

with the North Atlantic was established by seafloor spreading between Spitsbergen and Greenland leading to development of normal marine salinity conditions in Arctic Ocean waters. This turnover is signaled by occurrence of calcareous foraminiferal assemblages of western European affinities in the Oligocene of the Forlandsundet Graben.

Palaeontological collections at the Natural History Museum, University of Oslo.

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The Natural History Museum, University of Oslo, has large and scientifically important collections of geological and palaeontological material. The largest proportion is of Norwegian origin, but some significant non-Norwegian collections (e.g. material from the Fram II expedition to the Canadian Arctic, and the 1921 Novaya Zemlya collection) have recently attracted much attention.

The palaeontological collections of the University of Oslo, were originally established long before the University Paleontologisk Museum (PMO) came into being in the 1920's and prior to the reorganisation of the University of Oslo museums in 1999. The collections are constantly being supplemented with new material and presently comprise approximately 1.7 million fossils and sedimentary rock samples. Of highest scientific value is the "Collection of types and illustrated fossils". This collection contains material used in the naming of new species (types) as well as other specimens illustrated and/or mentioned in scientific publications. The collection is curated according to international rules (e.g. The International Code of Zoological Nomenclature).

In 1984 work began to register the collections using the computer. Use of non-professional labour to aid data entry has been partly financed by government employment programs. Supervision and information validation by scientific staff have ensured the quality of the resulting database. The combined scientific and non-professional labour has proved useful in a situation where the universities cannot finance sufficient scientific positions.

The palaeontological databases are public accessible (mainly text based, but partly also with images and PDFs): <http://bryozo.uio.no/types/default.htm>.

Because a large proportion of fossil material comes from the Palaeozoic rocks of the Oslo Region, an effort in producing a data base of the official lithostratigraphy was started in 2004. Relevant publications defining lithostratigraphic units have been scanned and most units are hierarchically retrievable from the site "Oslo Region Lithostratigraphy":

<http://www.nhm.uio.no/forskning-samlinger/>

[databaser/geologi/oslo_litostrat/](http://www.nhm.uio.no/databaser/geologi/oslo_litostrat/).

Catalogues (printed versions) have been made based on aggregated data from the databases: Jurassic-Cretaceous material from Andøya (Vesterålen), Novaya Zemlya (Russia), Estonian and Russian Ordovician trilobites, Cenozoic vertebrate material from Uruguay, and Norwegian mammoths.

The electronic collections, databases and catalogues are accessible from:

<http://www.nhm.uio.no/forskning-samlinger/databaser/paleontologi/>

Value increase of old museum collections: The Novaya Zemlya collection at the Natural History Museum (Oslo) as an example

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Large collections of natural history specimens are housed in the Natural History Museum, University of Oslo. To make these more accessible to users, the collections are being computerized for subsequent Internet access. Information on the web has acted as good PR for many of the collections of geological and paleontological material and has led to an increase of loans to external users.

One particular collection, *The Holtedahl collection of material from Novaya Zemlya* has attracted special attention. In 1921, Professor Olaf Holtedahl (University of Oslo), led a scientific expedition to Novaya Zemlya, Arctic Russia. A wealth of important scientific information was collected during the 10 week long expedition, and 40 scientific reports ("Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya 1921", Vols. 1-40) and numerous smaller reports followed. The geological reports have been scanned and are available as PDFs.

Rich collections of paleontological material are available from this expedition, including Cambrian trilobites and brachiopods, Devonian corals and early fish, Carboniferous brachiopods and corals, numerous Permo-Carboniferous brachiopods, bryozoans, corals and fusulinids, and Jurassic/Cretaceous ammonites, belemnites and bivalves. Devonian agglomerates, black carbonates and sandstones, Permo-Carboniferous carbonates and shales, as well as magmatic rocks are well represented in the collection.

The catalogue initially prepared in 1989 by the Natural History Museum, lists 290 type and figured specimens of fossils, as well as 2856 reference specimens, 323 specimens of volcanic and metamorphic rocks and 385 sedimentary samples. Since then the data has been re-coded for database use, and retrievable ver-

sions both for FileMaker and MySQL have been tested on the web.

Renewed interest has led to re-identification of many samples and their stratigraphic position. Large data sets have been selected for biostratigraphic studies including Carboniferous and Permian fusulinids, many previously unknown from Novaya Zemlya, inorganic and organic geochemistry. Several reports have been prepared. One ongoing sub-project is to prepare an atlas of thin sections of specimens from selected areas and stratigraphic levels.

Currently the data is available only to sponsors of the project, but it is intended to make results known to the public in the near future.

Hydrocarbon seeps from the uppermost Jurassic, Western Spitsbergen, Svalbard

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Carbonate mounds, interpreted as being the result of hydrocarbon (or cold) seepage, outcrop in the Upper Jurassic dark silt- to paper-shale succession of the Agardhfjellet Formation, Slottsmøya Member, Knorringsfjellet area, Spitsbergen, Svalbard. Four mounds were mapped during field work in 2008, the largest being 3-4 m high and 7 m wide. Field work in the Knorringsfjellet and Janusfjellet area in 2009 revealed 10 more mounds. Analyzed samples from these mounds include zoned (botryoidal) carbonate of varying yellow to brown colour, fissure-infilling sparite, and various fossil shell material.

The macrofauna consists mainly of small to medium sized bivalves (<10 mm, up to 70 mm wide), rare brachiopods as well as worm tubes. Bivalves include at least eight species, including the largest known *Nucinella*, *Oxytoma* (or *Meleagrinnella*), *Pseudolimea*, a solemyid, a lucinid and possible arcticids and 'thyasirids'. Large accumulations of the bivalve genus *Buchia* are present in all mounds as well as in the dark surrounding shale. Gastropods, usually only preserved as internal moulds, are not common, but a species of *Amberleya* has tentatively been identified. Brachiopods are represented by probably three terebratulid species, two rhynchonellid species, as well as more common lingulids. Vestimentiferan as well as serpulid

worm tubes are also present. A rich microfauna consisting of uncompact agglutinated foraminiferan specimens of *Recurviodes scherkalyensis*, *Evolutinella schleiferi* and *Ammobaculites cf. gerkei* has been retrieved from dissolved carbonate samples. Calcareous foraminiferans and radiolarians have also been observed in several thin sections. Embedded ammonites and large (up to 40 x 1500 mm) wood pieces are considered to be from surface waters and not related to hydrocarbon seepage.

Stable isotope analyses show highly negative $\delta^{13}\text{C}$ values ($\sim -43\text{‰}$ VPDB) in the zoned carbonate whereas the sparite, ammonite and bivalve samples have $\delta^{13}\text{C} \sim -22\text{‰}$. The ^{13}C depletions indicate a methanogenic carbonate origin, in the range typical of thermogenic, rather than biogenic ($< -60\text{‰}$ PDB) methane. The ammonite and bivalve shells would originally have had normal-marine isotopic compositions. Their observed negative $\delta^{13}\text{C}$ values can be explained by recrystallization with introduction of light carbon from the authigenic carbonate. Large depletion of ^{13}O in the sparite, ammonite and bivalve material ($\delta^{13}\text{O} \sim -18\text{‰}$) indicates precipitation and recrystallization involving hydrothermal fluids, either synsedimentary, or in connection with sill emplacements in the Cretaceous. The isotope data from the carbonates will be compared with data from surrounding shale samples from where organic carbon isotope logs have been made.

The palaeoclimatic significance of archaeological finds exposed at retreating ice patches in Jotunheimen, Norway

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After 2000, retreating ice patches in Jotunheimen have exposed unique prehistoric remains related to reindeer hunting. The reindeer have in past, as at present, stayed on snow patches during warm days in the summer in order to avoid insects. Extensive reindeer hunting has taken place on and at such ice patches. Numerous objects related to this hunting activity, such as arrows, scaring sticks, and stone shelters ('bogestille'), have been detected at the retreating ice patches. The oldest and most spectacular find so far is a leather shoe (size 38) dated to ca. 3400 cal. yr BP. In 2007-2009, detailed multidisciplinary investigations were carried out at Gjuvfonni (near Galdhøpiggen) at an elevation of ca. 1850 m. Scaring sticks there date to AD 380-580 and AD 760-970. The age of the archaeological finds will be discussed in the context of late Holocene climate variations and glacier fluctuations.