is known since the 18th century. Every summer about 100 m<sup>3</sup> of dolomite are quarried from which about 1000 mineral specimens are recovered. This locality has yielded some 25 new mineral species. The Lengenbach site is a highly unusual example of a metamorphosed carbonate-hosted sulphide deposit rich in As and Ti. Besides the presence of many rare mineral species, the Lengenbach deposit is one of the few sites worldwide where metamorphism generated a sulphide melt (Hofmann 1994, Hofmann & Knill 1996).

Details of the history of development of this site are given by Graeser (1965) and Stalder et al. (1969, 1978). The activity of the Lengenbach syndicate has resulted in important collections of Lengenbach minerals (at the NMBE as well as at the museums of Basel and ETH Zurich) and in a number of publications summarized in Stalder et al. (1969, 1978) and Hofmann et al. (1983). The NMBE Lengenbach collection contains both well crystallized minerals as well as typical ore specimens. There is also a large stock of Lengenbach minerals available for exchange or sale. – The future of the Lengenbach quarry is uncertain because technical problems limit further exploitation to a few years.

### **3. Documentation of NMBE earth science collections**

In the mineral, rock and ore collections, the samples are accompanied by different levels of documentation:

- Label: All samples are accompanied by a label containing basic information such as sample number, type of object, and locality.
- The systematic mineral collection, the meteorite collection and parts of the palaeontological collection are registered in chronologically arranged catalogues (Eingangskatalog). All samples in these catalogues are numbered, and a corresponding number is firmly attached to the specimen(s) to allow identification, even in case of major damage to the collection.
- Several of the smaller collections of rocks and some integrated private collections are accompanied by the original catalogues of the former owners.
- The systematic mineral collection and the meteorite collection are registered in alphabetically arranged file card catalogues.
- For many samples and for some entire collections, additional analytical, historical or other information is stored in the archives.
- A computer-based inventory (Oracle database) of the systematic mineral collection was started in 1993 and completed in spring 1996. Computer-inventorying of the palaeontological, petrographic and ore collections began in 1995. Eventually, all collections should be computerized, allowing searches for objects according to any combination of criteria.

For every specimen, information to be included in the database comprises: Name (of mineral, fossil, ore, rock, meteorite); curatorial remarks (such as radioactive, oxidizing, poisonous); remarks about the object; locality of find; coordinates; date of find; finder; geological context; age; source; date of acquisition; mode of acquisition; price; value; weight; analytical results; references; historical remarks; references to photographs and other archival information. This list may serve as a guide to all those who plan to donate or sell material to our museum.

The NMBE archive contains important documents related to the collections. Among the documents kept are: Journals of curators from 1878 to 1960 (with some years missing); original catalogues and files of integrated collections; correspondence concerning the acquisition of samples; information about donors and suppliers; an archive of photographs. One of the most important objects among the archival materials is a detailed plan, dated 1801, of the lead-silver mines 'Gnadensonne' and 'Gute Hoffnung' near Trachselauenen, Bernese Oberland.

Several descriptions and reviews of the NMBE earth science collections have previously been published in German: Rollier (1892, 1893), von Fellenberg & Rollier (1894), Gerber (1935), Stalder (1982 a,b), Pfister (1982).

## **4. Description of NMBE earth science collections**

### **4.1. Main mineral collection (approx. 30 000 numbers)**

Key words (alphabetical order): adularia, Alps, amethyst, Be-silicates, Binntal, crichtonite-group minerals, diamond, epidote, fissure minerals, fluorite, Germany, gold, Gotthard, Grimsel, hematite, Lengenbach, Mexico, quartz, smoky quartz, REE-minerals, Rwanda, Saxony, scheelite, sulphosalts, Switzerland, Ti-oxides, titanite.



Fig. 1: Main mineral collection, B8624: Quartz, the most characteristic mineral from alpinotype fissures, with inclusions of the sulphosalt zinckenite. Felsberger Calanda, Grisons, Switzerland. Height of crystal 15 mm. Photograph: H. Mühlethaler.

The mineral collection forms the main body of the earth science collections. It contains several sub-collections and is currently the best documented part; its systematic part is fully computer-inventarized. Besides a systematically organized main part this collection comprises the Lengenbach collection with approximately 3000 specimens (or 10 % of the main collection). The most strongly represented fields are Swiss Alpine minerals, minerals from the Lengenbach quarry, and other Swiss localities. Large quartz crystals from the major finds in the Swiss Alps belong to the most important objects: Vorderer Zinggenstock (found 1719), Tiefengletscher (1868), Gerstengletscher (1948), Rhonegletscher (1969), Gerstenegg (1974; see Stalder 1986, 1987), Hinterer Zinggenstock (1970–1995). Quartz is by far the most strongly represented Alpine mineral (fig. 1), followed by adularia, carbonates, fluorite, Ti-oxides, REE-minerals, Be-

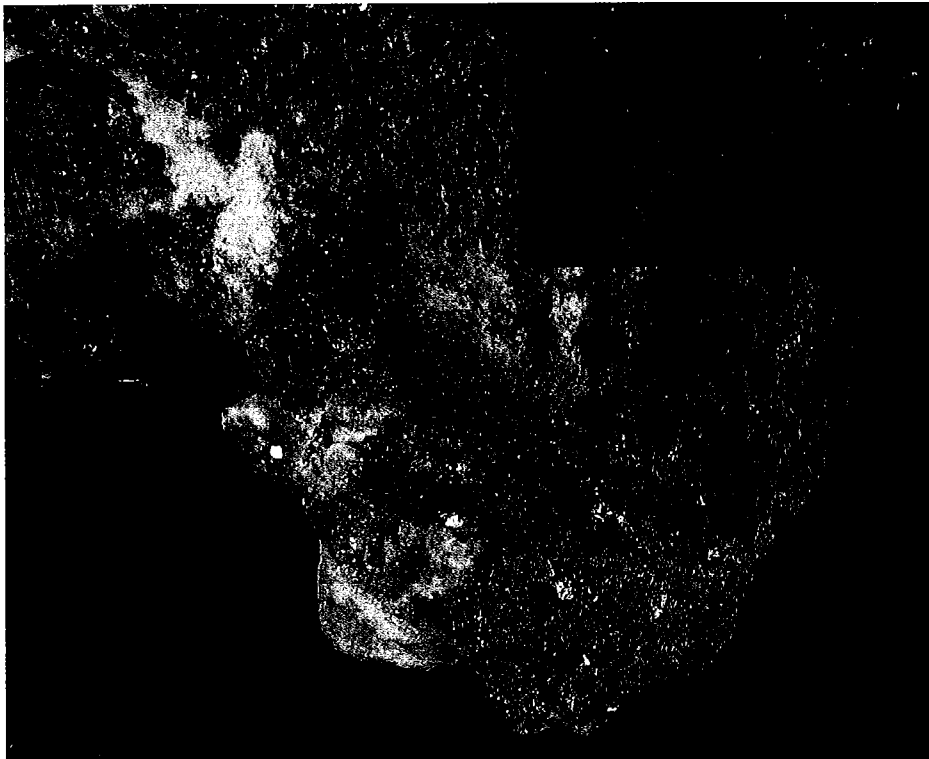


Fig. 2: Lengenbach collection, B6281: Realgar (red), orpiment (yellow) and baumhauerite (metallic) in direct contact with quartz. This typical ore sample from the Lengenbach quarry contains remnants of sulphide melt inclusions (inset), allowing a new interpretation of the genesis of the deposit (compare 2.3.). Field of view 5 x 8 cm (inset 0.5 x 0.5 mm). Photograph: P. Vollweider.

silicates and zeolites. The systematic collection contains all major and most rare minerals ever found in Swiss Alpine fissures. Among the rare Alpine minerals are exceptionally large crystals of scheelite (932 g), phenakite (4.5 cm), milarite (4 cm), lengenbachite (3.5 cm), kainosite (2 cm), crichtonite (1.3 cm).

The Lengenbach mineral and ore collection consists of specimens that were acquired by the museum primarily as a result of its participation in the Lengenbach Syndicate since 1958. Only relatively few older specimens are kept, most notably the largest realgar ever found in the Lengenbach, a 6 cm, 95.6 g single crystal recovered in 1945. The Lengenbach collection also includes typical ore samples with key features related to the genesis of the deposit, such as remnants of a metamorphogenic sulphide melt (fig. 2; Hofmann 1994).

Table 3: Type mineral specimens in the NMBE collections

Mineral	Inv. No	
IMA-recognized minerals:		
Cervandonite-(Ce)	B 3952, B 4695, B 4880	cotypes
Hennomartinite	B 5564	holotype
Imhofite	B 8868	holotype
Kornite	B 5564	holotype
Nchwangingite	B 8735	holotype
Nowackiite	B 2831	holotype
Preiswerkite	B 2548	holotype
Simonite	B 2920	holotype
Sinnerite	B 8869	holotype
Tuzlaite	B 8361	holotype
Wallisite	B 8870	holotype
Incompletely described mineral:		
Rathite-IV	1050	

Other strongly represented countries in terms of sample density are Germany (Harz Mts., Erzgebirge), the Czech Republic, Italy, Austria, Rwanda, Slovakia, Great Britain, Rumania, France, Norway, Sweden, Mexico and Algeria. The systematic collection further holds about 1000 gemstones and the type mineral specimens of 11 minerals (Tab. 3). A preliminary list of the number of localities and mineral species per country represented in the systematic collection is given in Table 4.

Subcollections, comprising mainly minerals and hydrothermally altered rocks contain samples from several important Alpine tunnel constructions:

- Gotthard highway tunnel (16.3 km, constructed 1969–1980)
- Furka railway tunnel (15.4 km, constructed 1973–1982)
- Lötschberg exploration tunnel (construction started in 1994)

#### 4.2. Meteorite collection including impact products (approximately 500 specimens)

Key words (alphabetical order): historic documents, impact ejecta, meteorites, polished sections, Rafrüti, Switzerland, thin sections, Twannberg, Ulmiz, Utzenstorf

Although the meteorite collection is relatively small (311 samples from 133 meteorites), it contains typical specimens from all major classes. The most important objects are the main masses of the Swiss meteorites Rafrüti (17.0 kg, recognized as meteorite in 1900, IRANOM, fine-grained, 9.32 % Ni; von Fellenberg 1900) and Utzenstorf (3.4 kg, H5 chondrite, date of fall 16. 8. 1928; Bevan and Easton 1977) and one of the largest samples of Ulmiz, Switzerland (26 g, H5 chondrite, date of fall 25. 12. 1926). Included in the meteorite collection is a set of thin sections (partly polished) of most major meteorite classes suitable for educational purposes and research. A serious loss to the meteorite collec-

Table 4: Regional specialization of the systematic mineral collection

	Samples	Localities	Species	Samples/ 1000 km <sup>2</sup>
Switzerland	12572	2232	427	304.46
Germany	2683	686	466	7.52
Czech Republic	465	150	159	5.90
Italy	1627	433	336	5.40
Austria	444	167	147	5.29
Rwanda	117	38	48	4.44
Slovakia	178	30	58	3.63
Great Britain	399	139	124	1.63
Rumania	295	56	86	1.24
France	559	270	224	1.01
Norway	283	111	129	0.87
Sweden	244	73	167	0.55
Mexico	762	232	165	0.39
Chile	131	29	61	0.29
Spain	122	63	53	0.24
Japan	68	55	58	0.22
Namibia	168	33	74	0.20
Poland	62	31	39	0.20
USA	1654	867	716	0.18
South Africa	183	71	98	0.15
Madagascar	84	30	44	0.14
Greenland	215	46	94	0.10
Bolivia	94	32	42	0.09
Peru	96	28	54	0.07
India	147	30	36	0.04
Brazil	364	87	91	0.04
Zaire	95	31	70	0.04
Canada	360	158	221	0.04
Australia	190	90	136	0.02
Russia	341	119	205	0.02

tion occurred when the Walkringen meteorite (date of fall 18 May 1698) was lost between 1710 and 1800 (Eugster & Hügi 1982). Historic documents related to the acquisition of the Rafrüti and Utzenstorf meteorites are kept in the archives.

The tektite collection includes 153 samples from 9 major strewn fields. The collection of meteorite impact products includes ejecta (mostly Upper Jurassic limestone blocks, shocked quartz grains) found in Miocene fluvioterrestrial marls near St. Gallen in Eastern Switzerland. These ejecta are most probably derived from the Ries Crater in Germany (age 14 million years). Included are samples of the Cretaceous/Tertiary boundary from Starkville, Colorado and Martisgraben, Switzerland. A catalogue including both meteorites and tektites is available upon request.

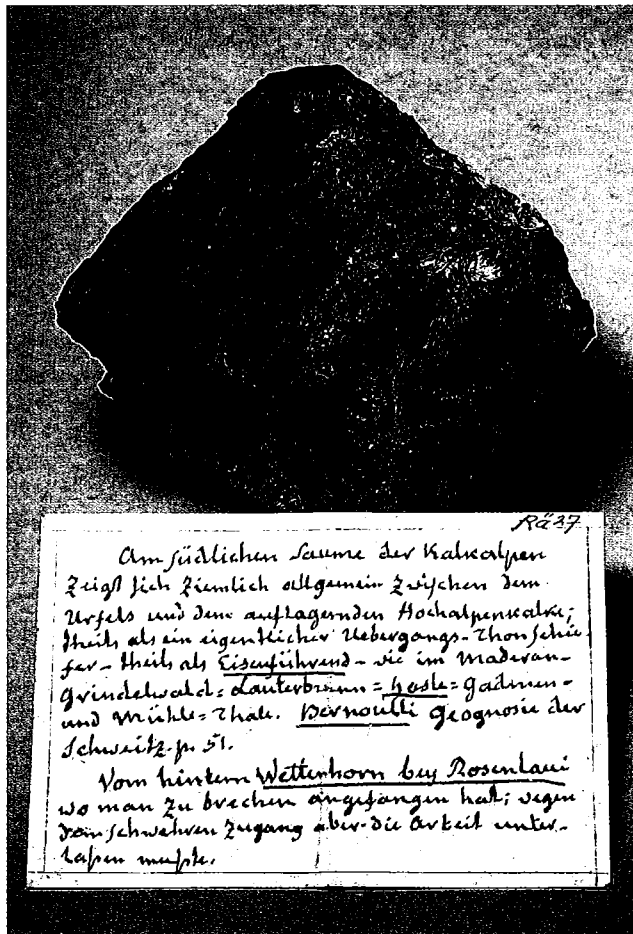


Fig. 3: Collection of Swiss ores: Historic specimen of hematite (iron ore) from the Wetterhorn, Grindelwald area. Label (early 19th century) written by Daniel Rätzer on the back of a playing-card (card size: 5.6 x 9.0 cm). Photograph: P. Vollenweider.

#### 4.3. Collection of ores and mineralized rocks ( $\pm$ 5000 specimens)

Key words (alphabetical order): Amstutz, Bohnerz, Chabaud, Fellenberg, Freiberg, iron ore, Mexico, MVT, ore, pisolithic iron ore, Quiquerez, redox, reduction spots, Saxony, SEDEX, Switzerland, USA

A collection of Swiss ores contains samples from mines and prospects. Well represented areas and mines are: Eocene siderolithic Fe ores (pisolitic Fe ore, Bohnerz) from the Jura Mountains, the Bernese Alps (fig. 3), the Alps of Valais. The pisolithic iron ore deposits of the Delsberg Basin (Jura) are particularly well documented in the collection of A. Quiquerez, comprising rocks and ores and two hand-coloured profiles (Kürsteiner et al. 1990).

A collection of ores from worldwide deposits predominantly consists of didactic

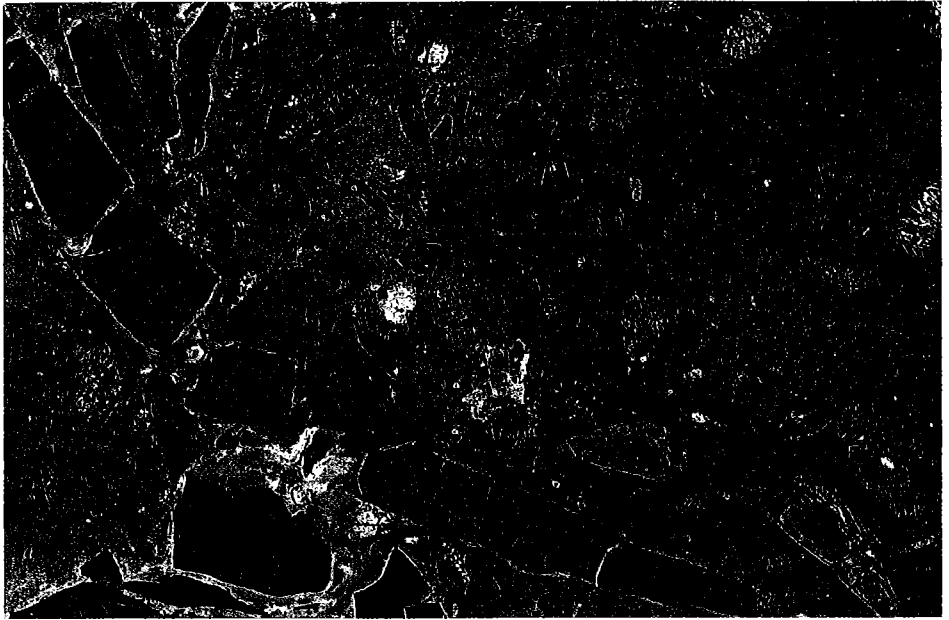


Fig. 4: Collection of diamond-related materials, B9397: Mica-rich kimberlite (orangeite) with xenolith containing Cr-diopside. Dan Carl Mine, Bellsbank field, Northern Cape, South Africa. Field of view 4.7 x 7 cm. Photograph: P. Vollenweider.

samples from many major ore districts (mainly sediment-hosted ores such as SEDEX, MVT, Kuroko type). Important contributions to the ore collection have been made by E. von Fellenberg (1881, Freiberg, Saxony), A. Chabaud (1911 to 1933, Mexico) and by G.C. Amstutz (1953 to 1996).

Small-scale redox-related mineralizations (approx. 200 samples), especially so-called reduction spots (Hofmann 1990, 1991), are also integrated in this collection.

#### **4.4. Petrographic collections (approximately 10 000 specimens)**

Key words (alphabetical order): Alpine tunnels, coal, erratic boulders, hydrothermal alteration, kimberlite, mantle xenoliths, Switzerland

The petrographic collections are either regionally organized, or they represent specialized research collections. The most important collections are:

- Diamond-related rocks (kimberlites, mantle xenoliths, high pressure metamorphics). This is the only petrographic collection currently being enlarged. Samples are mainly from South Africa (fig. 4) and Colorado.
- Hydrothermally altered rocks from Alpine fissures
- Swiss rocks (partly organized regionally, partly according to rock name)
- Swiss coals

- Systematic collection of rocks (worldwide)
- Regional rock collections from worldwide areas
- Collection of glaciologic objects from Switzerland, mainly samples from protected and other erratic boulders. The protected glacial boulders in the Canton of Bern are summarized in Schmalz (1987 b), with reference to samples at the NMBE.
- ‘Geological phenomena’ (e.g. corrosion by water and wind, concretions, etc.)
- Rocks from the Simplon railway tunnel
- Rocks from the Lötschberg railway tunnel
- Rocks from the Lötschberg exploration tunnel (under construction)

#### **4.5. Intact historic collections**

Key words: Historic collections, Switzerland, France, Tscharner, Exchaquet, Funk

Many collections were integrated into the main collections after acquisition, but a few historic collections remain intact, most notably that of F.L. Tscharner (catalogue dated 1784, described by Stalder 1984). This collection of about 500 samples notably contains ores from now abandoned mines. A summary of the integrated historic collections is given in Table 2.

An unusual historic petrographic collection is that of Johann Friedrich Funk II (1745–1811), consisting of rectangular slabs (typically 7.6 x 6.5 x 1 cm), one side polished, representative of the marbles used in the Funk furniture manufacture in Bern during the late 18th century (Rutsch & Stalder 1970).

#### **4.6. Palaeontological collections**

Key words: Switzerland, Italy, Alps, Mesozoic, Tertiary, Molasse, Belpberg, Jura Mts.

The palaeontological collections are specialized in the following fields:

Regional and thematic collections (mainly invertebrates):

- Swiss Molasse Basin with emphasis on the Burdigalian (Upper Marine Molasse) of the Bern area, especially the Belpberg (10 km SE of Bern)
- Swiss Jura Mts: Mesozoic
- Swiss Alps: Carboniferous to Tertiary. Very important collections from an area not belonging to the classic fossiliferous regions.
- Oligocene corals from southern Europe

Systematic collections:

- Echinoderms from the Jurassic of the Swiss Jura Mts.
- Teeth of Chondrichthyes from the Molasse
- Plants (mainly Cenozoic and Carboniferous), from various countries

The palaeontological collections comprise about 1700 drawers and many single oversized objects. Among the most important objects are:

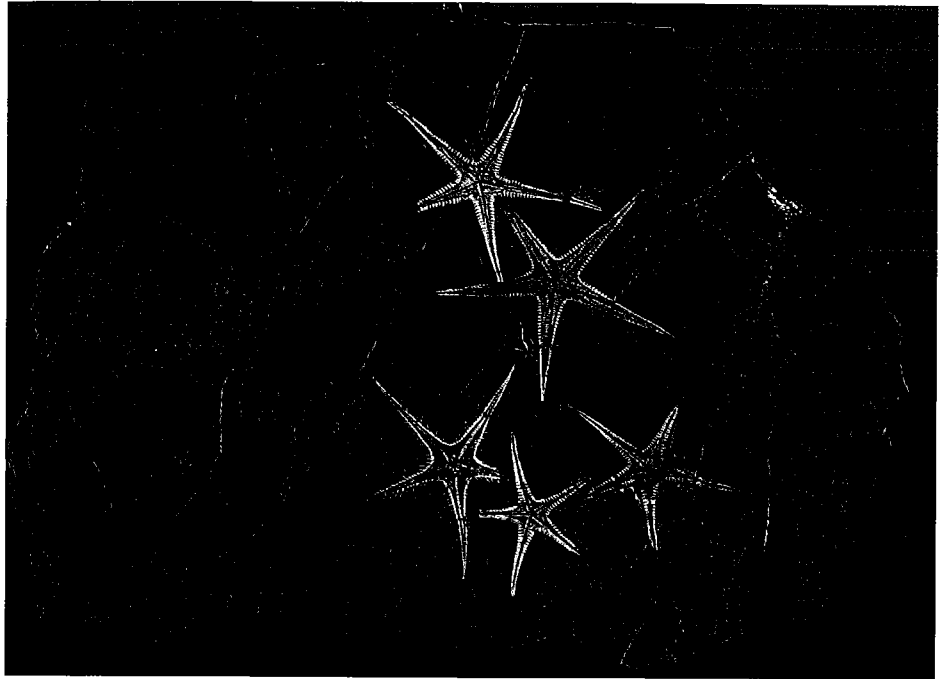


Fig. 5: Collection of Swiss fossils: Starfish (*Pentasteria longispina* Hess) from the Upper Jurassic of the Weissenstein, Solothurn. 60 x 73 cm. Photograph: P. Vollenweider.

- An ichthyosaur (*Stenopterygius longifrons*) from the Liassic of Teysachaux, Canton Fribourg, Switzerland
- The lower jaw of a dinotherium (*Dinotherium bavaricum*) from the Miocene of the Delsberg Basin, Canton Jura, Switzerland. This specimen is radioactive due to uranium accumulation from groundwater during diagenesis
- The skull of a rhinoceros (*Aceratherium gannatense*) from the Aquitanian of the City of Bern
- A skeleton of a giant deer (*Megaloceras giganteus*) from the Quarternary of Ireland
- A slab with 5 starfish (*Pentasteria longispina*) from the Upper Jurassic of the Weissenstein, Canton Solothurn, Switzerland (fig. 5)
- A slab (2 m maximum dimension) densely covered with bivalves, snails, ammonites and belemnites, from the Lower Dogger of Sissach, Canton Basel-land, Switzerland

A list of publications containing figured palaeontological specimens of the NMBE is available via Internet at [http://nmbe0.unibe.ch/abtew/pal\\_figured\\_spec.html](http://nmbe0.unibe.ch/abtew/pal_figured_spec.html), or as a hardcopy upon request.

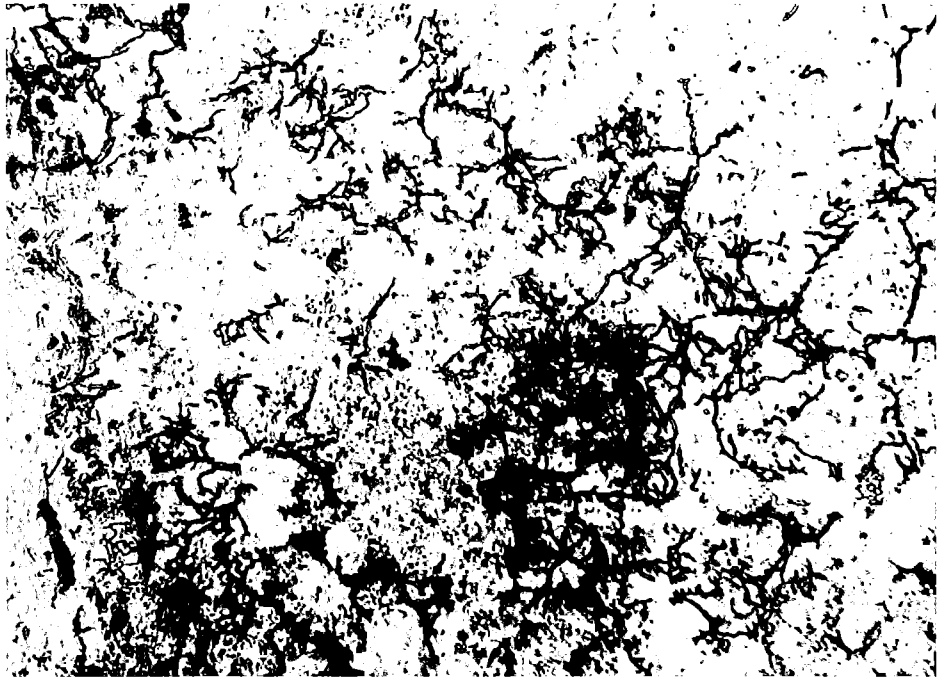


Fig. 6: Collection of microbial fossils and structures: Uraninite-mineralized microbial fossils (?) in quartz, Krunkelbach Mine, Schwarzwald, Southern Germany. Photomicrograph, plane polarized light, field of view 0.25 x 0.36 mm. Photograph: B. Hofmann.

#### 4.7. External objects belonging to the NMBE

Key words: Erratic boulders, Luegibodenblock, museum garden

22 erratic boulders and other large blocks of rock, still residing at their original locations, have been donated to the NMBE, a measure taken in order to protect the blocks from quarrying in the last century. A list of 21 of these objects is given by Schmalz (1987 a). The most notable example is the Luegibodenblock near Habkern (Swiss coordinate system 633.100/174.440; 46°43'15"N 7°52'20"E), an exotic granite block from the Tertiary Wildflysch formation measuring about 31 x 28 x 14 m (estimated weight: 12 000 tons). This rock was acquired by the museum for 980 Swiss francs in 1869. A piece of the Luegibodenblock-granite of 1 x 1 x 0.25 m was donated by the Swiss Confederation to the United States of America for integration into the Washington Monument in 1852. This block is now located in the staircase at about half height of the monument (after Schmalz 1986). Several erratic boulders have been moved from their original location to the garden of the NMBE. An unpublished guide of the museum garden objects is available upon request (Stalder et al. 1990).

#### 4.8. Curiosities

Key words: Pseudofossil, fake iron rose, anhydrite altar

A number of objects integrated during the growth of the collections have gained in importance because of their historical significance while their scientific value may now be negligible. These 'curiosities' include:

- 'Stamm im Gneisse von Guttannen': In 1886, a tree-trunk-like object was found in the crystalline gneiss near Guttannen in the Grimsel area. After a fervent scientific dispute (von Fellenberg 1886, Baltzer 1888, Bonney 1892), it was finally concluded that the object is of inorganic origin (von Fellenberg & Schmidt 1899). The main part of the object, 1.20 m long, is located in the museum garden, and several smaller segments are kept in the petrographic collection.
- 'Fake iron rose': An iron rose (Eisenrose, a form of hematite) of 9 cm diameter, supposedly from the Ritterpass area, Binntal, Swiss/Italian Alps. For a long time considered to be the most beautiful Alpine example, it was recently recognized as a fake (Hofmann & Stalder 1992). The object is property of the Institute of Mineralogy and Petrology, University of Bern.
- 'Anhydrite altar': During construction of the Simplon railway tunnel, a classic find of anhydrite crystals was made in Alpine fissures. Over 100 of these crystals, <1 to >5 cm in size, were assembled to form an altar-like object by engineer Riva.

#### 5. Collection strategy and main areas of interest

The earth science collections of the NMBE are both regionally and thematically specialized. As a result of ongoing developments in the field of information transfer, specialization will become increasingly important in order to maintain a high scientific standard of earth science collections. The main fields of future specialization of the NMBE earth science collections are:

- Minerals and ores from Switzerland (with emphasis on unusual Alpine fissure minerals, rare Swiss minerals, unusual localities, important finds)
- Didactic ore samples from world class mineral deposits
- Fossils from Switzerland with emphasis on localities in the Canton of Bern and the Alps
- Microbial fossils from subsurface and hydrothermal environments (fig. 6)
- Diamonds and diamond-related rocks, especially mantle xenoliths

#### 6. Access to the collections and sample requests

Access to collections is granted free of charge for scientific and educational purposes. Commercial applications are charged according to the size of the project and the amount of work by museum staff. Sample requests should be submit-

ted by letter, fax or e-mail, together with a short description of the intended use. Samples must be returned after use unless otherwise agreed. Samples remain property of the NMBE and must be referred to in publications by the prefix 'NMBE' followed by the sample number (e.g. NMBE A2578).

A list of key words relating to materials particularly well represented in the NMBE collections is given under 4.1. to 4.8. Detailed information about single specimens or collections can be obtained upon request.

## **7. Information about NMBE earth science collections on the Internet**

Information about the NMBE is available from the Internet at <http://www-nmbe.unibe.ch/>. Under 'earth science collections', in addition to the information contained in this paper, updates about the following areas of interest are available:

- NMBE want list (current areas of acquisition interest)
- current exhibition projects
- current research interests
- recent major acquisitions
- recent publications from the Earth Science Department
- recent publications about samples in the NMBE collections
- list of type specimens (minerals, fossils) and other unique objects kept at NMBE
- Earth Science Department staff list with respective fields of interest and e-mail addresses

It is planned to provide experimental access to on-line-search catalogues for minerals and meteorites in the near future.

## **8. Zusammenfassung**

Die erdwissenschaftlichen Sammlungen des Naturhistorischen Museums Bern (NMBE) werden übersichtsartig beschrieben, um den Zugang für Wissenschaft und Lehre zu verbessern. Die wichtigsten Sammlungsteile sind die Mineraliensammlung mit einem hohen Anteil an Schweizer Mineralien und Erzen (u. a. aus alpinen Zerrklüften und der Grube Lenggenbach/Waldis), die Sammlung von Schweizer Fossilien (Jura, Mittelland, Alpen) und die Sammlung fossiler Korallen. Die zu den Sammlungen vorhandenen Informationen sowie relevante Dienstleistungen werden beschrieben. Detailliertere Informationen über integrierte Sammlungen und frühere Konservatoren werden gegeben. Die gegenwärtige Sammlungsstrategie und die Forschungsschwerpunkte werden kurz beschrieben. Im Literaturverzeichnis sind alle Arbeiten zusammengefasst, welche weitergehende Informationen über die Sammlungen enthalten.

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