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Spitsbergen – Svalbard

A complete guide around the arctic archipelago

Nature and history,
Places and regions,
Useful and important information

By Rolf Stange

Geological glossary & literature

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Norwegian glossary

The definite article, that is at the end of a Norwegian noun, is in parentheses. Pl. = plural.

Boge(n) = open bay
Bre(en), Pl. Breane = glacier
Bukt(a) = bay
By(en) = town
Dal(en) = valley
Egg(ane) = sharp mountain ridge
Elv(a) = river
Fjell(et), Pl. Fjella = mountain
Fjord(en) = fjord
Fly(a) = plain
Fonn(a) = snow field, glacier, ice cap
Gruve(gruva) = mine
Halvøy(a) = peninsula
Hamn(a) = natural harbour
Holme(n), Pl. Holmane = small islet
Huk(en) = headland
Hytte (hytta) = hut
Jøkul(en) = glacier, ice cap
Kam(men) = ridge
Kapp(et) = cape, headland
Sjø(en) = lake
Slette(sletta) = plain
Sund(et) = sound, strait
Tind(en) = mountain peak
Vatn(et), Pl. Vatna = lake

Geological glossary

Ammonite: Extinct group of marine cephalopods (molluscs) with shells that often resemble rams' horns. Ammon was an ancient Egyptian god with a ram's head. Silurian to Cretaceous.
Anhydrite: see EVAPORITE.
Basalt: dark-coloured volcanic rock derived from molten magma with a low silica content. When cooled at depth below the surface of the earth's crust, forming larger crystals, it is called **gabbro**. **Dolerite** is a sub-volcanic variation of basaltic rocks, which means that it cooled below the surface, but not at great depth, resulting in medium-sized crystals. **Hyperite** is occasionally used synonymously with dolerite.
Basement: In Svalbard, the geological basement comprises all rocks that are older than or contemporary with the Caledonian orogeny during the Silurian. The basement is very inhomogenous in terms of rock types and ages. There are at least three different

basement provinces in Svalbard: a belt of metamorphic rocks along the west coast of Spitsbergen, typically phyllite and schist; a zone of metamorphic and magmatic rocks in northern Spitsbergen and northeastern Svalbard; and thirdly, weakly metamorphosed sediments around the northern Hinlopenstretet. All basement rocks have generally been deformed by tectonic movements to a higher degree than the SEDIMENTARY COVER ROCKS that were deposited after the Caledonian orogeny.

Beach ridge: Ridge of sand and gravel above the high tide line, thrown up by waves during heavy storms. In the case of land uplift or a fall in sea level, a beach ridge is left further from the sea and becomes inactive or "fossil". Also called raised beach.

Belemnite: Extinct group of marine cephalopods (molluscs) that were very similar to today's squid. Mostly, only a part of the skeleton that resembles a bullet is preserved. Devonian to Cretaceous.

Brachiopod: Marine invertebrate that resembles bivalves, although they are biologically markedly distinct. Cambrian to recent. Brachiopods are common in Carboniferous and Permian sediments in Spitsbergen.

Breccia: Coarse-grained sediment with large, sharp-edged clasts (rock fragments) that indicate shorter transportation distances (longer movement in flowing water produces rounded edges). The pores are filled with sand and mud.

Carbonate: Carbonate-bearing rock, for example limestone, dolostone.

Cleavage: Parallel orientation of planar minerals, often resulting in the tendency of a rock to split into very thin slices. Typical characteristic of metamorphic rocks such as SCHIST and, PHYLLITE.

Conglomerate: sediment deposited in fast-flowing water, consisting of rounded pebbles and a fine-grained matrix.

Deformation: Combined FOLDing and FAULTing.

Diabas: See BASALT.

Doline: Funnel-shaped holes in the ground after the collapse of caves in water-soluble rocks (CARBONATES, EVAPORITES).

Dolostone: A CARBONATE rock, also called dolomite, but dolostone is more convenient to prevent confusion with the mineral dolomite. Dolostone is chemically similar to limestone. Dolostones comes into being either directly as a sediment or through later chemical changes of LIMESTONE.

Dyke: INTRUSION of magma in a steep or vertical attitude.

Evaporite: Chemical sediment left after the evaporation of large volumes of water, for example GYPSUM, ANHYDRITE and halite (salt).

Fault: Large fracture cutting through rocks, caused by tectonic activity.

Fault zone: Area with a series of more or less parallel faults.

Fjord: Glacial valley submerged by the sea. A classical fjord is surounded by steep slopes and is quite deep, but often has a shallower ridge near the entrance area. Strictly speaking, a fjord should have only one entrance.

Gabbro: See BASALT.

Geomorphology: A branch of earth sciences that describes and explains surface

landforms.

Graben: Tectonic structure where a crustal block subsides along two bounding faults, causing deposition of large volumes of sediments. An important example in Spitsbergen is the Devonian Andrée Land Graben; a recent example is the Upper Rhine Valley in southeastern Germany.

Granite: See MAGMATITE.

Grenville-event: Important tectonic phase (OROGENY), approximately 950 to 1,300 million years ago. Evidence for this event is found mostly in the form of radiometric ages of crystalline BASEMENT rocks in northern Spitsbergen and elsewhere. During the Grenville-event, landmasses collided to form a "supercontinent" called Rodinia. About 800 million years ago Rodinia broke into several pieces, long before the creation of the next (and so far youngest) supercontinent Pangea (300-150 million years ago) and Gondwana (the southern part of Pangea).

Gypsum: EVAPORITIC sediment of commercial value.

Hecla Hoek: Local name for the BASEMENT in Svalbard, now regarded as old-fashioned and not commonly used in modern scientific literature.

Hematite: Reddish iron oxide, developes as a weathering product in warm, not too dry climate. Hematite is responsible for the intense red colouration of much of the Devonian OLD RED in Spitsbergen.

Hiatus: A hiatus indicates that rocks of a certain age were never deposited at a particular place or that they have been removed by erosion at a later time. There is a series of hiatuses in Svalbard, the most important being in the uppermost Devonian, upper Permian, several smaller ones in the Mesozoic, upper Cretaceous and upper Tertiary. Rocks of these ages do not exist in Svalbard (anymore). See also UNCONFORMITY.

Holocene: most recent part of earth history, including the present time. See also QUATERNARY.

Hyperite: See BASALT.

Ice age: Period that is characterised by cold climate and glaciation on a continental scale. Ice ages are known from all eras of earth history, the most recent one being the QUATERNARY.

Intrusion: Molten rock mass that has penetrated other rocks under pressure and crystallised.

Kar: Small glacial valley with the shape of an amphitheatre on a steep slope. Many kars have a small lake.

Limestone: Typical and widely spread CARBONATE rock; origin mostly as a BIOLOGICAL SEDIMENT (reefs, deposition of calcarous skeletons of marine organisms).

Magmatite: Crystalline rock derived from completely molten rock mass. If this forms slowly at great depths in the earth's crust, then the process is slow enough to allow large crystals to grow that are visible to the naked eye. In this case, the result is called **plutonite**, of which **granite** is an example. If the molten rock mass cools quickly at the surface, then the resulting volcanite has crystals that are too small to be seen without a magnifying glass ("lava"). If cooling is abrupt, under water or under

glacier ice, then no crystals can grow at all and the result is a volcanic glass. If the rock mass was not completely molten, then remains of the original rock structure are visible in the magmatite after cooling. Such a rock is called **migmatite**.

Marble: Metamorphic, crystallised LIMESTONE.

Metamorphism: Change of mineralogical composition and crystal structure of a rock without changing its chemistry, caused by heat and/or pressure.

Migmatite: See MAGMATITE.

Moraine: Young sediment deposited by a glacier, usually not solidified.

Old Red: Sediments, mostly sandstones and conglomerates, from the Devonian period, deposited as the result of weathering of the Caledonian mountains (see CALEDONIAN OROGENY), often with an intense reddish colouring due to a high HEMATITE content. In Svalbard, the Old Red is not metamorphic, but is somewhat deformed and thus occupies an intermediate position between BASEMENT and SEDIMENTARY COVER. The Old Red is also known, for example, in England, Scotland, Wales, Northern Ireland and East Greenland.

Orogeny: Tectonic phase of mountain formation as a result of continental collision.

Orogeny, Alpine: Tectonic phase from the Cretaceous into the upper Tertiary, during which several ancient oceans were closed, leading to the formation of a chain of mountain areas from the Himalayan ranges, Iran, Turkey to south Europe. At the same time, the north Atlantic ocean opened, separating Norway and Spitsbergen from Greenland. In the early stages (starting in upper Jurassic times), wide-spread intrusive activity took place in Svalbard (mainly eastern parts), followed by pronounced DEFORMATION, but without METAMORPHISM.

Orogeny, Caledonian: Tectonic phase, mainly during the Silurian, that led to the closure of an ancient ocean called Iapetus and thus to the formation of a large continent called Laurasia, that comprised present-day North America (including Greenland) and Europe (including Spitsbergen). Intense DEFORMATION, METAMORPHISM and magmatism occurred over large areas.

Palaeontology: A branch of science concerned with fossils.

Permocarboniferous: Combined term for Permian and Carboniferous, when the geological development is continuous and similar in certain respects during both periods.

Phyllite: Low grade metamorphic rock that shows a strong CLEAVAGE, usually silver-grey.

Pingo: Permafrost-phenomenon; a 20 to 30 metres high hill of ice with a thin cover of sand and gravel.

Pleistocene: Largest part of the most recent ice age, see QUATERNARY.

Plutonite: See MAGMATITE.

Quartz vein: See VEIN.

Quaternary: The most recent ICE AGE, starting approximately 2.7 million years ago. The Q. is subdivided into the PLEISTOCENE (2.7 million to 10,000 years ago) and the HOLOCENE, which includes present time.

Quaternary geology: A branch of geology that is concerned with young, mostly

unsolidified, deposits of the Quaternary; in Svalbard a mosaic of moraines, fluvial deposits, raised and active beaches, solifluction soil and so on.
Schist: METAMORPHIC rock that shows strong fissility due to parallel arrangement of mineral crystals, usually micas.
Sediment, biogenic: Sediment such as coal or most LIMESTONES formed by biological processes.
Sandstone: CLASTIC SEDIMENT composed of sandgrains.
Sediment, clastic: Mechanically deposited sediment, created by water, ice or wind.
Sedimentary cover rocks: Sediments younger than the BASEMENT, and usually showing only weak or absent deformation and metamorphism unless involved in a younger OROGENY. In Svalbard, the sedimentary cover comprises rocks from the Carboniferous to the lower Tertiary (the Devonian OLD RED has an in-between position between basement and cover rocks).
Shale: Silty SEDIMENTary rock composed of particles that are too small to be seen with the naked eye.
Sill: INTRUSION that runs parallel to the main structure of the host rocks, for example the bedding of sediments.
Siltstone: Silty SEDIMENTary rock composed of particles that are smaller than sand.
Sound: Strait with at least two connections to adjacent waters.
Stromatolite: Colony of calcarous algae or bacteria, often with a concentric structure resembling an onion or cabbage.
Surge: Sudden, pronounced advance of a glacier.
Svalbardian phase: Late phase of the CALEDONIAN OROGENY in the uppermost Devonian, that resulted in deformation of the OLD RED and in the creation of a pronounced angular UNCONFORMITY.
Unconformity: Break in a sedimentary succession. An unconformity is caused by a period of time during which no rocks were deposited and existing ones possibly eroded. An **angular unconformity** is a special case where the rocks on either side of the break are not parallel. An unconformity represents a HIATUS during which some tilting of the older rocks occurred.
Vein: Filling of cracks or fissures by minerals that precipitate from circulating water.
Volcanite: See MAGMATITE.

Literature

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