Rocks of Spitsbergen

Rocks of Spitsbergen

Lara Almarcegui

INSPIRERENDE KUNSTTILDELING

Vi i Miljødirektoratet er svært stolte over å ha fått tildelt Lara Almarceguis kunstverk gjennom KOROs kunstordning for statlige leiebygg til lokalene våre på Brattørkaia i Trondheim. Tematikken i kunstverket er interessant og relevant for oss, fordi også vi jobber med verdier på forskjellige plan. Tall og fakta på den ene siden, og ikke-målbare verdier på den andre.
Hovedoppgavene til Miljødirektoratet er å redusere klimagassutslipp, forvalte norsk natur og hindre forurensning. Vi arbeider i skjæringspunktet mellom mange kryssende interesser. Det ligger i vårt mandat at vi skal veie ulike hensyn mot hverandre. Vi skal legge til rette for vern av naturen, men også for bruk og verdiskaping. Vi skal motvirke forurensing, men også ta hensyn til andre samfunnsinteresser.

Svalbard er på mange måter Norges og Europas siste villmark. Over 60 prosent av landarealet er vernet, og de to største nasjonalparkene i Norge ligger nettopp på øya Spitsbergen. Denne villmarka har i seg selv stor egenverdi, og det gir Norge et særskilt internasjonalt ansvar for å ta vare på Svalbards natur. Men også disse områdene er påvirket av menneskelig aktivitet, for eksempel når vi utnytter de geologiske naturressursene.

Tall og fakta er viktige i Miljødirektoratets arbeid. Kvantifiserbare enheter utgjør mye av fundamentet i det vi jobber med. Tabellen i kunstverket skal gi oss en oversikt over vekten av Spitsbergen, ut fra geologiske komponenter. Samtidig er øya hjem for en rekke dyre- og plantearter og står for naturverdier som ikke kan måles og veies.

Lara Almarcegui er en internasjonalt anerkjent samtidskunstner, og kunsten i foajeen vil være en daglig velkomsthilsen til alle oss som arbeider ved Miljødirektoratets kontor på Brattørkaia. Omgivelsene våre preger hverdagen vår, og kunstverket kan få oss til å reflektere over verdiene i naturen og inspirere oss i det daglige arbeidet med å ta vare på miljøet.

På vegne av alle i Miljødirektoratet: Takk for et flott og tankevekkende kunstverk!

Ellen Hambro
miljødirektør

INSPIRATIONAL ART

We are very proud to receive an artwork of Lara Almarcegui here at the Norwegian Environment Agency at Brattørkaia in Trondheim. It is part of KORO's art loan programme (for government leased buildings). The theme of the artwork is very interesting and especially relevant for us, as we also work with values on different levels: Facts and figures on the one hand, and less tangible values on the other.

The main tasks of the Norwegian Environment Agency are to reduce greenhouse gas emissions, to manage Norwegian nature, and to prevent pollution. We work at the interface between intersecting interests. Our mandate involves weighing and assessing a variety of different considerations. We shall work to protect nature, but also to facilitate resource use and value creation. We shall seek to combat pollution while also taking public interests into account.

In many respects, Svalbard is Norway's and Europe's last remaining wilderness. Over sixty percent of the land area is protected, and the two largest national parks in Norway are to be found on the island of Spitsbergen. This wilderness has great intrinsic value in itself, and Norway bears a special responsibility internationally to take care of Svalbard's nature. Yet these areas are also affected by human activity, such as the extraction of geological resources.

Facts and figures are an important part of our work. Quantified data is absolutely fundamental to what we do. The table in the artwork provides an estimate of the weight of Spitsbergen, based on its geological components. At the same time, the island is home to a variety of animal and plant species, making it representative of natural assets that cannot be measured and weighed.

Lara Almarcegui is an internationally renowned contemporary artist, and her artwork in the entrance lobby will every day greet all of us who work at the Agency's Brattørkaia offices. We are influenced by our surroundings. Our surroundings influence our general welfare. This artwork will help us reflect on the values of nature. It will inspire us in our daily efforts to protect the environment.

On behalf of everyone at the Norwegian Environment Agency, thank you for a wonderful and thought-provoking work of art!

Ellen Hambro
Director General

EN VISS TYNGDE

Da vi i innkjøpskomiteen til KORO mottok søknaden om kunst til Miljødirektoratet i anledning flytting til nye lokaler, var vi aldri i tvil om hvorvidt vi skulle innvilge søknaden eller ikke. Det vi ser etter er sammenhenger som kan fungere som utgangspunkt for relevant, betydningsfull kunst, og dette var åpenbart en gyllen anledning.

Vi vurderer konkrete, estetiske forhold som arkitektur, romforhold, beliggenhet, og mer abstrakte ting som renommé, offentlighetsgrad og virksomhetens relevans. Vil det bety noe å plassere et kunstverk nettopp her? Hvilken effekt kan vi oppnå? Og hvilken betydning vil kunsten få for et publikum av daglige brukere? På befaring til det som den gangen fortsatt het Direktoratet for naturforvaltning, traff vi kontorarbeidere med turstøvler og ryggsekk under skrivebordet. Det slo oss at denne virksomheten egentlig er lokalisert på to nivåer: Det ene, kanskje mest åpenbare, er kontorlokalene, men det andre, og kanskje viktigste, befinner seg mer udefinert rundt i hele det landskapet vi kaller Norge. Helt presist hvor Miljødirektoratet er lokalisert, er egentlig et litt vanskelig spørsmål å svare på. Direktoratet eksisterer på en måte med ett bein på hver side av skillet mellom naturen og kulturen, og billedliggjør nærmest selv den forhandlingen eller friksjonen det er satt til å vokte over.

Spørsmål tilknyttet forvaltningen av naturressurser opptar og bekymrer mange i dag. Menneskeskapte klimaendringer, ekstremvær, utrydding av dyrearter og avskoging, er eksempler på brennhete temaer. Under alle disse problemene ligger det store spørsmålet om hvordan vi mennesker kan leve i, og som en del av, en bærekraftig verden. En verden med en brukbar fremtid, ikke bare for oss selv, men også for kommende generasjoner. Kunsten springer ut av sin egen samtid. Engasjementet rundt disse problemene er naturlig nok også sterkt tilstede i samtidskunsten. I bakgrunnen ligger angsten for at vi ikke klarer å enes om noe alternativ til den generelle, menneskelige grådigheten som ligger til grunn for denne situasjonen.
Vi valgte å invitere den spanske kunstneren Lara Almarcegui til å lage et helt

nytt verk for Miljødirektoratet og det nye bygget på Brattørkaia. En rød tråd gjennom hele hennes kunstnerskap er motstanden mot arkitektur, byplanlegging og design som redskap for kontroll og regulering av samfunnet. Hennes kanskje aller mest kjente arbeider er fra serien *Wastelands*: store, landartlignende intervensjoner i urbant landskap. For hver intervensjon har hun forhandlet frem en kontrakt med grunneieren, som forplikter seg til å la tomta stå urørt over en avtalt periode på opptil 15 år. Kontrasten mellom hennes *Wastelands* og områdene rundt øker etter hvert som landskapet endres gjennom utbygging og industrialisering. Samtidig vil områdene som omfattes av hennes kontrakter vernes mot inngrep, og bare følge en naturlig utvikling. Slik blir de overlatt til tilfeldigheter og spontane hendelser, til vind, regn, sol og vegetasjon. I løpet av noen år blir disse områdene stående som de eneste tomme og åpne rommene i en ellers helt utbygget sammenheng. Hvis man gjør et tankeeksperiment og for et øyeblikk forsøker å forestille seg at Miljødirektoratet skulle uttrykke seg kunstnerisk, er det nærliggende å tenke seg at kunstnerskapet deres ville hatt mye til felles med kunstproduksjonen til Almarcegui.

Almarceguis nye verk, *Rocks of Spitsbergen*, utviklet spesielt for Miljødirektoratet, er typisk for hennes kunstnerskap. Det forholder seg pragmatisk til en konkret verden, men produserer et tankevekkende og poetisk resultat. Verket består av den beregnede vekten av Norges største øy, Spitsbergen på Svalbard. En lang utregningsprosess vises her som en enkel liste med navnene på de forskjellige bergartene og hvor mange tonn som finnes av hver enkelt av dem i grunnfjellet på øya. Listen er satt opp på samme måte som man ville gjort i et ordinært kontordokument, blåst kraftig opp, og malt rett på veggen i inngangspartiet. En rekke vitenskapelige betegnelser ved siden av en rad med tall. Men hva er et tall?

Tallene er forsøk på å beskrive en uoversiktelig verden, holde den fast, styre den. Disse er etablert gjennom en møysommelig og krevende vitenskapelig forskningsprosess som har pågått i nesten et år. Tallene beskriver øya, ligger som et rutenett over den, så finmasket og presist som mulig. De er et forsøk på å kjenne et landskap, kontrollere det, forstå det. Et lite stykke av jordens overflate, avgrenset og innrammet av vannet rundt, er forsøkt representert. Mål og vekt, ubestridelige størrelser. Oversatt til et fast språk, til en ny form. Tallene er så presise som kunnskapen vår tillater. Men akkurat som

ord er tall menneskelige konstruksjoner, ikke naturfenomener. De *er* ingenting, bare abstrakte, kroppsløse begreper. De kan hele tiden måtte løses opp, omorganiseres, tenkes om. De er kartet, ikke terrenget. På samme måte som en øy avgrenses av vannet omkring, finnes det også grenser for hva vi kan måle og veie, hva vi kan vite med sikkerhet.

Verket til Almarcegui er en representasjon av øya Spitsbergen, på samme måte som et fotografi eller et maleri kan vise et bilde av et landskap. Det *viser til* landskapet, men *er* det ikke. Det er en ny kropp, skapt etter form av et eksisterende landskap. Det er et kunstverk, det eksisterer i kraft av seg selv. Forhandlingen mellom kultur og natur konkretiseres i dette verket, der landskapet stiger opp over havoverflaten og bare *er*. Vil ingenting, ligger der bare. Rolig, sakte, passivt. Velkjent, men samtidig mystisk og ugjennomtrengelig. Så konkret at det nesten blir abstrakt.

Og selv om tallene i Almarceguis tallrekke skulle greie å fange opp kompleksiteten i dette virkelige landskapet, vil de likevel raskt komme i utakt med det de beskriver. For verden står jo ikke stille. Landskapet selv vil kanskje ikke noe, men vi mennesker vil noe med det. Verden, naturen er i bruk, den påvirkes og endres fra utsiden. Vi legger til, og vi trekker fra. Sprenger, borrer oss inn, bygger, graver, flytter vekten rundt. Helt siden begynnelsen av forrige århundre har gruvedrift vært hovednæringen på Svalbard. Store mengder kull og steinmasser er gravd ut. I den såkalte Gruve 7, drevet av Store Norske Spitsbergen Kulkompani, rapporteres det om en produksjon på 80 000 tonn kull årlig, mens det i Sveagruva tas ut omtrent 3 millioner tonn i året. Det undersøkes også om gullfunn gjort i området vil gi grunnlag for lønnsom gruvedrift i årene som kommer. Det tette grunnfjellet hules ut fra innsiden, blir stadig lettere. Når dette verket avdukes i 2014, vil tallene allerede være litt misvisende.

Rocks of Spitsbergen er altså et slags snapshot. Et landskap i endring, frosset i et øyeblikk. Beskrevet i et tørt språk vi kjenner fra forvaltning og vitenskap, et språk vi har lett for å tro er *sant*. Et saklig, usentimentalt språk. Men virkelighetens detaljrikdom vil alltid overskride våre modeller, kategorier og systemer. Vi er nødt til å forenkle og tolke verden rundt oss. Vi velger noe inn, mens noe faller bort fra regnestykket vårt. Verket til Lara Almarcegui er på én og samme tid kunst og vitenskap. Det er verken mer eller mindre presist enn et

fotografi, et maleri, et dikt eller et musikkstykke. Det fremkaller et bilde i våre sinn, muligens den sanneste representasjonen av Spitsbergen som finnes: vår egen, individuelle forestilling om denne øya. Den består kanskje av én andel faktabasert kunnskap, litt fantasi, noen fordommer, et minne om følelsen av neglesprett, noen historier om isbjørner, samt en viss mengde gjetninger, misforståelser og direkte feil. Gjennom alle de presise tallene er det likevel et slikt poetisk og emosjonelt ladet bilde vi sannsynligvis ser for vårt indre blikk. For hva annet enn våre egne fornemmelser kan vi egentlig vite noe om?

Marianne Heier
Komiteen for KOROs kunstordning for statlige leiebygg og eldre statsbygg

A CERTAIN WEIGHT

When we received an application from the Norwegian Environment Agency (Miljødirektoratet) for artworks for its new premises, we were never in any doubt about whether or not the application should be approved. What we look for are contexts that can provide a basis for relevant, meaningful art, and this was obviously a golden opportunity.

The committee assesses specific aesthetic conditions, such as architecture, spatial characteristics, and location, together with more abstract things, such as an institution's reputation, public profile, and relevance. What impact will a work of art have at the place in question? What effect can we achieve? And what will it mean for those who see it on a daily basis? When we made a preliminary visit to what was at that point still the Norwegian Directorate for Nature Management (Direktoratet for naturforvaltning), we found office workers with hiking boots and backpacks under their desks. It struck us that the institution's work took place on two arenas simultaneously: the first and most obvious was the office, but the second, and perhaps more important one, was a less defined locality that could be anywhere in the landscape we call Norway. In a sense, the Agency has one foot on either side of the distinction between nature and culture; it could in itself be a metaphor for the negotiations and frictions that form its daily business.

Questions about the management of natural resources are a matter of concern to many people today. Man-made climate change, extreme weather, deforestation, and threats to bio-diversity are just a few of the topics that currently top the agenda. Lurking behind all these problems are broader questions of how we humans should organise our lives within, and as part of, a sustainable world. A world with a worthwhile future, not just for ourselves, but also for coming generations. Art reflects the era of its making. A deep concern with these issues does of course also find ready expression in contemporary art. Rumbling in the background is the fear that we might never agree on an alternative to the general human greed that is causing this situation.
We chose to invite the Spanish artist Lara Almarcegui to create an entirely

new work for the Environment Agency and its new premises at Brattørkaia in Trondheim. A common thread running through Almarcegui's entire production is her opposition to architecture, urban planning and design as means of controlling and regulating society. Perhaps her best-known works are those in the series *Wastelands*: large interventions reminiscent of land art in the urban landscape. For each intervention, she negotiates a contract that commits the property owner to leave the site undisturbed for an agreed period of anything up to fifteen years. The contrast between her "wastelands" and the surrounding areas increases as the landscape changes as a result of development and industrialisation. Meanwhile, the plots of ground covered by her contracts are protected against encroachment and allowed to evolve in accordance with natural processes. Hence they are given over to chance and spontaneous events – to the wind, the rain, sun and vegetation. In the course of a few years, these areas become the only empty, open spaces in settings that are otherwise thoroughly urban developments. If, by way of a thought experiment, one asks what the Environment Agency would do if it decided to express itself artistically, one could easily imagine it creating something very similar to one of Almarcegui's projects.

Almarcegui's latest work, *Rocks of Spitsbergen*, developed specially for the Environment Agency, is typical of her production. It adopts a pragmatic approach to the real world, but with results that are thought-provoking and poetic. The work consists of an attempt to calculate the weight of Norway's largest island, Spitsbergen, in the Svalbard Archipelago. A long and complex calculation process is shown here as a simple list of the names of the different rock types and how many tons there are of each in the island's bedrock. The list is laid out in the way one would lay out an ordinary office document, radically enlarged, and painted directly onto the wall of the Agency's entrance lobby.

A series of scientific terms beside a column of numbers. But what is a number? Numbers are tools to describe a confusing reality, to pin it down and control it. The numbers here are the results of a painstaking and arduous research process that has been going on for almost a year. The figures describe the island, overlaying it like a grid, as finely meshed as possible. They constitute an attempt to get to know a landscape, to monitor and understand it, an attempt to represent one small section of the earth's surface, bounded

and framed by the surrounding water. Spatial extent and weight – incontrovertible dimensions. Translated into a fixed language, a new form. The figures are as accurate as current knowledge allows. But just like words, numbers are human constructs, not natural phenomena. They *are* nothing, mere abstractions, disembodied concepts. At any time it might become necessary to undo them, to reorganise and reassess them. They are a map rather than the terrain itself. Just as the island is bounded by the surrounding water, there are limits to what we can measure and weigh, to what we can know with certainty.

Almarcegui's work is a representation of the island of Spitsbergen, in the same way that a photograph or a painting can be a picture of a landscape. It *refers to* but is not itself a landscape. It is a new entity created to correspond with an existing landscape. As an artwork it exists in its own right. This is a work that physically embodies the negotiation between culture and nature, a work in which the land rises above sea level and simply *is*. It has no purpose, but is simply there. Silent, slow, passive. Familiar, yet simultaneously mysterious and impenetrable. So concrete it verges on abstraction.

Even if Almarcegui's lists of numbers were to succeed in capturing the complexity of the real landscape, they will soon be out of step with what they describe. Because the world does not stand still. Although the landscape might lack purpose, we humans certainly do not. The world and nature are put to use; they are influenced and altered from the outside. We add and we subtract. We blast, drill, build, dig, and shift the weight around. Since the beginning of the last century, mining has been the main industry on Svalbard. Huge quantities of coal and stone have been excavated. According to reports, the so-called Mine 7, run by Store Norske Spitsbergen Kulkompani, produces some 80,000 tons of coal annually, while Sveagruva extracts around three million tons a year. Studies are also underway to see whether gold discovered in the area could provide a basis for profitable mining in the years to come. The dense bedrock is being hollowed out from within and becoming lighter in consequence. When this work is unveiled in 2014, the numbers will already be slightly inaccurate.

Rocks of Spitsbergen is therefore a kind of snapshot. A landscape in the process of change, frozen at a single moment. Described in the dry language we associate with management and science, a language we are disposed

to regard as *true*. An unbiased, unsentimental language. But reality's wealth of detail will always outrun our models, categories and systems. We are compelled to simplify and interpret the world around us. We choose what to include, while omitting other factors from our calculations. Lara Almarcegui's work is both art and science at one and the same time. It is neither more nor less accurate than a photograph, a painting, a poem or a piece of music. It evokes an image in our minds, perhaps the most accurate representation of Spitsbergen there could ever be: the individual's own private idea of this island. It consists perhaps of one part factual knowledge, one part fantasy, a dose of preconceptions, a recollection of frozen fingers, various tales of polar bears, and a certain amount of guesswork, misconception and downright error. Shimmering through the precise figures, it is likely to be a poetic and emotionally charged image that remains in the mind's eye. For what can we really know anything about, other than our own feelings?

Marianne Heier
The Committee for KORO's Public Art Programme for Government-rented Properties and older Government Buildings

Rocks of Spitsbergen
Lara Almarcegui

I arbeidet med prosjektforslaget mitt for det norske miljøverndirektoratet, orienterte jeg meg om flere planer som ville kunne forårsake betydelige forandringer i det norske landskapet; blant annet større prosjekter innen miljøgjenoppretning som ville involvere gruver, militære treningsområder og elver. Jeg lette også etter prosjekter som utgjorde en trussel for miljøet, som for eksempel fremtidige veier, broer, tuneller, kraftlinjer og nye gruver. Jeg besøkte et samfunn som ventet på avgjørelsen om hvorvidt en rutilgruve skulle åpnes, og ble dypt grepet av dette kritiske øyeblikket, fylt av frykt og forventning. Men etter hvert gikk det opp for meg at hvis hensikten er å drøfte mulighetene for miljøvern og gruvedriftens ødeleggelse av naturen, finnes det ikke et bedre egnet sted enn polarøya Spitsbergen.

Listen over steiner i *Rocks of Spitsbergen* henviser til øyas fortid, til den gang kolliderende tektoniske plater formet regionen og dannet fjellene, og avleiringene ble til steiner. Verket kommenterer hvordan øyområdet har forandret seg som følge av geologisk evolusjon og gruvedrift. Spitsbergen har en lang historie med gruvedrift og mange forsøk på å utvinne de rike malmårene. Det er blitt drillet etter kobber, asbest, sinkmalm, jern, gull, bly og fosfater. Med anslagsvis kullforekomster på rundt 22 millioner tonn, har området rundt Longyearbyen to aktive gruver, og nye utgravinger er rett rundt hjørnet. Hovedmålet med mitt prosjekt er derfor å rette søkelyset mot øyas framtid. Hva blir konsekvensene for området ved ytterligere steinbrudd og mineralutvinning? I mitt prosjekt forsøker jeg å gi et bilde av øyas mulige ødeleggelse, gjennom utforsking av dens geologiske opphav og fremtidige utnytting.

Rocks of Spitsbergen
Lara Almarcegui

In order to propose a project relating to the activities of the Norwegian Environment Agency, I studied various plans that would cause major changes to the country's landscapes; these included large-scale environmental restoration projects involving mines, military training areas and rivers. I also searched for projects that posed threats to the environment, such as future roads, bridges, tunnels, transmission lines and new mining endeavours. I visited a community waiting for a decision on whether a rutile mine would be opened there. I was deeply impressed by this difficult moment of fear and anticipation. But as I later realized, if my intention was to talk about the destruction of landscape through mining and the possibilities of environmental protection, there was nowhere more pertinent than the island of Spitsbergen in the Arctic.

The list of rocks in *Rocks of Spitsbergen* refers to the island's past, when the region was shaped by the collision of tectonic plates, forming mountains, and sediments were deposited, producing rocks. The work comments on the ways the island territory has changed – and been changed – as a result of geological evolution and mining. The island has a long history of mining with many attempts to extract its abundant ores. There have been drilling expeditions in the search for copper, asbestos, zinc ore, iron, gold, lead and phosphates. With estimated coal deposits of some 22 million tons, the area around Longyearbyen has two active mines, and further extraction will start soon. The main aim of my project is therefore to focus on the future of the island. What will happen to the region if its rocks are extracted for minerals? What I seek to do is offer a vision of the island's possible destruction through an exploration of its geological origins and future exploitation.

Rocks of Spitsbergen

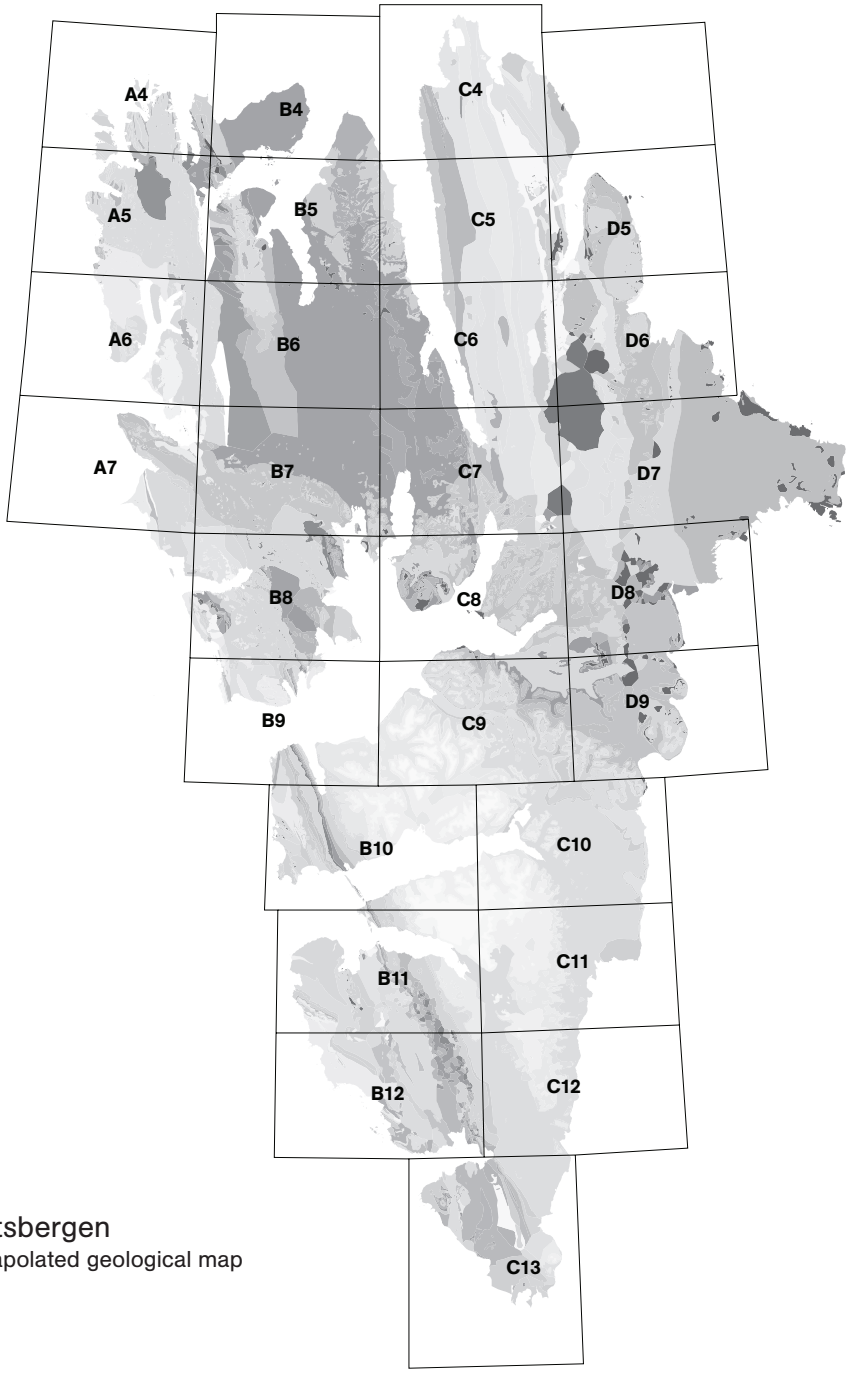
Carbonate rocks	5536,36 km³
Sandstone & Psammite	4 211,46 km³
Mudstone & Shales	1945,44 km³
Siltstone	1232,27 km³
Conglomerate & Breccia	660,73 km³
Evaporite	134,45 km³
Metaigneous rocks	727,31 km³
Quartzite	699,39 km³
Metasediments	593,22 km³
Schist	584,03 km³
Marble	413,18 km³
Amphibolite	346,41 km³
Gneiss	270,03 km³
Granite	521,18 km³
Plutonite	117,06 km³
Vulcanite	25,19 km³
Unknown	534,65 km³
Total	**18 552,32 km³**

Beregningen av Spitsbergens bergarter

Rocks of Spitsbergen identifiserer de ulike bergartene som Spitsbergen, en del av øygruppa Svalbard, består av. Ved å dele opp øyas geologiske bestanddeler og anslå volumet på hver bergart, er det mulig å gi et estimat på øyas totale vekt.
Utregningene er gjort av den tidligere geologistudenten ved Universitetssenteret på Svalbard (UNIS) Katja Baum, under veiledning av geologiprofessor Alvaar Braathen fra UNIS og Winfried Dallmann fra seksjon for geologi og geofysikk ved Norsk Polarinstitutt i Tromsø. Mesteparten av beregningsarbeidet har bestått i å analysere et kart over Spitsbergen i ArcMap – et analyseprogram for geografiske kartdata. Steinvolumene er beregnet ut i fra Polarinstituttets kartdatabase. Et rastrert diagram er samtidig generert ved å skanne vertikalsnitt fra geologiske kart slik at man kan angi variasjoner i formasjonenes tykkelse. Ved å sammenstille data fra tverrsnittene og samsvarende kartdata, kan man anslå det totale volumet av formasjonene. Deretter er formasjonsvolumet delt på antall underliggende bergarter. Kartet som ble brukt er en ny versjon fra 2013. Det inneholder imidlertid usikkerhetsmomenter på grunn av manglende data fra noen områder.

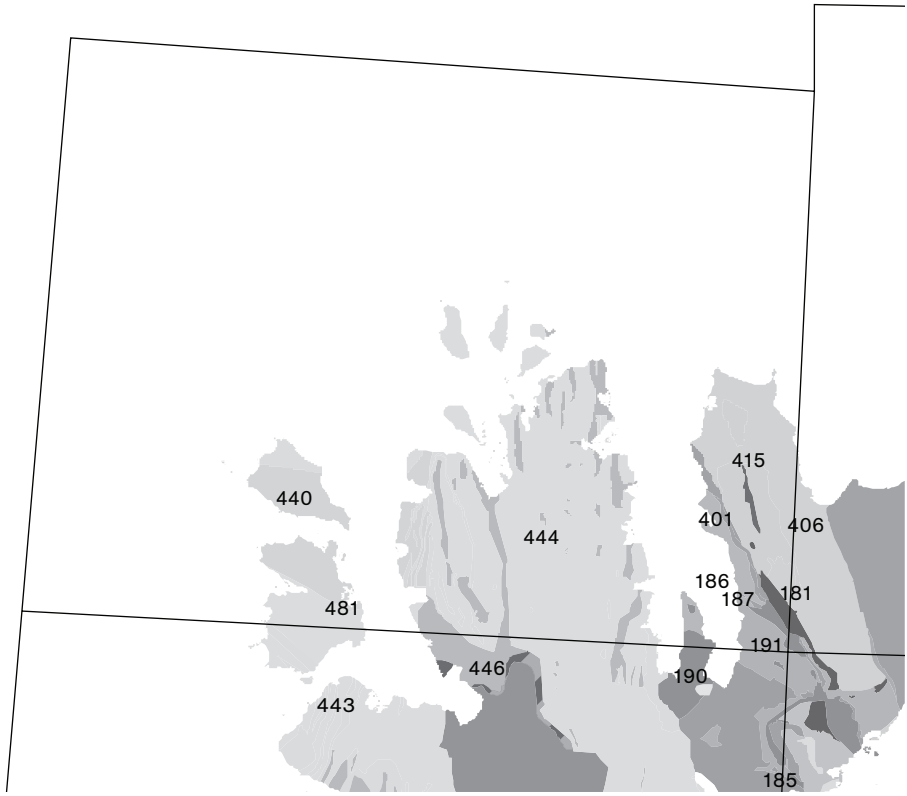
The calculation of the Rock composition of Spitsbergen

Rocks of Spitsbergen identifies the different rocks of Spitsbergen Island, part of the Svalbard Archipelago. After separating the island's geological units and calculating the volume of each rock type, it is possible to present an estimate for the total weight of the island.
The calculations were performed by Katja Baum, former student of geology at UNIS – The University Centre in Svalbard, with advice from Alvaar Braathen, professor of structural geology at UNIS, and Winfried Dallmann from the Geology and Geophysics Section of the Norwegian Polar Institute (NPI) in Tromsø. Most of the work for the calculation consisted in processing a map of Spitsbergen using ArcMap – a program for analyzing geospatial data. The volumes of the rock units were calculated from the map database provided by NPI. Separately, a rasterized diagram was made from scanned cross-sections taken from printed geological maps to indicate the variations in thickness of the formations. By collating data from the cross-sections with the corresponding map data, it was possible to estimate the volume of the formations as a whole. Subsequently, the formation volume was divided by the different types of rocks contained within it. The map used was a new version from 2013, which still contains uncertainties, due to a lack of data in some areas.



Spitsbergen
extrapolated geological map

A4



A4

Lilljeborgfjellet Formation
Grid code 181

Volume m³	111839471,8852
Volume km³	0,111839472
Rock type	Conglomerate

Wulffberget Formation
Grid code 185

Volume m³	328829850,246
Volume km³	0,32882985
Rock type	Conglomerate

Rabotdalen Formation
Grid code 186

Volume m³	252514788,3888
Volume km³	0,252514788
Rock type	Sandstone

Princesse Alicefjellet Formation
Grid code 187

Volume m³	409370760,276
Volume km³	0,40937076
Rock type	Conglomerate

Andréebreen Group
Grid code 190

Volume m³	93013568,6657
Volume km³	0,093013569
Rock type	Sandstone, siltstone

Frænkelrygg Formation
Grid code 191

Volume m³	9433294,0592
Volume km³	0,009433294
Rock type	Sand, siltstone

Richarddalen Complex
Grid code 401

Volume m³	3085866253,4388
Volume km³	3,085866253
Rock type	Metamagatite

Biscayarhuken unit (mica schist and psammitic schist)
Grid code 406

Volume m³	3822410236,9324
Volume km³	3,822410237
Rock type	Schist

Metagabbro
Grid code 415

Volume m³	198938634,2104
Volume km³	0,198938634
Rock type	Metagabbro

SC: fine grained felsic gneisses
Grid code 440

Volume m³	6508808242,848
Volume km³	6,508808243
Rock type	Gneiss

SC: banded gneisses
Grid code 443

Volume m³	2352701470,2732
Volume km³	2,35270147
Rock type	Gneiss

SC: migmatites
Grid code 444

Volume m³	47356678087,7916
Volume km³	47,35667809
Rock type	Migmatite

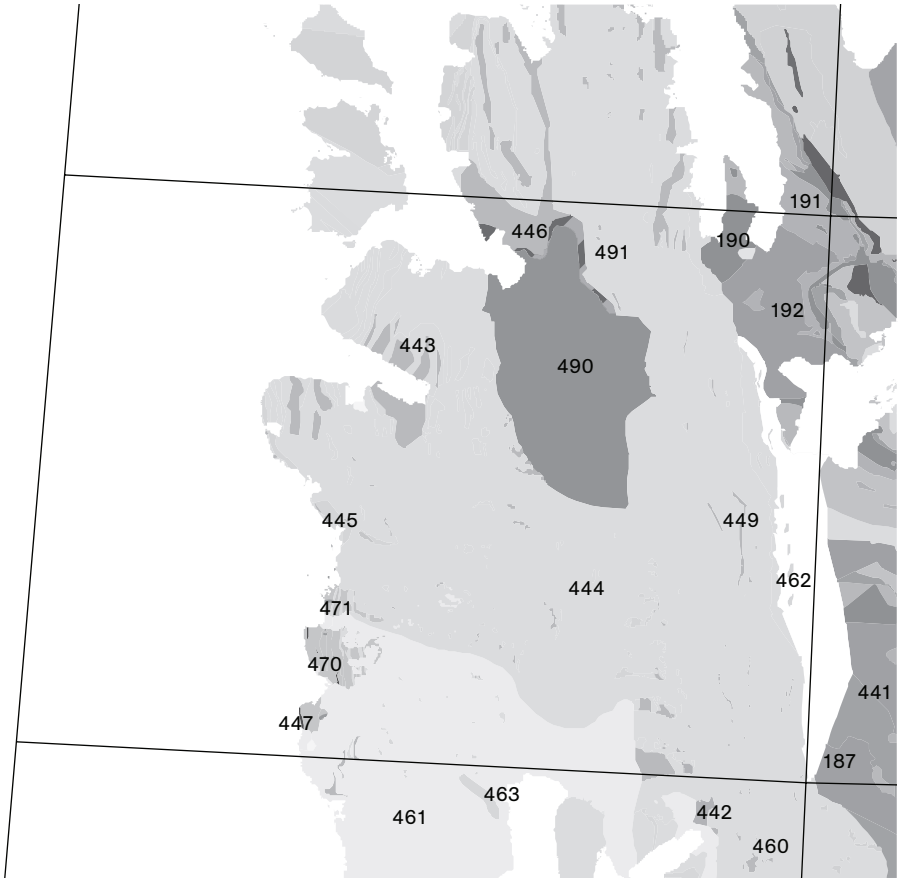
SC: late tectonic granites
Grid code 446

Volume m^3	6550696162,7126
Volume km^3	6,550696163
Rock type	Granite

SC: quartzite
Grid code 481

Volume m^3	197982925,1775
Volume km^3	0,197982925
Rock type	Quartzite

A5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Princesse Alicefjellet Formation
Grid code 187

Volume m³	431813466
Volume km³	0,431813466
Rock type	Conglomerate

Andréebreen Group
Grid code 190

Volume m³	1408759821
Volume km³	1,408759821
Rock type	Sandstone, siltstone

Frænkelrygg Formation
Grid code 191

Volume m³	1925207357
Volume km³	1,925207357
Rock type	Sandstone, siltstone

Ben Nevis Formation
Grid code 192

Volume m³	10703280991
Volume km³	10,70328099
Rock type	Sandstone (siltstone, mudstone)

SC: porphyroblastic gneisses
Grid code 441

Volume m³	2956302109
Volume km³	2,956302109
Rock type	Gneiss

SC: granitic orthogneisses
Grid code 442

Volume m³	332088813
Volume km³	0,332088813
Rock type	Gneiss

SC: banded gneisses
Grid code 443

Volume m³	13580875400
Volume km³	13,5808754
Rock type	Gneiss

SC: migmatites
Grid code 444

Volume m³	347882513916
Volume km³	347,8825139
Rock type	Migmatite

SC: migmatites with aplites
Grid code 445

Volume m³	1590975604
Volume km³	1,590975604
Rock type	Migmatite

SC: late tectonic granites
Grid code 446

Volume m³	16872233441
Volume km³	16,87223344
Rock type	Granite

SC: amphibolite
Grid code 447

Volume m³	47965103
Volume km³	0,047965103
Rock type	Amphibolite

SC: marble/skarn
Grid code 449

Volume m³	1432453598
Volume km³	1,432453598
Rock type	Marble/Skarn

SF: micaceous schist
Grid code 460

Volume m³	5805073069
Volume km³	5,805073069
Rock type	Schist

SF: garnet-mica schist
Grid code 461

Volume m³	48524121501
Volume km³	48,5241215
Rock type	Schist

SF: (garnet-)mica schist w. aplites
Grid code 462

Volume m³	10592357600
Volume km³	10,5923576
Rock type	Schist

SF: quartzite
Grid code 463

Volume m³	1339236316
Volume km³	1,339236316
Rock type	Quartzite

NF: banded garnet-biotite gneiss
Grid code 470

Volume m³	2551944150
Volume km³	2,55194415
Rock type	Gneiss

NF: banded gneiss with aplites
Grid code 471

Volume m³	666223198
Volume km³	0,666223198
Rock type	Gneiss

Hornemantoppen Granite
Grid code 490

Volume m³	63822439465
Volume km³	63,82243946
Rock type	Granite

HG: xenolith-rich marginal zone
Grid code 491

Volume m³	1908071126
Volume km³	1,908071126
Rock type	Granite

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Red Bay Group
Grid code 183

Volume m³	118168712
Volume km³	0,118168712
Rock type	Sandstone, conglomorate

SC: granitic orthogneisses
Grid code 442

Volume m³	567834628
Volume km³	0,567834628
Rock type	Gneiss

SC: migmatites
Grid code 444

Volume m³	86186572119
Volume km³	86,18657212
Rock type	Migmatites

SC: late tectonic granites
Grid code 446

Volume m³	12453796269
Volume km³	12,45379627
Rock type	Granite

SC: marble/skarn
Grid code 449

Volume m³	275941743
Volume km³	0,275941743
Rock type	Marble/Skarn

GF: upper banded marbles
Grid code 451

Volume m³	33588525513
Volume km³	33,58852551
Rock type	Marble

GF: lower banded marbles
Grid code 452

Volume m³	1031205068
Volume km³	1,031205068
Rock type	Marble

Unknown
Grid code 455

Volume m³	5589967223
Volume km³	5,589967223
Rock type	Unknown

Unknown
Grid code 456

Volume m³	166690375
Volume km³	0,166690375
Rock type	Unknown

SF: micaceous schist
Grid code 460

Volume m³	73712868884
Volume km³	73,71286888
Rock type	Schist

SF: garnet-mica schist
Grid code 461

Volume m³	29732213276
Volume km³	29,73221328
Rock type	Schist

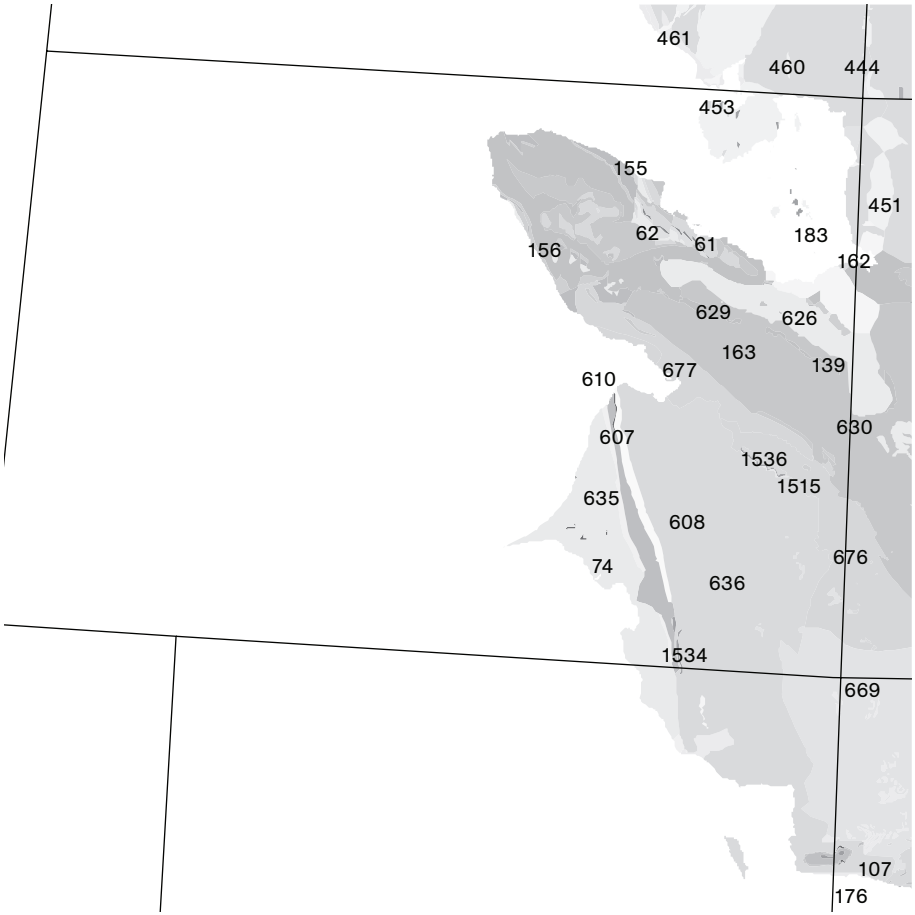
SF: (garnet-)mica schist w. aplites
Grid code 462

Volume m³	8406656244
Volume km³	8,406656244
Rock type	Schist

SF: quartzite
Grid code 463

Volume m^3	1245664008
Volume km^3	1,245664008
Rock type	Quartzite

A7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Kongsfjorden Formation
Grid code 61

Volume m³	98710859,34
Volume km³	0,098710859
Rock type	Sandstone, shale, coal (10:1:1)

Brøggerbreen Formation
Grid code 62

Volume m³	204895569
Volume km³	0,204895569
Rock type	Sandstone, shale, conglomerate (7:1:2)

Sarsbukta conglomerate
Grid code 74

Volume m³	868411804,1
Volume km³	0,868411804
Rock type	Conglomerate

Vardebukta Formation
Grid code 107

Volume m³	34838557,07
Volume km³	0,034838557
Rock type	Shale, siltstone, sandstone

Orustdalen Formation
Grid code 139

Volume m³	132707292,9
Volume km³	0,132707293
Rock type	Sandstone

Brøggertinden Formation
Grid code 155

Volume m³	1233370906
Volume km³	1,233370906
Rock type	Conglomerate, sandstone, shale (2:1)

Scheteligfjellet Formation
Grid code 156

Volume m³	731307560,9
Volume km³	0,731307561
Rock type	Carbonate rocks, calcareous sandstone, conglomerate and sedimentary breccia (Carbonates 8:2 sst)

Wordiekammen Formation
Grid code 162

Volume m³	8803707449
Volume km³	8,803707449
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	4020381653
Volume km³	4,020381653
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Kapp Starostin Formation
Grid code 176

Volume m³	2446732515
Volume km³	2,446732515
Rock type	Siltstone, sandstone, limestone (1:1)

Red Bay Group
Grid code 183

Volume m³	26038056,55
Volume km³	0,026038057
Rock type	Sandstone, conglomorate

SC: migmatites
Grid code 444

Volume m³	1946514800
Volume km³	1,9465148
Rock type	Migmatites

GF: upper banded marbles
Grid code 451

Volume m³	3713560917
Volume km³	3,713560917
Rock type	Marble

GF: graphitic carbonate schist
Grid code 453

Volume m³	16809940,68
Volume km³	0,016809941
Rock type	Schist

SF: micaceous schist
Grid code 460

Volume m³	6105669294
Volume km³	6,105669294
Rock type	Schist

SF: garnet-mica schist
Grid code 461

Volume m³	134404411,3
Volume km³	0,134404411
Rock type	Schist

Sarsøyra Formation
Grid code 607

Volume m³	184729612,3
Volume km³	0,184729612
Rock type	Conglomerate

Aavatsmarkbreen Formation
Grid code 608

Volume m³	1496622497
Volume km³	1,496622497
Rock type	Phyllite, vulcanites, psammites, carbonate

Vestgøtabreen Complex
Grid code 610

Volume m³	4291710,296
Volume km³	0,00429171
Rock type	4% dolostone, 20% marble, 43% schist, 3% serpentinite, 10% greenstone, 1% psamitte, 10% glaukophanite, 9% eclogite

Nielsenfjellet unit
Grid code 626

Volume m³	14287834235
Volume km³	14,28783423
Rock type	Schist

Steenfjellet unit
Grid code 629

Volume m³	1346059777
Volume km³	1,346059777
Rock type	Dolomitic marble

Bogegga unit
Grid code 630

Volume m³	38048012807
Volume km³	38,04801281
Rock type	Schist

Comfortlessbreen Group, quartzite
Grid code 635

Volume m³	1164956584
Volume km³	1,164956584
Rock type	Quartzite

Comfortlessbreen Group, diamictite
Grid code 636

Volume m³	56005836877
Volume km³	56,00583688
Rock type	Diamictite

Alkhornet Formation carbonate rocks
Grid code 669

Volume m³	1597252150
Volume km³	1,59725215
Rock type	Carbonate

Moefjellet unit
Grid code 676

Volume m³	24791552806
Volume km³	24,79155281
Rock type	Dolostone

Trondheimfjella unit
Grid code 677

Volume m³	5144592564
Volume km³	5,144592564
Rock type	Phyllite

Carbonate rocks and phyllite probably Upp Prot
Grid code 1515

Volume m³	140914164,1
Volume km³	0,140914164
Rock type	Carbonate, phyllite

Green phyllite and greenschist (B)
Grid code 1534

Volume m³	238352760,8
Volume km³	0,238352761
Rock type	Phyllite, schist

Diamictite (F)
Grid code 1536

Volume m³	430918703,7
Volume km³	0,430918704
Rock type	Diamictite

B4

B4

Lilljeborgfjellet Formation
Grid code 181

Volume m³	1012989773
Volume km³	1,012989773
Rock type	Conglomerate

Wulffberget Formation
Grid code 185

Volume m³	74648843
Volume km³	0,074648843
Rock type	Conglomerate

Rabotdalen Formation
Grid code 186

Volume m³	74440281
Volume km³	0,074440281
Rock type	Sandstone

Princesse Alicefjellet Formation
Grid code 187

Volume m³	30492099
Volume km³	0,030492099
Rock type	Conglomerate

Andréebreen Group
Grid code 190

Volume m³	201290993
Volume km³	0,201290993
Rock type	Sandstone, siltstone

Frænkelrygg Formation
Grid code 191

Volume m³	491665
Volume km³	0,000491665
Rock type	Sandstone, siltstone

Dicksonfjorden Member
Grid code 205

Volume m³	23473755417
Volume km³	23,47375542
Rock type	Sandstone

Tavlefjellet Member
Grid code 243

Volume m³	14817413940
Volume km³	14,81741394
Rock type	Mudstone

Forkdalen Member
Grid code 244

Volume m³	187978000
Volume km³	0,187978
Rock type	Siltstone, mudstone, sandstone

Richarddalen Complex
Grid code 401

Volume m³	1783479414
Volume km³	1,783479414
Rock type	Megamagatite

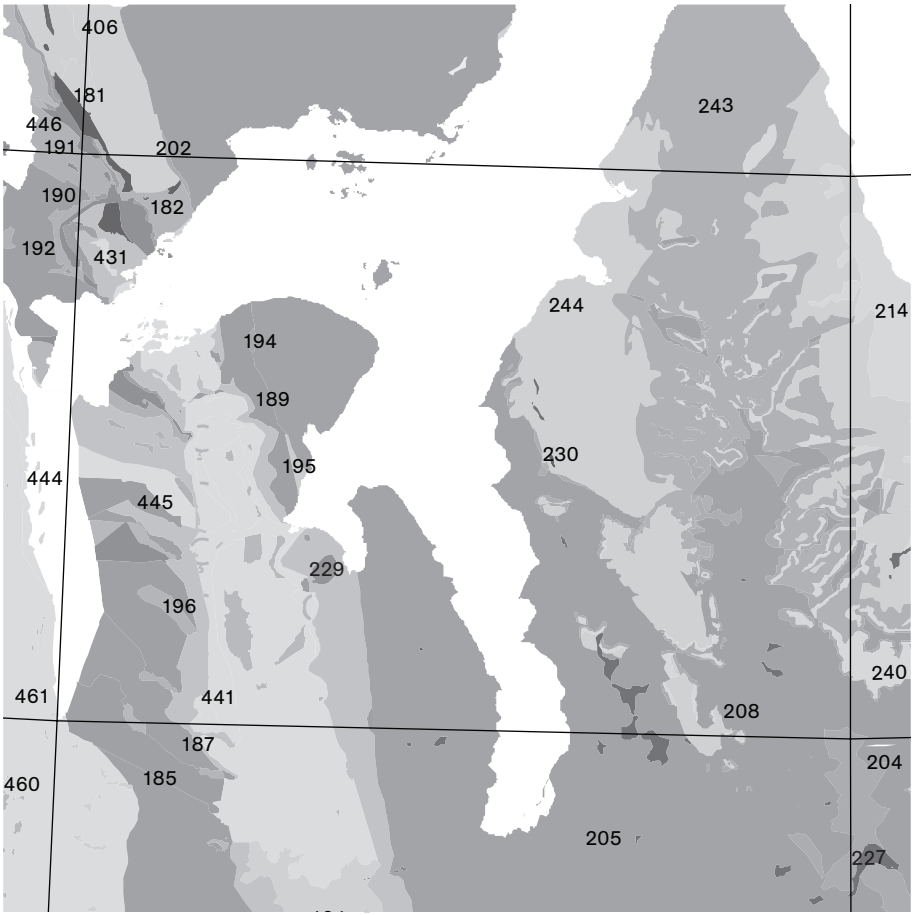
Biscayarhuken unit (mica schist and psammitic schist)
Grid code 406

Volume m³	12304808393
Volume km³	12,30480839
Rock type	Schist

Metagabbro
Grid code 415

Volume m³	16213865
Volume km³	0,016213865
Rock type	Metagabbro

B5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Lilljeborgfjellet Formation
Grid code 181

Volume m³	2769763233
Volume km³	2,769763233
Rock type	Conglomerate

Albertbreen Formation
Grid code 182

Volume m³	3635382955
Volume km³	3,635382955
Rock type	Sandstone

Wulffberget Formation
Grid code 185

Volume m³	15284775534
Volume km³	15,28477553
Rock type	Conglomerate

Princesse Alicefjellet Formation
Grid code 187

Volume m³	2620349371
Volume km³	2,620349371
Rock type	Conglomerate

Småbreen sandstones
Grid code 189

Volume m³	6693125497
Volume km³	6,693125497
Rock type	Sandstone

Andréebreen Group
Grid code 190

Volume m³	9367354242
Volume km³	9,367354242
Rock type	Sandstone, siltstone

Frænkelrygg Formation
Grid code 191

Volume m³	6576563535
Volume km³	6,576563535
Rock type	Sandstone, siltstone

Ben Nevis Formation
Grid code 192

Volume m³	27762539929
Volume km³	27,76253993
Rock type	Sandstone

Brotfjellet conglomerate
Grid code 194

Volume m³	292933730
Volume km³	0,29293373
Rock type	Conglomerate

Germaniabekken conglomerate
Grid code 195

Volume m³	152340941
Volume km³	0,152340941
Rock type	Conglomerate

Schivefjellet Member
Grid code 196

Volume m³	4810021545
Volume km³	4,810021545
Rock type	Conglomerate

Fotkollen sandstones upper division
Grid code 202

Volume m³	278432008
Volume km³	0,278432008
Rock type	Sandstone

Austfjorden Member
Grid code 204

Volume m³	81702080
Volume km³	0,08170208
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	202498734765
Volume km³	202,4987348
Rock type	Sandstone

Verdalen Member
Grid code 208

Volume m³	21082666723
Volume km³	21,08266672
Rock type	Carbonate

Wijde Bay Formation
Grid code 214

Volume m³	1257955228
Volume km³	1,257955228
Rock type	Siltstone, shalestone, sandstone

Tertiary basalt
Grid code 227

Volume m³	6463830593
Volume km³	6,463830593
Rock type	Basalt

Other quaternary volcanic rocks
Grid code 229

Volume m³	582663870
Volume km³	0,58266387
Rock type	Volcanics

Erosive remains of basalt
Grid code 230

Volume m³	112221124
Volume km³	0,112221124
Rock type	Basalt

Skamdalen Member
Grid code 240

Volume m³	13599862725
Volume km³	13,59986272
Rock type	Siltstone, mudstone

Tavlefjellet Member
Grid code 243

Volume m³	122271899279
Volume km³	122,2718993
Rock type	Mudstone

Forkdalen Member
Grid code 244

Volume m³	109113414847
Volume km³	109,1134148
Rock type	Siltstone, mudstone, sandstone

Biscayarhuken unit (mica schist and psammitic schist)
Grid code 406

Volume m³	6417459953
Volume km³	6,417459953
Rock type	Schist

Generalfjella Formation
Grid code 431

Volume m³	43314058751
Volume km³	43,31405875
Rock type	Marble, pelties

SC: porphyroblastic gneisses
Grid code 441

Volume m³	18918440652
Volume km³	18,91844065
Rock type	Gneiss

SC: migmatites
Grid code 444

Volume m³	53073588913
Volume km³	53,07358891
Rock type	Migmatite

SC: migmatite with aplites
Grid code 445

Volume m³	20573936
Volume km³	0,020573936
Rock type	Migmatite

SC: late tectonic granites
Grid code 446

Volume m³	9149573142
Volume km³	9,149573142
Rock type	Granite

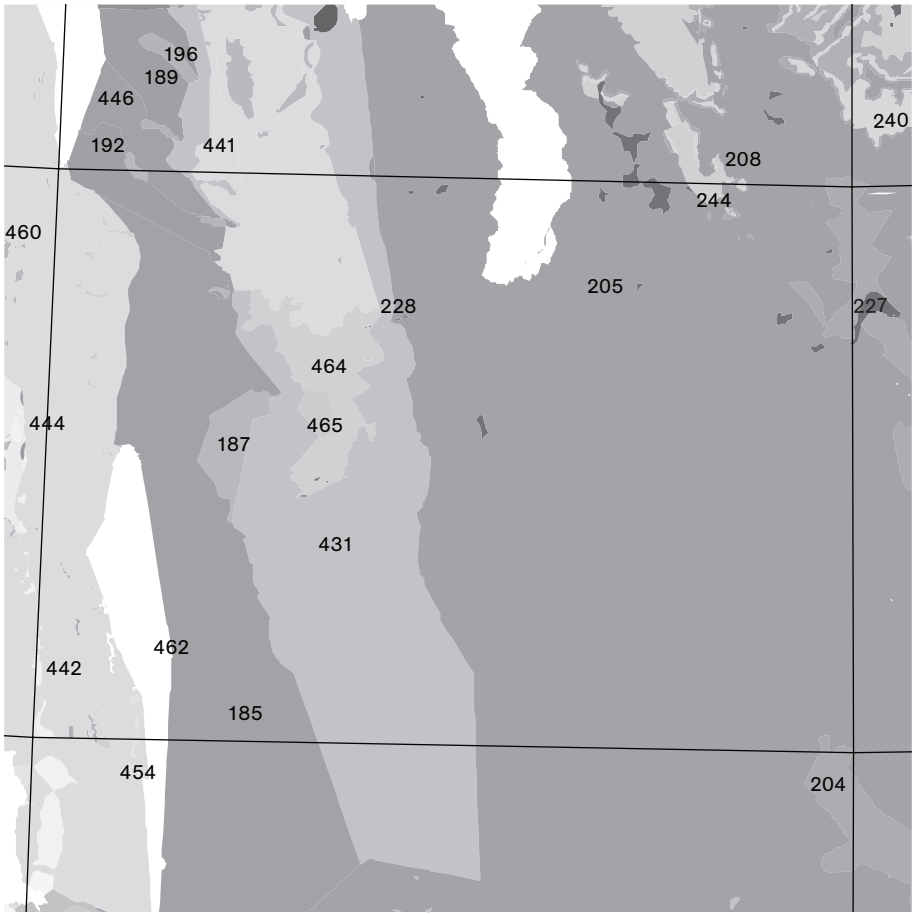
SF: micaceous schist
Grid code 460

Volume m³	17316572932
Volume km³	17,31657293
Rock type	Schist

SF: (garnet-) mica schist w. aplites
Grid code 461

Volume m³	12642541443
Volume km³	12,64254144
Rock type	Schist

B6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Wulffberget Formation
Grid code 185

Volume m³	1,71671E+11
Volume km³	171,6712653
Rock type	Conglomerate

Princesse Alicefjellet Formation
Grid code 187

Volume m³	17674425546
Volume km³	17,67442555
Rock type	Conglomerate

Småbreen sandstones
Grid code 189

Volume m³	1121026,1
Volume km³	0,001121026
Rock type	Sandstone

Ben Nevis Formation
Grid code 192

Volume m³	11228969941
Volume km³	11,22896994
Rock type	Sandstone

Schivefjellet Member
Grid code 196

Volume m³	683494629,9
Volume km³	0,68349463
Rock type	Conglomerate

Austfjorden Member
Grid code 204

Volume m³	4393158829
Volume km³	4,393158829
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	6,02092E+11
Volume km³	602,0924331
Rock type	Sandstone

Verdalen Member
Grid code 208

Volume m³	897128210,6
Volume km³	0,897128211
Rock type	Carbonate

Tertiary basalt
Grid code 227

Volume m³	4219763794
Volume km³	4,219763794
Rock type	Basalt

Quaternary basalt
Grid code 228

Volume m³	149728680,3
Volume km³	0,14972868
Rock type	Basalt

Skamdalen Member
Grid code 240

Volume m³	238776030,3
Volume km³	0,23877603
Rock type	Siltstone, mudstone

Forkdalen Member
Grid code 244

Volume m³	3116167153
Volume km³	3,116167153
Rock type	Siltstone, mudstone, sandstone

Generalfjella Formation
Grid code 431

Volume m³	2,30368E+11
Volume km³	230,3679639
Rock type	Marble

SC: porphyroblastic gneisses
Grid code 441

Volume m³	462077196,2
Volume km³	0,462077196
Rock type	Gneiss

SC: granitic orthogneisses
Grid code 442

Volume m³	267297469,2
Volume km³	0,267297469
Rock type	Gneiss

SC: migmatites
Grid code 444

Volume m³	1,56715E+11
Volume km³	156,7148809
Rock type	Migmatites

SC: late tectonic granites
Grid code 446

Volume m³	37775688,69
Volume km³	0,037775689
Rock type	Granite

Unknown
Grid code 454

Volume m³	144600915,9
Volume km³	0,144600916
Rock type	Unknown

SF: micaceous schist
Grid code 460

Volume m³	5833743,569
Volume km³	0,005833744
Rock type	Schist

SF: (garnet-) mica schist w. aplites
Grid code 462

Volume m³	49336437234
Volume km³	49,33643723
Rock type	Schist

SF: various metasediments
Grid code 464

Volume m³	46515168775
Volume km³	46,51516878
Rock type	Metasediments

SF: marble
Grid code 465

Volume m³	4594237642
Volume km³	4,594237642
Rock type	Marble

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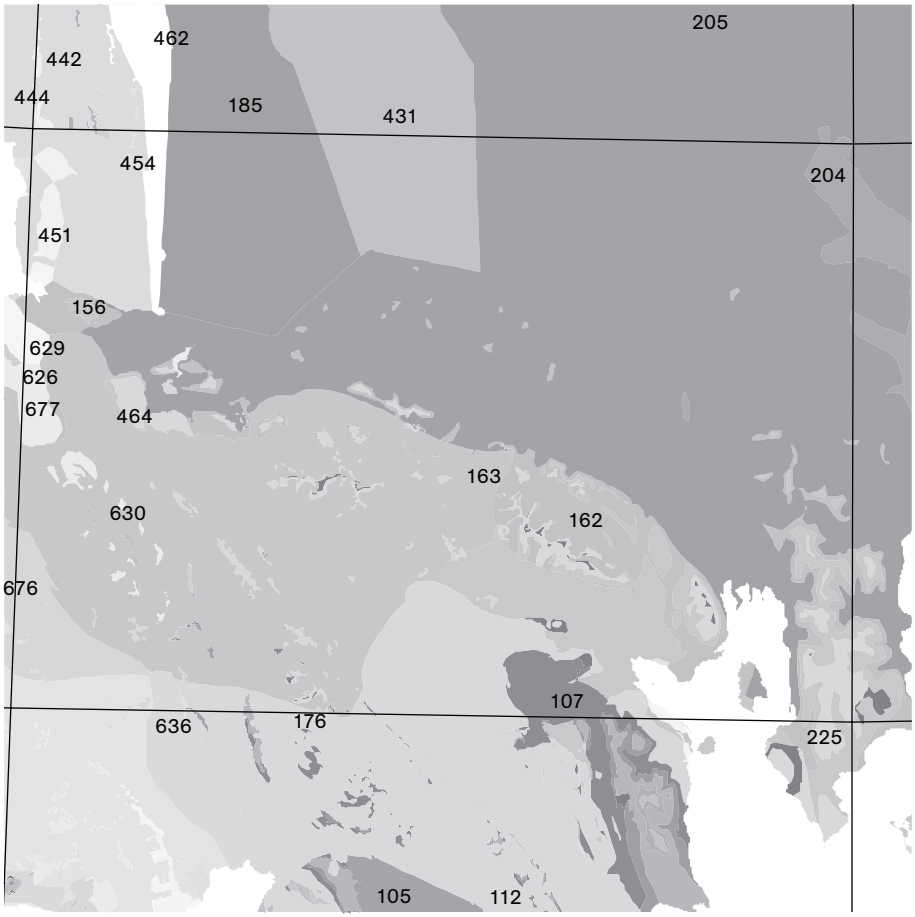
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Sassendalen Group
Grid code 105

Volume m³	250736423,7
Volume km³	0,250736424
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	3170703094
Volume km³	3,170703094
Rock type	Shale, siltstone, sandstone

Bravaisberget Formation
Grid code 112

Volume m³	96635629,79
Volume km³	0,09663563
Rock type	Mudstone, siltstone, sandstone

Scheteligfjellet Formation
Grid code 156

Volume m³	311708263,7
Volume km³	0,311708264
Rock type	Carbonate rocks, calcareous sandstone, conglomerate and sedimentary breccia (Carbonates 8:2 sst)

Wordiekammen Formation
Grid code 162

Volume m³	47393359771
Volume km³	47,39335977
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	32263527749
Volume km³	32,26352775
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Kapp Starostin Formation
Grid code 176

Volume m³	54858954499
Volume km³	54,8589545
Rock type	Siltstone, sandstone, limestone (1:1)

Wulffberget Formation
Grid code 185

Volume m³	99179221590
Volume km³	99,17922159
Rock type	Conglomerate

Austfjorden Member
Grid code 204

Volume m³	2408956119
Volume km³	2,408956119
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	3,97084E+11
Volume km³	397,0842377
Rock type	Sandstone

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	2365645584
Volume km³	2,365645584
Rock type	Dolerite

Generalfjella Formation
Grid code 431

Volume m³	76498839362
Volume km³	76,49883936
Rock type	Marble

SC: granitic orthogneisses
Grid code 442

Volume m³	409603943,9
Volume km³	0,409603944
Rock type	Gneiss

SC: migmatites
Grid code 444

Volume m³	27065065901
Volume km³	27,0650659
Rock type	Migmatites

GF: upper banded marbles
Grid code 451

Volume m³	157057560,2
Volume km³	0,15705756
Rock type	Marble

Unknown
Grid code 454

Volume m³	527693117,1
Volume km³	0,527693117
Rock type	Unknown

SF: (garnet-)mica schist w. aplites
Grid code 462

Volume m³	10181822636
Volume km³	10,18182264
Rock type	Schist

SF: various metasediments
Grid code 464

Volume m³	476106920,6
Volume km³	0,476106921
Rock type	Metasediments

Nielsenfjellet unit
Grid code 626

Volume m³	3419554765
Volume km³	3,419554765
Rock type	Schist

Steenfjellet unit
Grid code 629

Volume m³	769788459,8
Volume km³	0,76978846
Rock type	Dolomitic marble

Bogegga unit
Grid code 630

Volume m³	2,33415E+11
Volume km³	233,414807
Rock type	Schist

Comfortlessbreen Group, diamictite
Grid code 636

Volume m³	243800478,6
Volume km³	0,243800479
Rock type	Diamictite

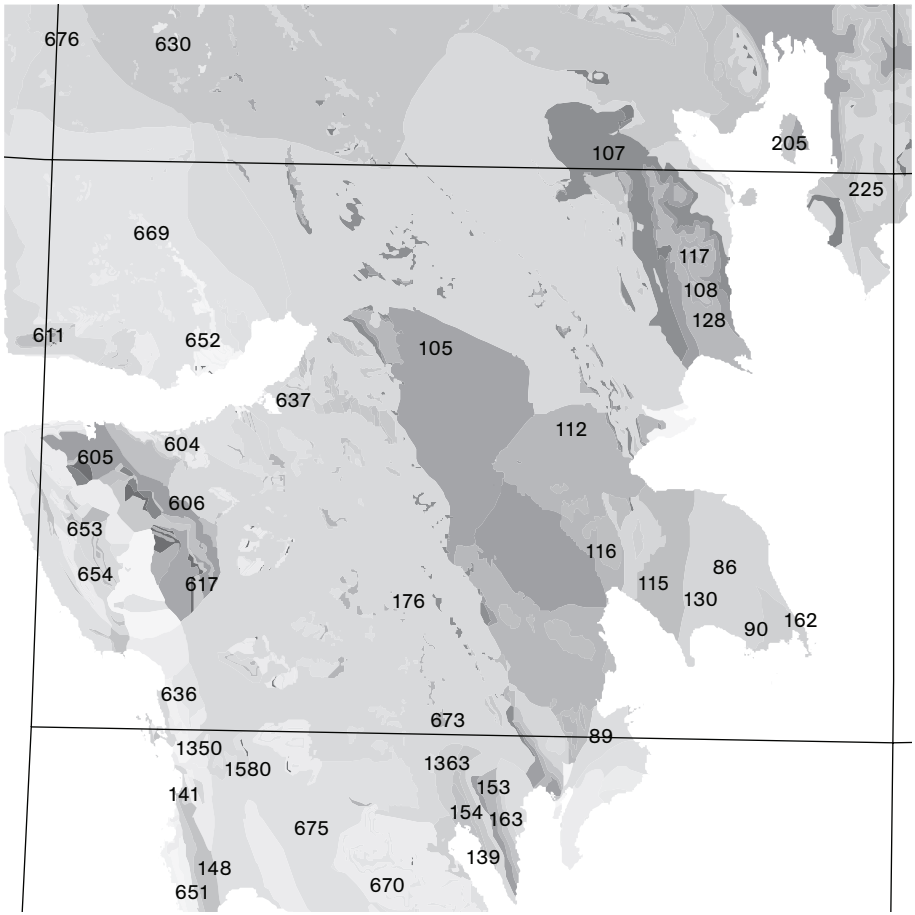
Moefjellet unit
Grid code 676

Volume m³	6653260973
Volume km³	6,653260973
Rock type	Dolostone

Trondheimfjella unit
Grid code 677

Volume m³	43623143,7
Volume km³	0,043623144
Rock type	Diamictite

B8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B8

Janusfjellet Subgroup
Grid code 86

Volume m³	13331078358
Volume km³	13,33107836
Rock type	Shale, siltstone, sandstone

Helvetiafjellet and Carolinefjellet Formations
Grid code 89

Volume m³	7713299,484
Volume km³	0,007713299
Rock type	Sandstone, coal, siltstone, shale, conglomerate

Helvetiafjellet Formation
Grid code 90

Volume m³	1429938915
Volume km³	1,429938915
Rock type	Sandstone, coal, shale, conglomerate

Sassendalen Group
Grid code 105

Volume m³	46555241729
Volume km³	46,55524173
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	30290969471
Volume km³	30,29096947
Rock type	Shale, siltstone, sandstone

Tvillingodden Formation
Grid code 108

Volume m³	26971215294
Volume km³	26,97121529
Rock type	Shale, siltstone, sandstone

Bravaisberget Formation
Grid code 112

Volume m³	56301540229
Volume km³	56,30154023
Rock type	Mudstone, siltstone, sandstone

Kapp Toscana Group
Grid code 115

Volume m³	14353107424
Volume km³	14,35310742
Rock type	Shale, siltstone, sandstone

Storfjorden Subgroup
Grid code 116

Volume m³	82391498,15
Volume km³	0,082391498
Rock type	Shale, siltstone, sandstone

Tschermakfjellet Formation
Grid code 117

Volume m³	1386792945
Volume km³	1,386792945
Rock type	Shale

De Geerdalen F and Wilhelmøya SG
Grid code 128

Volume m³	648804613,3
Volume km³	0,648804613
Rock type	Sandstone, shale

Billefjorden Group
Grid code 130

Volume m³	4318,1109
Volume km³	4,31811E-06
Rock type	Sandstone, shale, conglomerate

Orustdalen Formation
Grid code 139

Volume m³	690554786,5
Volume km³	0,690554787
Rock type	Sandstone

Vegardfjella Formation
Grid code 141

Volume m³	437328731,3
Volume km³	0,437328731
Rock type	Mudstone, sandstone, coaly shale

Gipsdalen Group
Grid code 148

Volume m³	31546659,66
Volume km³	0,03154666
Rock type	Various carbonate and clastic rocks, evaporites

Petrellskaret Formation
Grid code 153

Volume m³	902651544,1
Volume km³	0,902651544
Rock type	Shale, sandstone

Tårnkanten Formation
Grid code 154

Volume m³	1127468899
Volume km³	1,127468899
Rock type	Sandstone

Wordiekammen Formation
Grid code 162

Volume m³	2552402630
Volume km³	2,55240263
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	14173970399
Volume km³	14,1739704
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Kapp Starostin Formation
Grid code 176

Volume m³	3,52608E+11
Volume km³	352,6076263
Rock type	Siltstone, sandstone, limestone (1:1)

Dicksonfjorden Member
Grid code 205

Volume m³	986452194,2
Volume km³	0,986452194
Rock type	Sandstone

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	2163079968
Volume km³	2,163079968
Rock type	Dolerite

Holmeslettfj F without Bullt cgl
Grid code 604

Volume m³	4797741302
Volume km³	4,797741302
Rock type	Slate

Bulltinden Conglomerate Member
Grid code 605

Volume m³	3279713340
Volume km³	3,27971334
Rock type	Conglomerates

Motalafjella Formation
Grid code 606

Volume m³	2710261818
Volume km³	2,710261818
Rock type	Slate, limestone (3/5 - 2/5)

Vestgøtabreen Complex: magnesite rocks
Grid code 611

Volume m³	199999342,4
Volume km³	0,199999342
Rock type	Magnesite Rocks

Vestgøtabreen Complex: greenstone
Grid code 613

Volume m³	608871597,5
Volume km³	0,608871597
Rock type	Greenstone

Vestgøtabreen Complex: phyllite w greenst serpent qtze lmst lenses
Grid code 617

Volume m³	1423579807
Volume km³	1,423579807
Rock type	Phyllite

Vestgøtabreen Complex: schistose limestone
Grid code 618

Volume m³	402278301,8
Volume km³	0,402278302
Rock type	Schist

Vestgøtabreen Complex: gnt-chl-mica schist glaucoph sch eclogite
Grid code 619

Volume m³	519802723,2
Volume km³	0,519802723
Rock type	Schist, eclogite

Bogegga unit
Grid code 630

Volume m³	11111939413
Volume km³	11,11193941
Rock type	Schist

Comfortlessbreen Group, diamictite
Grid code 636

Volume m³	15436808191
Volume km³	15,43680819
Rock type	Diamictite

Comfortlessbreen Group, carbonate rocks
Grid code 637

Volume m³	392428112
Volume km³	0,392428112
Rock type	Carbonate

Daudmannsodden Group carbonate rocks
Grid code 651

Volume m³	1162109769
Volume km³	1,162109769
Rock type	Carbonate

Daudmannsodden Group slate and pyllite/phyllitic pelite
Grid code 652

Volume m³	1826210304
Volume km³	1,826210304
Rock type	Slate, phyllite

Daudmannsodden Group metasandstone
Grid code 653

Volume m³	2801787384
Volume km³	2,801787384
Rock type	Metasediments

Daudmannsodden Group quartzite bands
Grid code 654

Volume m³	432949505,9
Volume km³	0,432949506
Rock type	Quartzite

Alkhornet Formation carbonate rocks
Grid code 669

Volume m³	43447217749
Volume km³	43,44721775
Rock type	Carbonate

Alkhornet Formation phyllite
Grid code 670

Volume m³	10305268433
Volume km³	10,30526843
Rock type	Phyllite

Trollheimen Volcanic Mb
Grid code 673

Volume m³	2660958828
Volume km³	2,660958828
Rock type	Volcanites

Løvliebreen F areno-argillaceous phyllite
Grid code 675

Volume m³	11942542368
Volume km³	11,94254237
Rock type	Phyllite

Moefjellet unit
Grid code 676

Volume m³	1277119577
Volume km³	1,277119577
Rock type	Dolostone

Bellsund Diamictite Group
Grid code 1350

Volume m³	5558779,621
Volume km³	0,00555878
Rock type	Diamictite

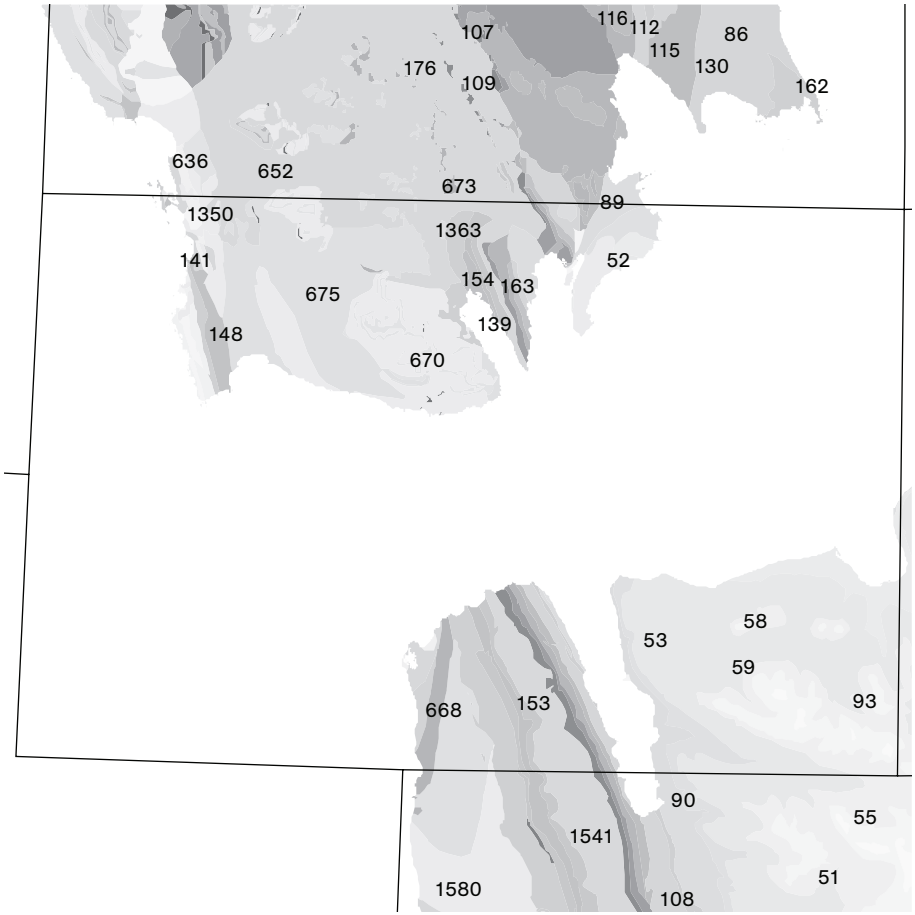
Kapp Lyell unit: phyllite with clasts
Grid code 1363

Volume m³	21050066,4
Volume km³	0,021050066
Rock type	Phyllite

Dolerite and metagabbro probably Upp Prot
Grid code 1580

Volume m³	155897787,5
Volume km³	0,155897787
Rock type	Dolerite, metagabbro

B9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B9

Firkanten Formation
Grid code 51

Volume m³	1105488208
Volume km³	1,105488208
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	799767170,4
Volume km³	0,79976717
Rock type	Shale, mudstone, siltstone

Sarkofagen Formation
Grid code 53

Volume m³	26882697454
Volume km³	26,88269745
Rock type	Sandstone

Frysjaodden Formation
Grid code 55

Volume m³	12196350267
Volume km³	12,19635027
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	14104511115
Volume km³	14,10451111
Rock type	Sandstone, siltstone, shale

Aspelintoppen Formation
Grid code 59

Volume m³	1375124175
Volume km³	1,375124175
Rock type	Sandstone, siltstone, mudstone

Janusfjellet Subgroup
Grid code 86

Volume m³	1754075873
Volume km³	1,754075873
Rock type	Shale, siltstone, sandstone

Helvetiafjellet and Carolinefjellet Formations
Grid code 89

Volume m³	1017423564
Volume km³	1,017423564
Rock type	Sandstone,shale, siltstone, conglomerate

Helvetiafjellet Formation
Grid code 90

Volume m³	51464350,24
Volume km³	0,05146435
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	361555567,4
Volume km³	0,361555567
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	1384485454
Volume km³	1,384485454
Rock type	Shale, siltstone, sandstone

Tvillingodden Formation
Grid code 108

Volume m³	871648480,3
Volume km³	0,87164848
Rock type	Shale, siltstone, sandstone

Vikinghøgda Formation
Grid code 109

Volume m³	750818276,9
Volume km³	0,750818277
Rock type	Shale, siltstone

Bravaisberget Formation
Grid code 112

Volume m³	1905757497
Volume km³	1,905757497
Rock type	Mudstone, siltstone, sandstone

Kapp Toscana Group
Grid code 115

Volume m³	704783809,9
Volume km³	0,70478381
Rock type	Shale, siltstone, sandstone

Storfjorden Subgroup
Grid code 116

Volume m³	556381518,9
Volume km³	0,556381519
Rock type	Shale, siltstone, sandstone

Billefjorden Group
Grid code 130

Volume m³	63051881,34
Volume km³	0,063051881
Rock type	Sandstone, shale, conglomerate

Orustdalen Formation
Grid code 139

Volume m³	3080785544
Volume km³	3,080785544
Rock type	Sandstone

Vegardfjella Formation
Grid code 141

Volume m³	10086763,3
Volume km³	0,010086763
Rock type	Mudstone, sandstone, coaly shale

Gipsdalen Group
Grid code 148

Volume m³	145049486,2
Volume km³	0,145049486
Rock type	Various carbonate and clastic rocks, evaporites

Petrellskaret Formation
Grid code 153

Volume m³	117062427,6
Volume km³	0,117062428
Rock type	Shale, sandstone

Tårnkanten Formation
Grid code 154

Volume m³	81510448,78
Volume km³	0,081510449
Rock type	Sandstone

Wordiekammen Formation
Grid code 162

Volume m³	746377609,9
Volume km³	0,74637761
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	2092073413
Volume km³	2,092073413
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Kapp Starostin Formation
Grid code 176

Volume m³	21051740631
Volume km³	21,05174063
Rock type	Siltstone, sandstone, limestone (1:1)

Daudmannsodden Group carbonate rocks
Grid code 636

Volume m³	67381291,07
Volume km³	0,067381291
Rock type	Carbonate

Daudmannsodden Group slate and pyllite/phyllitic pelite
Grid code 652

Volume m³	27266788,48
Volume km³	0,027266788
Rock type	Phyllite

Alkhornet Formation
Grid code 668

Volume m³	119629557,3
Volume km³	0,119629557
Rock type	Calcarbonate, phyllites

Alkhornet Formation carbonate rocks
Grid code 669

Volume m³	3876080199
Volume km³	3,876080199
Rock type	Carbonate

Alkhornet Formation phyllite
Grid code 670

Volume m³	16591348907
Volume km³	16,591348907
Rock type	Phyllite

Trollheimen Volcanic Mb
Grid code 673

Volume m³	380851605,9
Volume km³	0,380851606
Rock type	Volcanite

Løvliebreen F areno-argillaceous phyllite
Grid code 675

Volume m³	14928291666
Volume km³	14,92829167
Rock type	Phyllite

Bellsund Diamictite Group
Grid code 1350

Volume m³	26257366,92
Volume km³	0,026257367
Rock type	Diamictite

Kapp Lyell unit: phyllite with clasts
Grid code 1363

Volume m³	29162367,11
Volume km³	0,029162367
Rock type	Phyllite

Malmberget unit undiff
Grid code 1484

Volume m³	170703590,2
Volume km³	0,17070359
Rock type	Marble

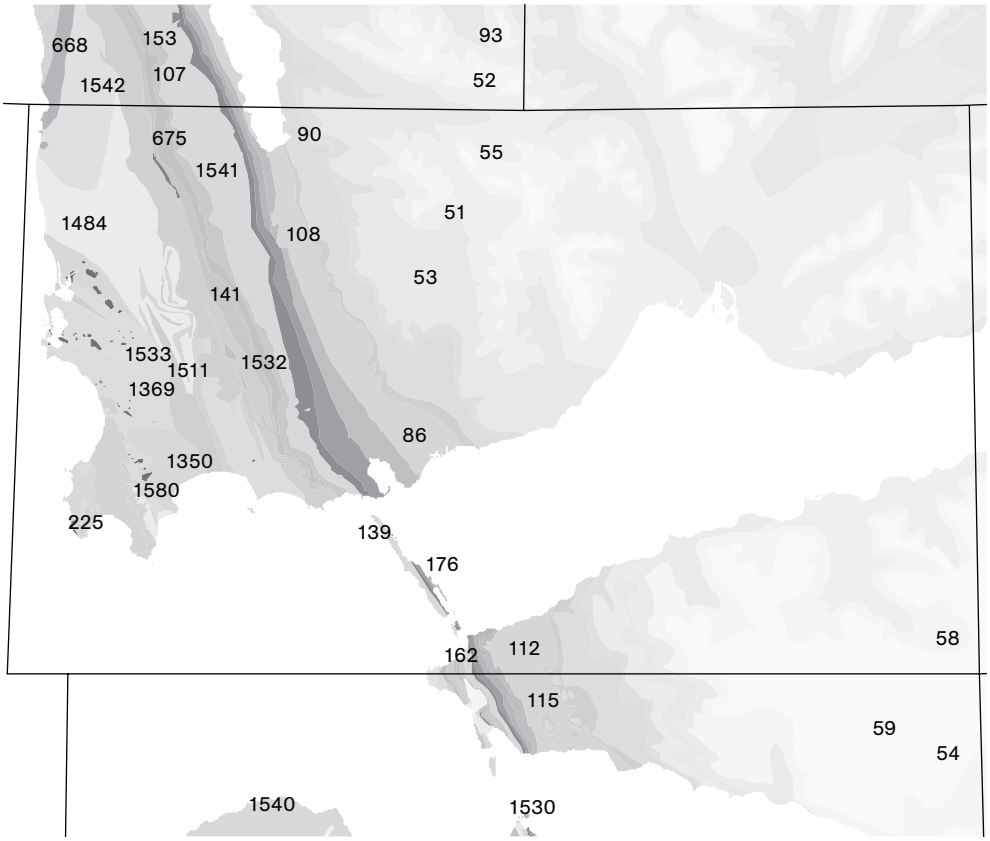
Höferpynt Formation og mulige ekvivalenter
Grid code 1541

Volume m³	9941085,604
Volume km³	0,009941086
Rock type	Marble

Dolerite and metagabbro
probably Upp Prot
Grid code 1580

Volume m^3	89865286,83
Volume km^3	0,089865287
Rock type	Dolerite, metagabbro

B10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B10

Firkanten Formation
Grid code 51

Volume m³	5405689646
Volume km³	5,405689646
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	8513972296
Volume km³	8,513972296
Rock type	Shale, mudstone, siltstone

Sarkofagen Formation
Grid code 53

Volume m³	33296131997
Volume km³	33,296132
Rock type	Sandstone

Grumantbyen Formation
Grid code 54

Volume m³	3736578356
Volume km³	3,736578356
Rock type	Sandstone

Frysjaodden Formation
Grid code 55

Volume m³	65752003304
Volume km³	65,7520033
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	73362309490
Volume km³	73,36230949
Rock type	Sandstone, siltstone, shale

Aspelintoppen Formation
Grid code 59

Volume m³	78521699060
Volume km³	78,52169906
Rock type	Sandstone, siltstone, mudstone

Janusfjellet Subgroup
Grid code 86

Volume m³	14712925467
Volume km³	14,71292547
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 90

Volume m³	2967094659
Volume km³	2,967094659
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	11050695599
Volume km³	11,0506956
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	6060056547
Volume km³	6,060056547
Rock type	Shale, siltstone, sandstone

Tvillingodden Formation
Grid code 108

Volume m³	5536403633
Volume km³	5,536403633
Rock type	Shale, siltstone, sandstone

Bravaisberget Formation
Grid code 112

Volume m³	1087656374
Volume km³	1,087656374
Rock type	Mudstone, siltstone, sandstone

Kapp Toscana Group
Grid code 115

Volume m³	5258446386
Volume km³	5,258446386
Rock type	Shale, siltstone, sandstone

Orustdalen Formation
Grid code 139

Volume m³	9554242446
Volume km³	9,554242446
Rock type	Sandstone

Sergeijevfjellet Formation
Grid code 140

Volume m³	2915780287
Volume km³	2,915780287
Rock type	Sandstone, shale

Vegardfjella Formation
Grid code 141

Volume m³	150900993,2
Volume km³	0,150900993
Rock type	Mudstone, sandstone, coaly shale

Petrellskaret Formation
Grid code 153

Volume m³	682339761,2
Volume km³	0,682339761
Rock type	Shale, sandstone

Wordiekammen Formation
Grid code 162

Volume m³	4312230877
Volume km³	4,312230877
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	5498195823
Volume km³	5,498195823
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Kapp Starostin Formation
Grid code 176

Volume m³	19614799762
Volume km³	19,61479976
Rock type	Siltstone, sandstone, limestone (1:1)

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	163664636
Volume km³	0,163664636
Rock type	Dolerite

Alkhornet Formation
Grid code 668

Volume m³	3440015,628
Volume km³	0,003440016
Rock type	Carbonate, phyllite

Løvliebreen F areno-argillaceous phyllite
Grid code 675

Volume m³	1366647713
Volume km³	1,366647713
Rock type	Phyllite

Bellsund Diamictite Group
Grid code 1350

Volume m³	567658611,4
Volume km³	0,567658611
Rock type	Diamictite

Lågneset Formation phyllite shale qtze
Grid code 1369

Volume m³	670766216,6
Volume km³	0,670766217
Rock type	Phyllite, shale, quartzite

Malmberget unit undiff
Grid code1484

Volume m³	7188551171
Volume km³	7,188551171
Rock type	Marble

Massive dolomite Upp Prot to Late Pal
Grid code 1511

Volume m³	15612139,16
Volume km³	0,015612139
Rock type	Dolomite

Proterozoic marbles
Grid code 1530

Volume m³	1396234610
Volume km³	1,39623461
Rock type	Marble

Proterozoic quartzite
Grid code 1532

Volume m³	1352218403
Volume km³	1,352218403
Rock type	Quartzite, schist

Proterozoic phyllite
Grid code 1533

Volume m³	2596860133
Volume km³	2,596860133
Rock type	Phyllite

Slyngfjellkonglomeratet og mulige ekvivalenter
Grid code 1540

Volume m³	46890990,12
Volume km³	0,04689099
Rock type	Conglomerate

Höferpynt Formation og mulige ekvivalenter
Grid code 1541

Volume m³	369358519,2
Volume km³	0,369358519
Rock type	Dolomite

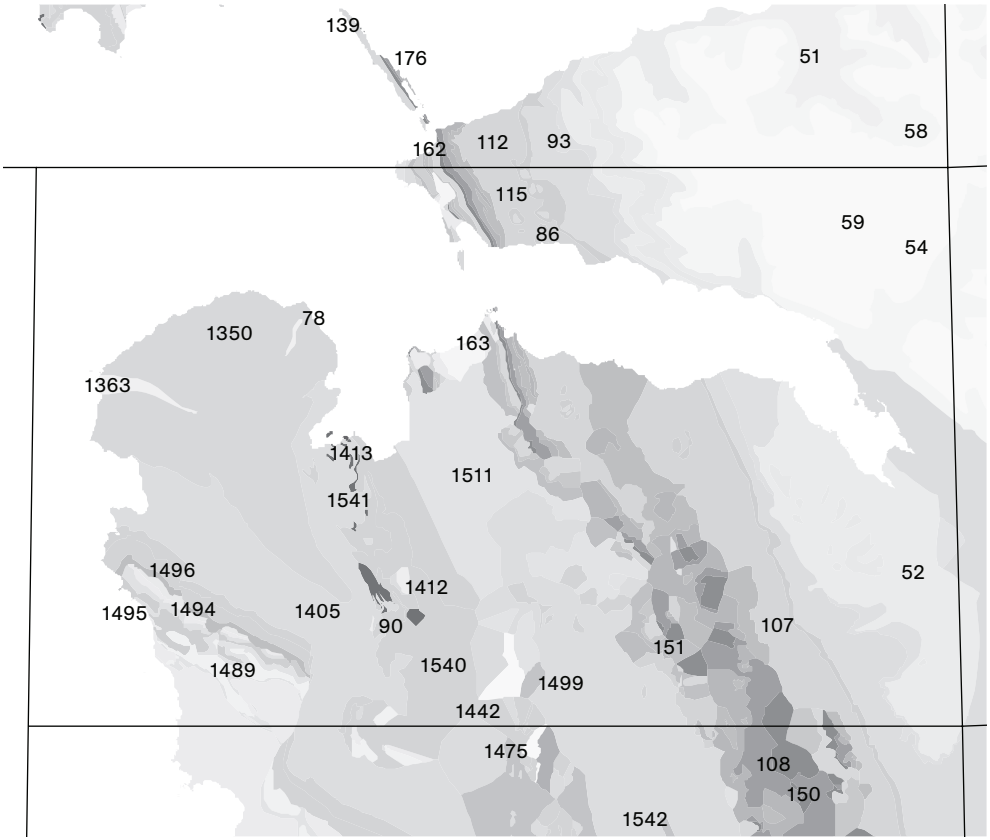
Gåshamn Formation og mulige ekvivalenter
Grid code 1542

Volume m³	2385378099
Volume km³	2,385378099
Rock type	Phyllite

Dolerite and metagabbro probably Upp Prot
Grid code 1580

Volume m³	15591121,23
Volume km³	0,015591121
Rock type	Dolerite, metagabbro

B11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B11

Firkanten Formation
Grid code 51

Volume m³	4156658169
Volume km³	4,156658169
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	27416318046
Volume km³	27,41631805
Rock type	Shale, mudstone, siltstone

Grumantbyen Formation
Grid code 54

Volume m³	7710552743
Volume km³	7,710552743
Rock type	Sandstone

Battfjellet Formation
Grid code 58

Volume m³	12401197929
Volume km³	12,40119793
Rock type	Sandstone, siltstone, shale

Aspelintoppen Formation
Grid code 59

Volume m³	44458154125
Volume km³	44,45815412
Rock type	Sandstone, siltstone, mudstone

Calypsostranda Group
Grid code 78

Volume m³	170345,625
Volume km³	0,000170346
Rock type	Sandstone, siltstone, shale, coal

Janusfjellet Subgroup
Grid code 86

Volume m³	34183913617
Volume km³	34,18391362
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 90

Volume m³	5507518012
Volume km³	5,507518012
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	14997905192
Volume km³	14,99790519
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	4157742503
Volume km³	4,157742503
Rock type	Shale, siltstone, sandstone

Tvillingodden Formation
Grid code 108

Volume m³	7455147103
Volume km³	7,455147103
Rock type	Shale, siltstone, sandstone

Bravaisberget Formation
Grid code 112

Volume m³	13874886079
Volume km³	13,87488608
Rock type	Mudstone, siltstone, sandstone

Kapp Toscana Group
Grid code 115

Volume m³	19305218978
Volume km³	19,30521898
Rock type	Shale, siltstone, sandstone

Orustdalen Formation
Grid code 139

Volume m³	202200926,8
Volume km³	0,202200927
Rock type	Sandstone

Hyrnefjellet Formation
Grid code 150

Volume m³	1106231046
Volume km³	1,106231046
Rock type	Conglomerate, sandstone

Treskelodden Formation
Grid code 151

Volume m³	9912224799
Volume km³	9,912224799
Rock type	Conglomerate, sandstone

Wordiekammen Formation
Grid code 162

Volume m³	73343763,41
Volume km³	0,073343763
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	4213203867
Volume km³	4,213203867
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Kapp Starostin Formation
Grid code 176

Volume m³	5296347674
Volume km³	5,296347674
Rock type	Siltstone, sandstone, limestone (1:1)

Bellsund Diamictite Group
Grid code 1350

Volume m³	47105679287
Volume km³	47,10567929
Rock type	Diamictite

Kapp Lyell unit: phyllite with clasts
Grid code 1363

Volume m³	521139806,2
Volume km³	0,521139806
Rock type	Phyllite

Thiisfjellet Formation
Grid code 1405

Volume m³	1154176279
Volume km³	1,154176279
Rock type	Limestone, conglomerate (1:1)

Diabasodden Suite
Grid code 1412

Volume m³	1438250855
Volume km³	1,438250855
Rock type	Dolerite

Asbestodden ultramafites
Grid code 1413

Volume m³	391950,8124
Volume km³	0,000391951
Rock type	Ultramafites

Dunderdalen Formation calcareous green phyllite
Grid code 1418

Volume m³	482208320,3
Volume km³	0,48220832
Rock type	Phyllite

Skoddefjellet Formation
Grid code 1442

Volume m³	107975077,5
Volume km³	0,107975077
Rock type	Schist

Deilegga Group
Grid code 1475

Volume m³	1136436044
Volume km³	1,136436044
Rock type	Conglomerate, dolomite, slate

Botnedalen Formation
Grid code 1489

Volume m³	51610500,32
Volume km³	0,0516105
Rock type	Carbonates, phyllite

Unknown
Grid code 1490

Volume m³	334721600,2
Volume km³	0,3347216
Rock type	Unknown

Trinutane Formation: lower part pink quartzite
Grid code 1494

Volume m³	652645876,6
Volume km³	0,652645877
Rock type	Quartzite

Trinutane Formation: upper part ferrous dol and pink marble
Grid code 1495

Volume m³	252764311,4
Volume km³	0,252764311
Rock type	Dolomite, marble

Thiisdalen Formation
Grid code 1496

Volume m³	224154208,8
Volume km³	0,224154209
Rock type	Phyllite, quartzite

Dørdalen Formation
Grid code 1497

Volume m³	247151682,4
Volume km³	0,247151682
Rock type	Carbonate, phyllite

Magnethøgda unit
Grid code 1499

Volume m³	255146394
Volume km³	0,255146394
Rock type	Carbonate, phyllite, quartzite

Massive dolomite Upp Prot to Late Pal
Grid code 1511

Volume m³	43372360562
Volume km³	43,37236056
Rock type	Dolomite

Slyngfjellkonglomeratet og mulige ekvivalenter
Grid code 1540

Volume m³	12967897084
Volume km³	12,96789708
Rock type	Conglomerate

Höferpynt Formation og mulige ekvivalenter
Grid code 1541

Volume m³	17011806423
Volume km³	17,01180642
Rock type	Dolomite

Gåshamn Formation og mulige ekvivalenter
Grid code 1542

Volume m³	41824041028
Volume km³	41,82404103
Rock type	Phyllite

B12


52
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1489
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1311
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131
1336

B12

Firkanten Formation
Grid code 51

Volume m³	712407478,3
Volume km³	0,712407478
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	1329606116
Volume km³	1,329606116
Rock type	Shale, mudstone, siltstone

Janusfjellet Subgroup
Grid code 86

Volume m³	22275554271
Volume km³	22,27555427
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 90

Volume m³	2495801591
Volume km³	2,495801591
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	8722622173
Volume km³	8,722622173
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	12043152886
Volume km³	12,04315289
Rock type	Shale, siltstone, sandstone

Tvillingodden Formation
Grid code 108

Volume m³	37454438058
Volume km³	37,45443806
Rock type	Shale, siltstone, sandstone

Bravaisberget Formation
Grid code 112

Volume m³	28640518432
Volume km³	28,64051843
Rock type	Mudstone, siltstone, sandstone

Kapp Toscana Group
Grid code 115

Volume m³	8495957221
Volume km³	8,495957221
Rock type	Shale, siltstone, sandstone

Adriabukta Formation
Grid code 131

Volume m³	14612898,28
Volume km³	0,014612898
Rock type	Shale, sandstone, conglomerate

Treskelen Subgroup
Grid code 149

Volume m³	605865712,5
Volume km³	0,605865713
Rock type	Conglomerate, sandstone

Hyrnefjellet Formation
Grid code 150

Volume m³	1913733091
Volume km³	1,913733091
Rock type	Conglomerate, sandstone

Treskelodden Formation
Grid code 151

Volume m³	2741053969
Volume km³	2,741053969
Rock type	Conglomerate, sandstone

Gipshuken Formation
Grid code 163

Volume m³	5542198423
Volume km³	5,542198423
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Kapp Starostin Formation
Grid code 176

Volume m³	5390809285
Volume km³	5,390809285
Rock type	Siltstone, sandstone, limestone (1:1)

Marietoppen Formation
Grid code 222

Volume m³	3104277593
Volume km³	3,104277593
Rock type	Sandstone

Sørkapp Land Gr without Wiederfjellet F
Grid code 1311

Volume m³	29475475394
Volume km³	29,47547539
Rock type	Psephites, psammites

Wiederfjellet Formation
Grid code 1315

Volume m³	911220446,6
Volume km³	0,911220447
Rock type	Quartzite

Sofiekammen Gr without Vardepiggen F
Grid code 1328

Volume m³	42712031832
Volume km³	42,71203183
Rock type	Carbonate

Vardepiggen Formation
Grid code 1336

Volume m³	807,76
Volume km³	8,0776E-07
Rock type	Marble

Jens Erikfjellet volcanites
Grid code 1397

Volume m³	4306137770
Volume km³	4,30613777
Rock type	Volcanites

Thiisfjellet Formation
Grid code 1405

Volume m³	473895790,3
Volume km³	0,47389579
Rock type	Limestone, conglomerate (1:1)

Skoddefjellet Formation
Grid code 1442

Volume m³	3971542897
Volume km³	3,971542897
Rock type	Schist

Ariekammen Formation
Grid code 1443

Volume m³	2080740508
Volume km³	2,080740508
Rock type	Marble

Revdalen Formation
Grid code 1444

Volume m³	440110538,8
Volume km³	0,440110539
Rock type	Schist

Eimfjellet Group: tuffaceous quartzites
Grid code 1447

Volume m³	1208029589
Volume km³	1,208029589
Rock type	Quarzite

Eimfjellet Group: amphibolites undiff
Grid code 1448

Volume m³	7383151520
Volume km³	7,38315152
Rock type	Amphibolites

Gulliksenfjellet quartzites
Grid code 1451

Volume m³	875268102,8
Volume km³	0,875268103
Rock type	Quartzite, amphibolites

Eimfjellet Group: dark phyllites locally w qtze layers
Grid code 1454

Volume m³	78998905,41
Volume km³	0,078998905
Rock type	Phyllite

Eimfjellet Group: quartzites and quartz mica schists
Grid code 1456

Volume m³	833765436,1
Volume km³	0,833765436
Rock type	Quartzite, schist

Eimfjellet Group: diamictites
Grid code 1457

Volume m³	13071383
Volume km³	0,013071383
Rock type	Diamictite

Deilegga Group
Grid code 1475

Volume m³	35884192675
Volume km³	35,88419268
Rock type	Conglomerate, dolomite, slate

Kapp Berg Formation
Grid code 1486

Volume m³	27643376706
Volume km³	27,64337671
Rock type	Phyllite, quartzite

Peder Kokkfjellet Formation
Grid code 1488

Volume m³	1498396602
Volume km³	1,498396602
Rock type	Carbonate

Botnedalen Formation
Grid code 1489

Volume m³	3775023510
Volume km³	3,77502351
Rock type	Carbonates, phyllite

Unknown
Grid code 1490

Volume m³	1216539783
Volume km³	1,216539783
Rock type	Unknown

Seljehaugen Formation: lower part black limestone
Grid code 1491

Volume m³	164085187
Volume km³	0,164085187
Rock type	Limestone

Seljehaugen Formation: upper part grey dolomite
Grid code 1492

Volume m³	73632684,72
Volume km³	0,073632685
Rock type	Dolomite

Trinutane Formation: lower part pink quartzite
Grid code 1494

Volume m³	845018785,6
Volume km³	0,845018786
Rock type	Quarzite

Trinutane Formation: upper part ferrous dol and pink marble
Grid code 1495

Volume m³	154923462,9
Volume km³	0,154923463
Rock type	Dolomite, marble

Thiisdalen Formation
Grid code 1496

Volume m³	74427538,12
Volume km³	0,074427538
Rock type	Phyllite, quartzite

Magnethøgda unit
Grid code 1499

Volume m³	3478848102
Volume km³	3,478848102
Rock type	Carbonate, phyllite, quartzite

Massive dolomite Upp Prot to Late Pal
Grid code 1511

Volume m³	1130770473
Volume km³	1,130770473
Rock type	Dolomite

Slyngfjellkonglomeratet og mulige ekvivalenter
Grid code 1540

Volume m³	40059232776
Volume km³	40,05923278
Rock type	Conglomerate

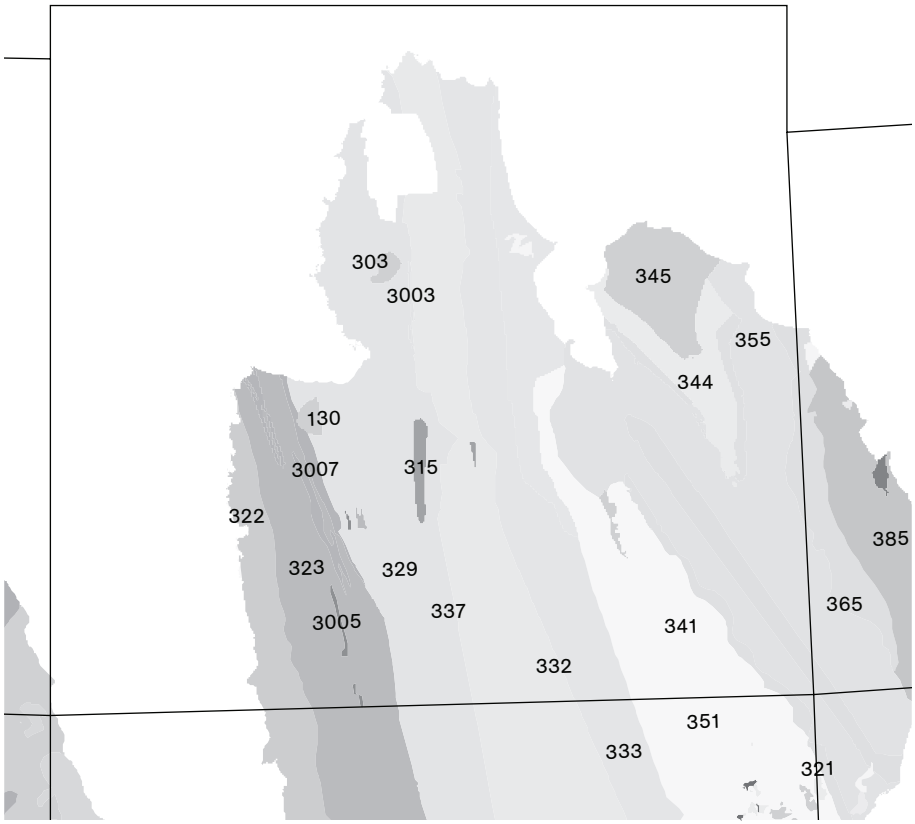
Höferpynt Formation og mulige ekvivalenter
Grid code 1541

Volume m³	14674605316
Volume km³	14,67460532
Rock type	Dolomite

Gåshamn Formation og mulige ekvivalenter
Grid code 1542

Volume m³	164599154001
Volume km³	164,599154
Rock type	Phyllite

C4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C4

Billefjorden Group
Grid code 130

Volume m³	1409566422
Volume km³	1,409566422
Rock type	Sandstone, shale, conglomerate

Smutsbreen unit
Grid code 303

Volume m³	486070193
Volume km³	0,486070193
Rock type	Metasediment

Instrumentbergenheten
Grid code 315

Volume m³	2491034308
Volume km³	2,491034308
Rock type	Granitoid

Sørbreen unit
Grid code 321

Volume m³	153890
Volume km³	0,00015389
Rock type	Quartzite, amphibolite

Vassfaret unit
Grid code 322

Volume m³	2171718936
Volume km³	2,171718936
Rock type	Metasediment

Bangenhuk unit
Grid code 323

Volume m³	14736358762
Volume km³	14,73635876
Rock type	Gneiss

Polhem- og Rittervatnenheten
Grid code 329

Volume m³	36270189945
Volume km³	36,27018994
Rock type	Psammites, amphibolites

Unknown
Grid code 332

Volume m³	8051999478
Volume km³	8,051999478
Rock type	Unknown

Unknown
Grid code 333

Volume m³	39216190506
Volume km³	39,21619051
Rock type	Unknown

Flåen subunit
Grid code 337

Volume m³	50311464106
Volume km³	50,31146411
Rock type	Semipelite, psammite, quartzite

Unknown
Grid code 341

Volume m³	8408628786
Volume km³	8,408628786
Rock type	Unknown

Glasgowbreen Formation
Grid code 344

Volume m³	10594682437
Volume km³	10,59468244
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	3543224675
Volume km³	3,543224675
Rock type	Quartzite, shale

Kortbreen Formation
Grid code 351

Volume m³	35623238277
Volume km³	35,62323828
Rock type	Quartzite, limestone

Akademikarbreen Group
Grid code 355

Volume m³	58357363693
Volume km³	58,35736369
Rock type	Dolomite, limestone

Unknown
Grid code 365

Volume m³	20096474502
Volume km³	20,0964745
Rock type	Unknown

Oslobregruppen (kambrium-ordovicium)
Grid code 385

Volume m³	4185070830
Volume km³	4,18507083
Rock type	Limestone, dolomite

Unknown
Grid code 3003

Volume m³	174501125
Volume km³	0,174501125
Rock type	Unknown

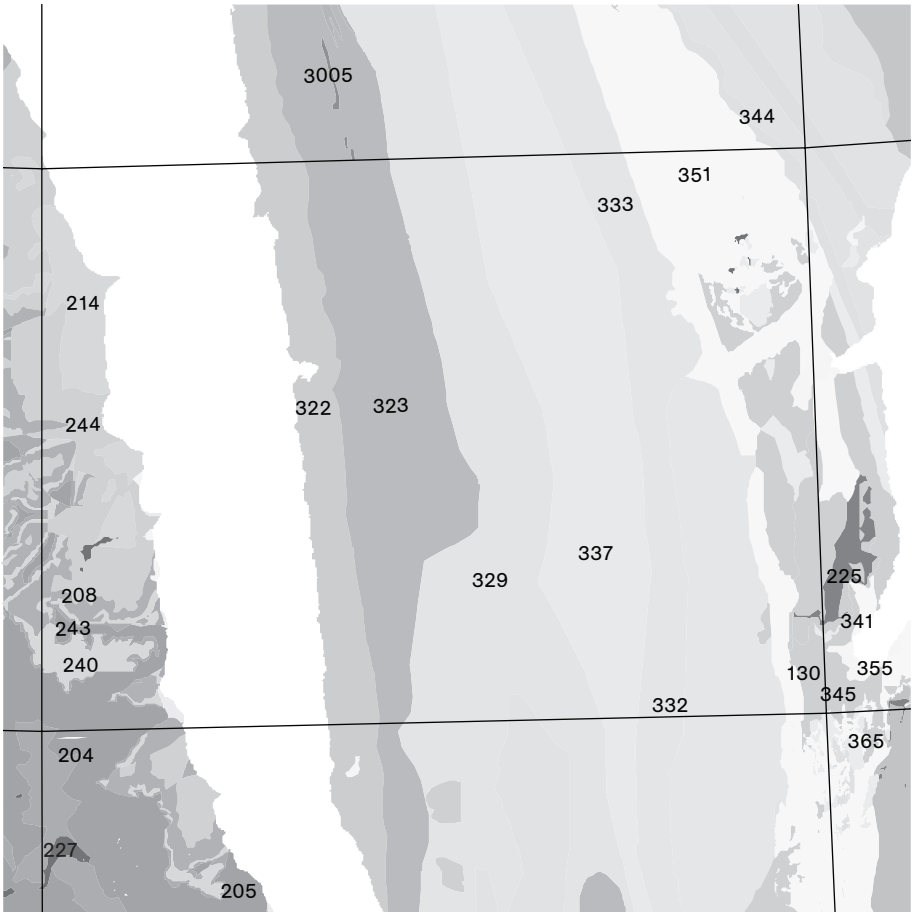
Unknown
Grid code 3005

Volume m³	362844630
Volume km³	0,36284463
Rock type	Unknown

Unknown
Grid code 3007

Volume m³	2089208012
Volume km³	2,089208012
Rock type	Unknown

C5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205

C5

Billefjorden Group
Grid code 130

Volume m³	20829753121,67
Volume km³	20,82975312
Rock type	Sandstone, shale, conglomerate

Austfjorden Member
Grid code 204

Volume m³	52754177,07
Volume km³	0,052754177
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	12251696388,11
Volume km³	12,25169639
Rock type	Sandstone

Verdalen Member
Grid code 208

Volume m³	3917980602,77
Volume km³	3,917980603
Rock type	Carbonate

Wijde Bay Formation
Grid code 214

Volume m³	14915183755,18
Volume km³	14,91518376
Rock type	Sandstone, siltstone, shale

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	7349730716,09
Volume km³	7,349730716
Rock type	Dolerite

Tertiary basalt
Grid code 227

Volume m³	1365635406,67
Volume km³	1,365635407
Rock type	Basalt

Skamdalen Member
Grid code 240

Volume m³	15417483225,93
Volume km³	15,41748323
Rock type	Siltstone, mudstone

Tavlefjellet Member
Grid code 243

Volume m³	12781468872,92
Volume km³	12,78146887
Rock type	Mudstone

Forkdalen Member
Grid code 244

Volume m³	33453619436,09
Volume km³	33,45361944
Rock type	Siltstone, mudstone, sandstone

Vassfaret unit
Grid code 322

Volume m³	29858565320,08
Volume km³	29,85856532
Rock type	Metasediment

Bangenhuk unit
Grid code 323

Volume m³	136303867938,62
Volume km³	136,3038679
Rock type	Gneiss

Polhem- og Rittervatnenheten
Grid code 329

Volume m³	230883706235,45
Volume km³	230,8837062
Rock type	Psammites, amphibolites

Unknown
Grid code 332

Volume m³	59828259452,66
Volume km³	59,82825945
Rock type	Unknown

Unknown
Grid code 333

Volume m³	88169571746,08
Volume km³	88,16957175
Rock type	Unknown

Flåen subunit
Grid code 337

Volume m³	234687350013,69
Volume km³	234,68735
Rock type	Semipelite, psammite, quartzite

Unknown
Grid code 341

Volume m³	4001402144,57
Volume km³	4,001402145
Rock type	Unknown

Glasgowbreen Formation
Grid code 344

Volume m³	7720353910,58
Volume km³	7,720353911
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	26023572256,00
Volume km³	26,02357226
Rock type	Quartzite, shale

Kortbreen Formation
Grid code 351

Volume m³	95632837274,70
Volume km³	95,63283727
Rock type	Quartzite, limestone

Akademikarbreen Group
Grid code 355

Volume m³	13518667648,93
Volume km³	13,51866765
Rock type	Dolomite, limestone

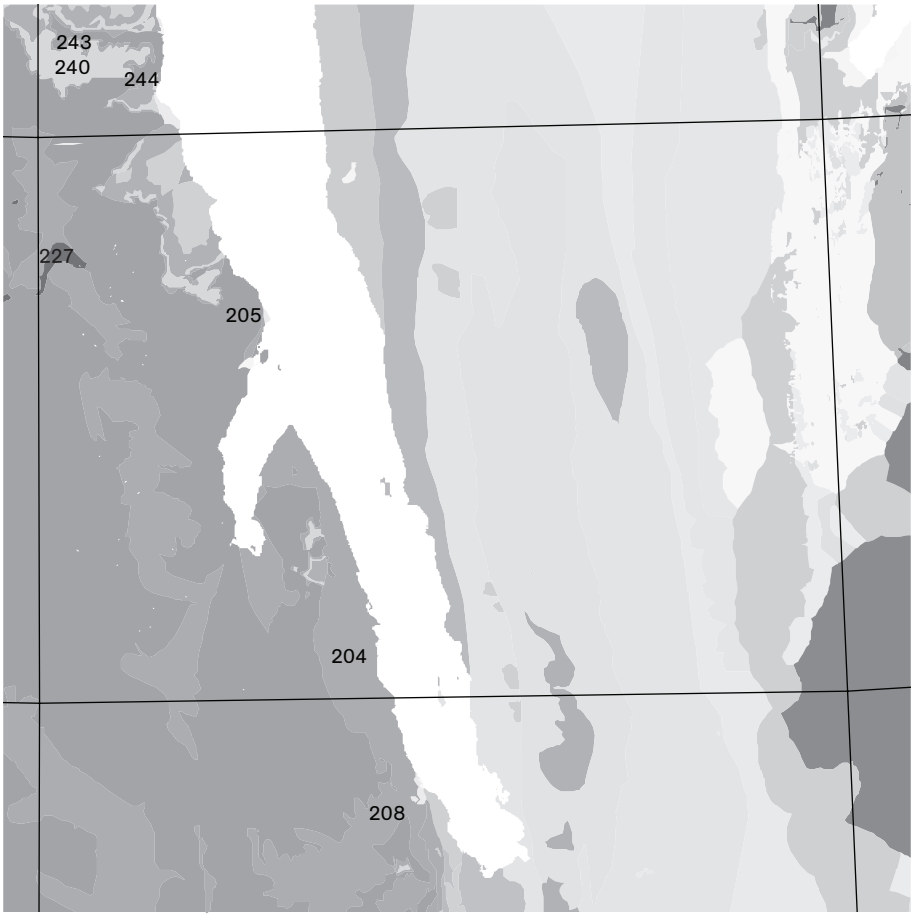
Unknown
Grid code 365

Volume m³	3044844892,16
Volume km³	3,044844892
Rock type	Unknown

Unknown
Grid code 3005

Volume m³	98999171,37
Volume km³	0,098999171
Rock type	Unknown

C6a



C6a

Austfjorden Member
Grid code 204

Volume m³	64380133425
Volume km³	64,38013343
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	2,08902E+11
Volume km³	208,9016482
Rock type	Sandstone

Verdalen Member
Grid code 208

Volume m³	2750511073
Volume km³	2,750511073
Rock type	Carbonate

Tertiary basalt
Grid code 227

Volume m³	3973306932
Volume km³	3,973306932
Rock type	Basalt

Skamdalen Member
Grid code 240

Volume m³	4917778771
Volume km³	4,917778771
Rock type	Siltstone, mudstone

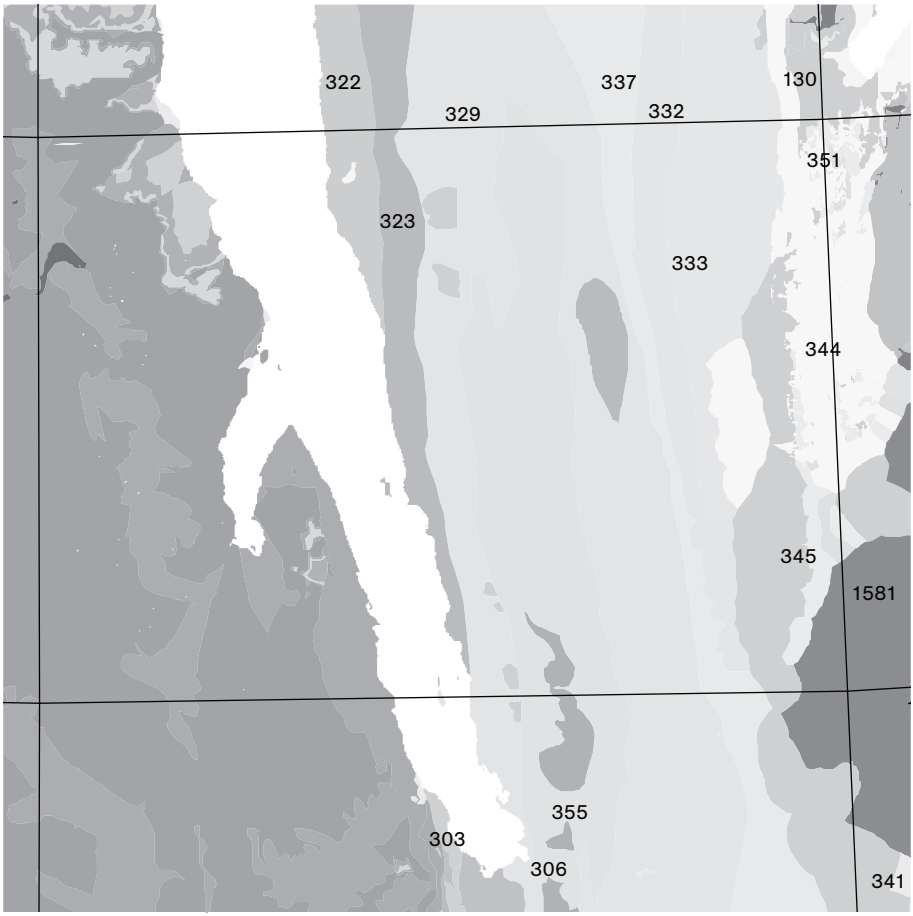
Tavlefjellet Member
Grid code 243

Volume m³	8617186533
Volume km³	8,617186533
Rock type	Mudstone

Forkdalen Member
Grid code 244

Volume m³	4862634513
Volume km³	4,862634513
Rock type	Siltstone, mudstone, sandstone

C6b



C6b

Billefjorden Group
Grid code 130

Volume m³	7087425752
Volume km³	7,087425752
Rock type	Sandstone, shale, conglomerate

Smutsbreen unit
Grid code 303

Volume m³	10513928
Volume km³	0,010513928
Rock type	Semipelite, marble

Eskolabreen unit
Grid code 306

Volume m³	756248535,9
Volume km³	0,756248536
Rock type	Feldspathite, semipelite, amphibolite

Vassfaret unit
Grid code 322

Volume m³	3836137281
Volume km³	3,836137281
Rock type	Metasediment

Bangenhuk unit
Grid code 323

Volume m³	35944263818
Volume km³	35,94426382
Rock type	Gneiss

Polhem- og Rittervatnenheten
Grid code 329

Volume m³	2,20558E+11
Volume km³	220,5584342
Rock type	Psammites, amphibolites

Unknown
Grid code 332

Volume m³	69384656868
Volume km³	69,38465687
Rock type	Unknown

Unknown
Grid code 333

Volume m³	70572111077
Volume km³	70,57211108
Rock type	Unknown

Flåen subunit
Grid code 337

Volume m³	46411360563
Volume km³	46,41136056
Rock type	Semipelite, psammite, quartzite

Unknown
Grid code 341

Volume m³	7528593268
Volume km³	7,528593268
Rock type	Unknown

Glasgowbreen Formation
Grid code 344

Volume m³	27508222568
Volume km³	27,50822257
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	79964209337
Volume km³	79,96420934
Rock type	Quartzite, shale

Kortbreen Formation
Grid code 351

Volume m³	1,05419E+11
Volume km³	105,4193126
Rock type	Quartzite, limestone

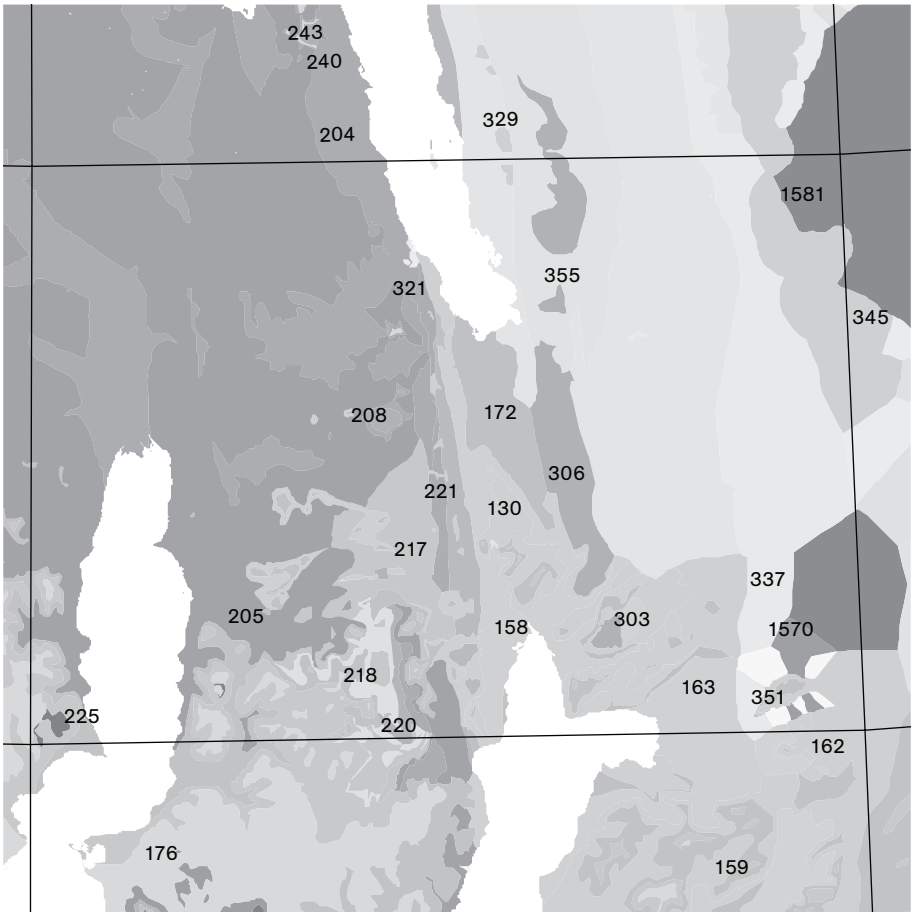
Akademikarbreen Group
Grid code 355

Volume m³	1,56164E+11
Volume km³	156,1636009
Rock type	Dolomite, limestone

Granitt, kaledonsk
Grid code 1581

Volume m³	15304786330
Volume km³	15,30478633
Rock type	Granite

C7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225
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162
176
159

C7

Billefjorden Group
Grid code 130

Volume m³	25800393840
Volume km³	25,800393840
Rock type	Sandstone, shale, conglomerate

Ebbadalen Formation
Grid code 158

Volume m³	26281098995
Volume km³	26,281099
Rock type	Wide range of clastics, carbonate rocks and evaporites

Minkinfjellet Formation
Grid code 159

Volume m³	43232622996
Volume km³	43,232623
Rock type	Dolomite, sandstone, gypsum

Wordiekammen Formation
Grid code 162

Volume m³	27574444873
Volume km³	27,57444487
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	11055198234
Volume km³	11,05519823
Rock type	Dolomite, limestone, anhydrite, gypsum, carbonate breccias

Hultberget Formation
Grid code 172

Volume m³	12209552252
Volume km³	12,20955225
Rock type	Shale, sandstone, conglomerate

Kapp Starostin Formation
Grid code 176

Volume m³	4155386510
Volume km³	4,15538651
Rock type	Siltstone, sandstone, limestone (1:1)

Austfjorden Member
Grid code 204

Volume m³	43375206290
Volume km³	43,37520629
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	225876642610
Volume km³	225,8766426
Rock type	Sandstone

Verdalen Member
Grid code 208

Volume m³	2280996316
Volume km³	2,280996316
Rock type	Carbonate

Fiskekløfta Member
Grid code 217

Volume m³	31575172630
Volume km³	31,57517263
Rock type	Mudstone, siltstone, sandstone

Fiskekløfta Member
Grid code 218

Volume m³	5664997497
Volume km³	5,664997497
Rock type	Mudstone, siltstone, sandstone

Plantekløfta Member
Grid code 220

Volume m³	1463961079
Volume km³	1,463961079
Rock type	Conglomerate

Mimerbukta sandstones
Grid code 221

Volume m³	5200111626
Volume km³	5,200111626
Rock type	Sandstone

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume km³	170102464
Volume km³	0,170102464
Rock type	Dolerite

Skamdalen Member
Grid code 240

Volume km³	166911668
Volume km³	0,166911668
Rock type	Siltstone, Mudstone

Tavlefjellet Member
Grid code 243

Volume km³	1624665057
Volume km³	1,624665057
	Mudstone

Smutsbreen unit
Grid code 303

Volume km³	1115470534
Volume km³	1,115470534
Rock type	Semipelite, marble

Eskolabreen unit
Grid code 306

Volume m³	22631571718
Volume m³	22,63157172
Rock type	Feldspathite, semipelite, amphibolite

Sørbreen unit
Grid code 321

Volume m³	68241
Volume km³	0,0006824
Rock type	Quartzite, amphibolite

Bangenhuk unit
Grid code 323

Volume m³	10025003740
Volume km³	10,0250037399
Rock type	Gneiss

Polhem- og Rittervatnenheten
Grid code 329

Volume m³	190250174134
Volume km³	190,2501741344
Rock type	Psammite, amphibolite

Unknown
Grid code 333

Volume m³	2381131946
Volume km³	2,381131946
Rock type	Unknown

Flåen subunit
Grid code 337

Volume m³	151543203693
Volume km³	151,5432037
Rock type	Semipelite, psammite, quartzite

Glasgowbreen Formation
Grid code 344

Volume m³	1282953029
Volume km³	1,282953029
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	71749299986
Volume km³	71,74929999
Rock type	Quartzite, shale

Kortbreen Formation
Grid code 351

Volume m³	4903397691
Volume km³	4,903397691
Rock type	Quartzite, limestone

Akademikarbreen Group
Grid code 355

Volume m³	54259461739
Volume km³	54,25946174
Rock type	Dolomite, limestone

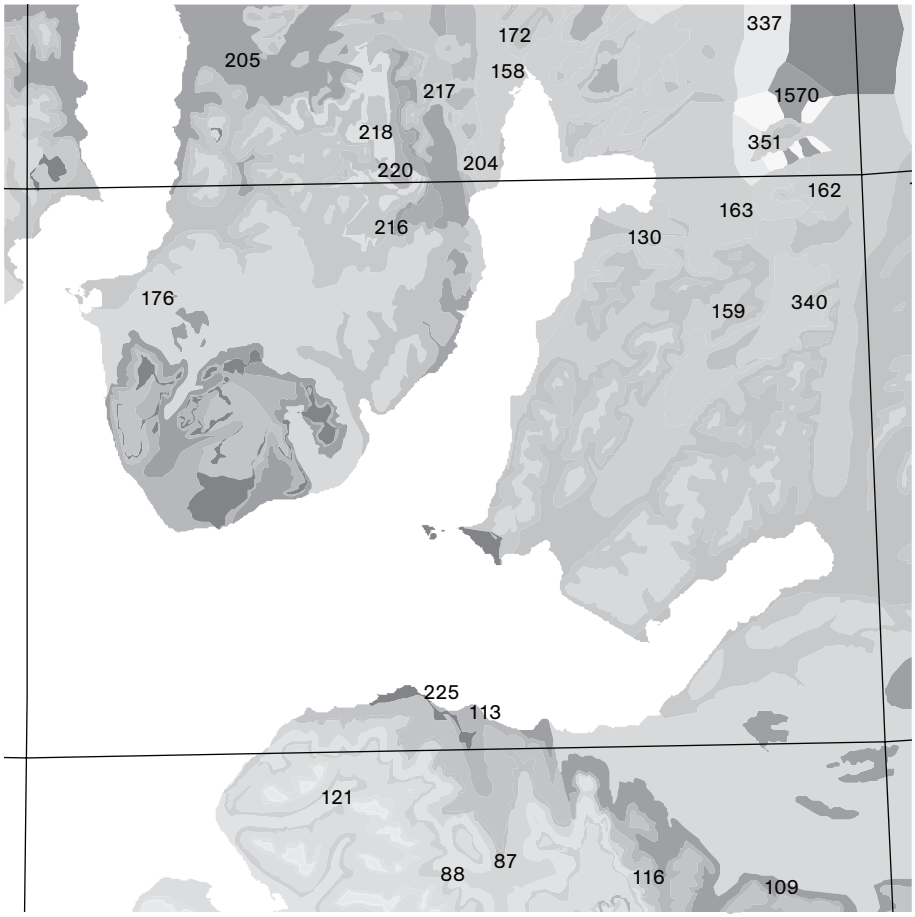
Granosyenite Caledonian
Grid code 1570

Volume m³	5572153694
Volume km³	5,572153694
Rock type	Granosyenit

Granitt, kaledonsk
Grid code 1581

Volume m³	55114812470
Volume km³	55,11481247
Rock type	Granite

C8


337
172
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163
216
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340
225
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121
87
88
116
109

C8

Agardhfjellet Formation
Grid code 87

Volume m³	1097082829,5950
Volume km³	1,0971
Rock type	Shale

Rurikfjellet Formation
Grid code 88

Volume m³	97287436,7526
Volume km³	0,0973
Rock type	Shale, siltstone, sandstone

Vikinghøgda Formation
Grid code 109

Volume m³	11442472089,1793
Volume km³	11,4425
Rock type	Shale, siltstone

Botneheia Formation
Grid code 113

Volume m³	11938251201,6396
Volume km³	11,9383
Rock type	Shale

Storfjorden Subgroup
Grid code 116

Volume m³	12342238511,1116
Volume km³	12,3422
Rock type	Shale, siltstone, sandstone

Wilhelmøya Subgroup
Grid code 121

Volume m³	290881678,4170
Volume km³	0,2909
Rock type	Shale, siltstone, sandstone

Billefjorden Group
Grid code 130

Volume m³	1126147073,9376
Volume km³	1,1261
Rock type	Sandstone, shale, conglomerate

Ebbadalen Formation
Grid code 158

Volume m³	20574132011,9328
Volume km³	20,5741
Rock type	Clastic rock, carbonate, evaporites

Minkinfjellet Formation
Grid code 159

Volume m³	42456785225,6730
Volume km³	42,4568
Rock type	Dolomite, sandstone, gypsum

Wordiekammen Formation
Grid code 162

Volume m³	69995133715,1586
Volume km³	69,9951
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	92658944378,9886
Volume km³	92,6589
Rock type	Dolomite, limestone, anhydrite/gypsum, Breccias

Hultberget Formation
Grid code 172

Volume m³	884385198,7255
Volume km³	0,8844
Rock type	Shale, sandstone, conglomerate

Kapp Starostin Formation
Grid code 176

Volume m³	116816423246,3800
Volume km³	116,8164
Rock type	Siltstone, sandstone, limestone

Austfjorden Member
Grid code 204

Volume m³	969571586,3328
Volume km³	0,9696
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	4006125695,0552
Volume km³	4,0061
Rock type	Sandstone

Wijde Bay Formation
Grid code 216

Volume m³	243774125,0007
Volume km³	0,2438
Rock type	Sandstone

Fiskekløfta Member
Grid code 217

Volume m³	1763858412,6698
Volume km³	1,7639
Rock type	Mudstone, siltstone, sandstone

Fiskekløfta Member
Grid code 218

Volume m³	1611853846,7700
Volume km³	1,6119
Rock type	Mudstone, siltstone, sandstone

Plantekløfta Member
Grid code 220

Volume m³	619588171,7421
Volume km³	0,6196
Rock type	Conglomerate

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	9052037300,2984
Volume km³	9,0520
Rock type	Dolerite

Bangenhuk unit
Grid code 323

Volume m³	55042283,5168
Volume km³	0,0550
Rock type	Gneiss

Flåen subunit
Grid code 337

Volume m³	2216498816,3236
Volume km³	2,2165
Rock type	Semipelite, psammite, quartzite

Veteranen Group
Grid code 340

Volume m³	10358095724,1195
Volume km³	10,3581
Rock type	Quartzite, shale, limestone

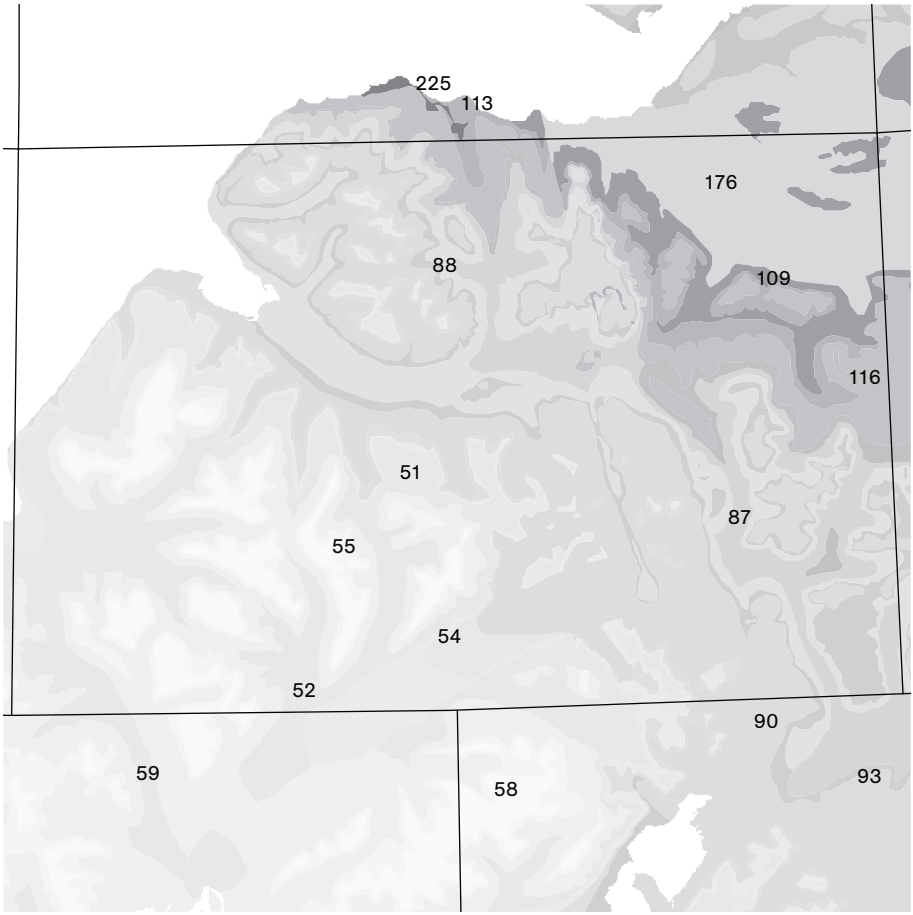
Kortbreen Formation
Grid code 351

Volume m³	1873232545,5320
Volume km³	1,8732
Rock type	Quartzite, limestone

Granosyenite Caledonian
Grid code 1570

Volume m³	1135643489,5923
Volume km³	1,1356
Rock type	Granosyenit

C9



C9

Firkanten Formation
Grid code 51

Volume m³	66584611388
Volume km³	66,58461139
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	36903168405
Volume km³	36,90316841
Rock type	Shale, mudstone, siltstone

Grumantbyen Formation
Grid code 54

Volume m³	191674259840
Volume km³	191,6742598
Rock type	Sandstone

Frysjaodden Formation
Grid code 55

Volume m³	51286755600
Volume km³	51,2867556
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	21715789340
Volume km³	21,71578934
Rock type	Sandstone, siltstone, shale

Aspelintoppen Formation
Grid code 59

Volume m³	19011415500
Volume km³	19,0114155
Rock type	Sandstone, siltstone, mudstone

Agardhfjellet Formation
Grid code 87

Volume m³	45501733809
Volume km³	45,50173381
Rock type	Shale, siltstone

Rurikfjellet Formation
Grid code 88

Volume m³	30421210400
Volume km³	30,4212104
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 90

Volume m³	39413031680
Volume km³	39,41303168
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	120044129400
Volume km³	120,0441294
Rock type	Shale, siltstone, sandstone

Vikinghøgda Formation
Grid code 109

Volume m³	110278211714
Volume km³	110,2782117
Rock type	Shale, siltstone

Botneheia Formation
Grid code 113

Volume m³	58552898911
Volume km³	58,55289891
Rock type	Mudstone, siltstone, sandstone

Storfjorden Subgroup Wilhelmøya Subgroup
Grid code 116

Volume m³	104143280950
Volume km³	104,143281
Rock type	Mudstone, calcareous siltstone

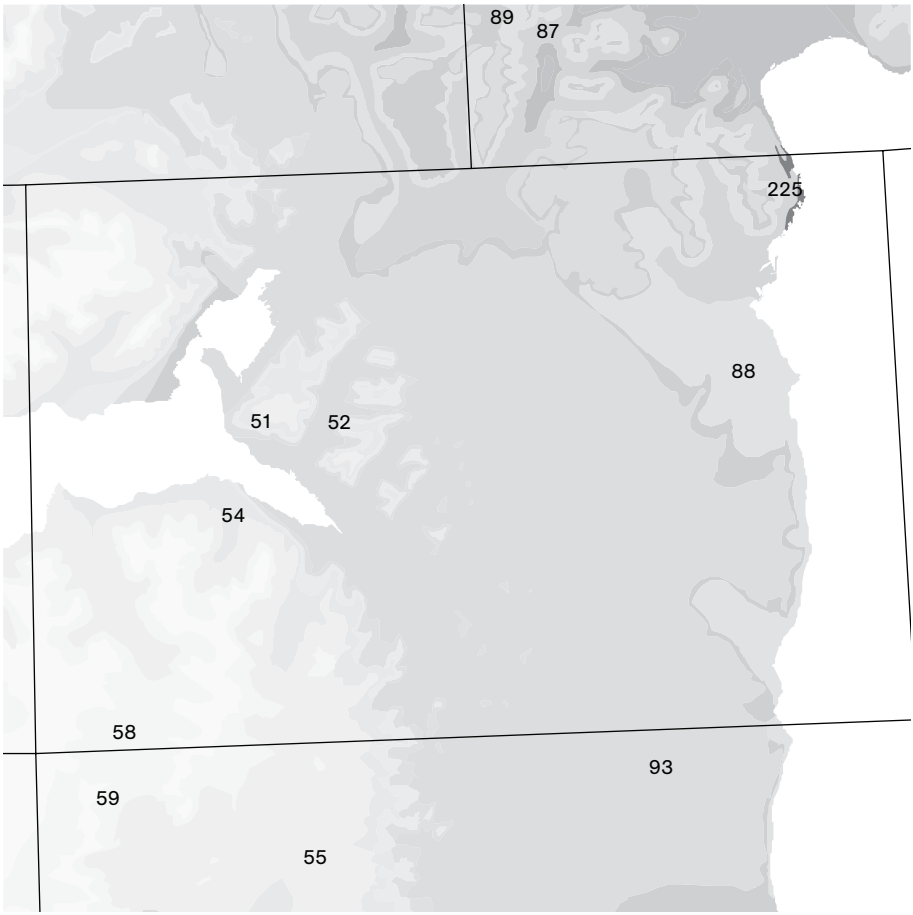
Kapp Starostin Formation
Grid code 176

Volume m³	32253894400
Volume km³	32,2538944
Rock type	Siltstone, sandstone, limestone (1:1)

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	16398040
Volume km³	0,01639804
Rock type	Dolerite

C10



C10

Firkanten Formation
Grid code 51

Volume m³	14801521791
Volume km³	14,80152179
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	52241068160
Volume km³	52,24106816
Rock type	Shale, mudstone, siltstone

Grumantbyen Formation
Grid code 54

Volume m³	27975031550
Volume km³	27,97503155
Rock type	Sandstone

Frysjaodden Formation
Grid code 55

Volume m³	49255444900
Volume km³	49,2554449
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	15450328152
Volume km³	15,45032815
Rock type	Sandstone, siltstone, shale

Aspelintoppen Formation
Grid code 59

Volume m³	17619877080
Volume km³	17,61987708
Rock type	Sandstone, siltstone, mudstone

Agardhfjellet Formation
Grid code 87

Volume m³	7064876400
Volume km³	7,0648764
Rock type	Shale, siltstone

Rurikfjellet Formation
Grid code 88

Volume m³	13408625300
Volume km³	13,4086253
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 89

Volume m³	19763788404
Volume km³	19,7637884
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	2,3699E+11
Volume km³	236,990496
Rock type	Shale, siltstone, sandstone

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	38971040
Volume km³	0,03897104
Rock type	Dolerite

C11

C11

Firkanten Formation
Grid code 51

Volume m³	21386959860
Volume km³	21,38695986
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	40247015640
Volume km³	40,24701564
Rock type	Shale, mudstone, siltstone

Grumantbyen Formation
Grid code 54

Volume m³	27681851200
Volume km³	27,6818512
Rock type	Sandstone

Frysjaodden Formation
Grid code 55

Volume m³	25081708200
Volume km³	25,0817082
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	14099726250
Volume km³	14,09972625
Rock type	Sandstone, siltstone, shale

Aspelintoppen Formation
Grid code 59

Volume m³	8306009270
Volume km³	8,30600927
Rock type	Sandstone, siltstone, mudstone

Rurikfjellet Formation
Grid code 88

Volume m³	201062200
Volume km³	0,2010622
Rock type	Shale, siltstone, sandstone

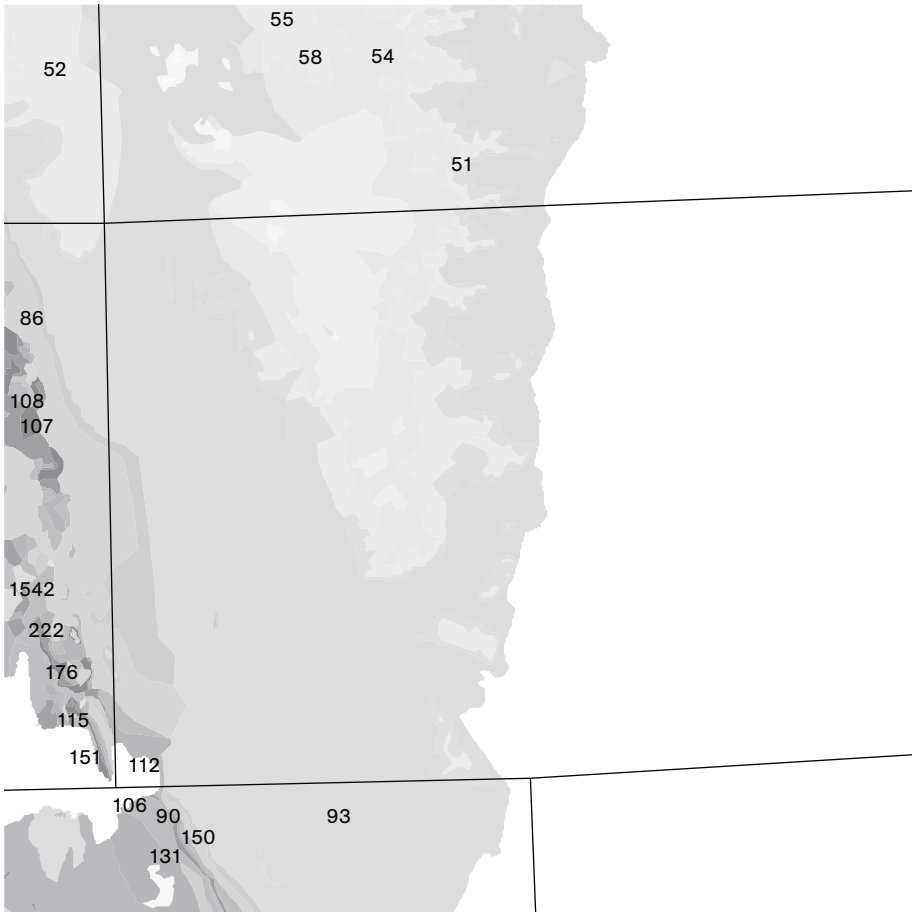
Helvetiafjellet Formation
Grid code 90

Volume m³	16116001740
Volume km³	16,11600174
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	190937507400
Volume km³	190,9375074
Rock type	Shale, siltstone, sandstone

C12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C12

Firkanten Formation
Grid code 51

Volume m³	31246934810
Volume km³	31,24693481
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	57413207680
Volume km³	57,41320768
Rock type	Shale, mudstone, siltstone

Grumantbyen Formation
Grid code 54

Volume m³	14442810480
Volume km³	14,44281048
Rock type	Sandstone

Frysjaodden Formation
Grid code 55

Volume m³	2509030480
Volume km³	2,50903048
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	48321980
Volume km³	0,04832198
Rock type	Sandstone, siltstone, shale

Janusfjellet Subgroup
Grid code 86

Volume m³	10059586920
Volume km³	10,05958692
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 90

Volume m³	75228169632
Volume km³	75,22816963
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	2,97512E+11
Volume km³	297,5120135
Rock type	Shale, siltstone, sandstone

Vardebukta and Tvillingodden Formations
Grid code 106

Volume m³	75599300
Volume km³	0,0755993
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	515899900
Volume km³	0,5158999
Rock type	Shale, siltstone, sandstone

Tvillingodden Formation
Grid code 108

Volume m³	326629400
Volume km³	0,3266294
Rock type	Shale, siltstone, sandstone

Bravaisberget Formation
Grid code 112

Volume m³	1287132800
Volume km³	1,2871328
Rock type	Mudstone, siltstone, sandstone

Kapp Toscana Group
Grid code 115

Volume m³	1184546900
Volume km³	1,1845469
Rock type	Shale, siltstone, sandstone

Adriabukta Formation
Grid code 131

Volume m³	26865860
Volume km³	0,02686586
Rock type	Shale, sandstone, conglomerate

Hyrnefjellet Formation
Grid code 150

Volume m³	59284460
Volume km³	0,05928446
Rock type	Conglomerate, sandstone

Treskelodden Formation
Grid code 151

Volume m³	45346740
Volume km³	0,04534674
Rock type	Conglomerate, sandstone

Kapp Starostin Formation
Grid code 176

Volume m³	4861140
Volume km³	0,00486114
Rock type	Siltstone, sandstone, limestone (1:1)

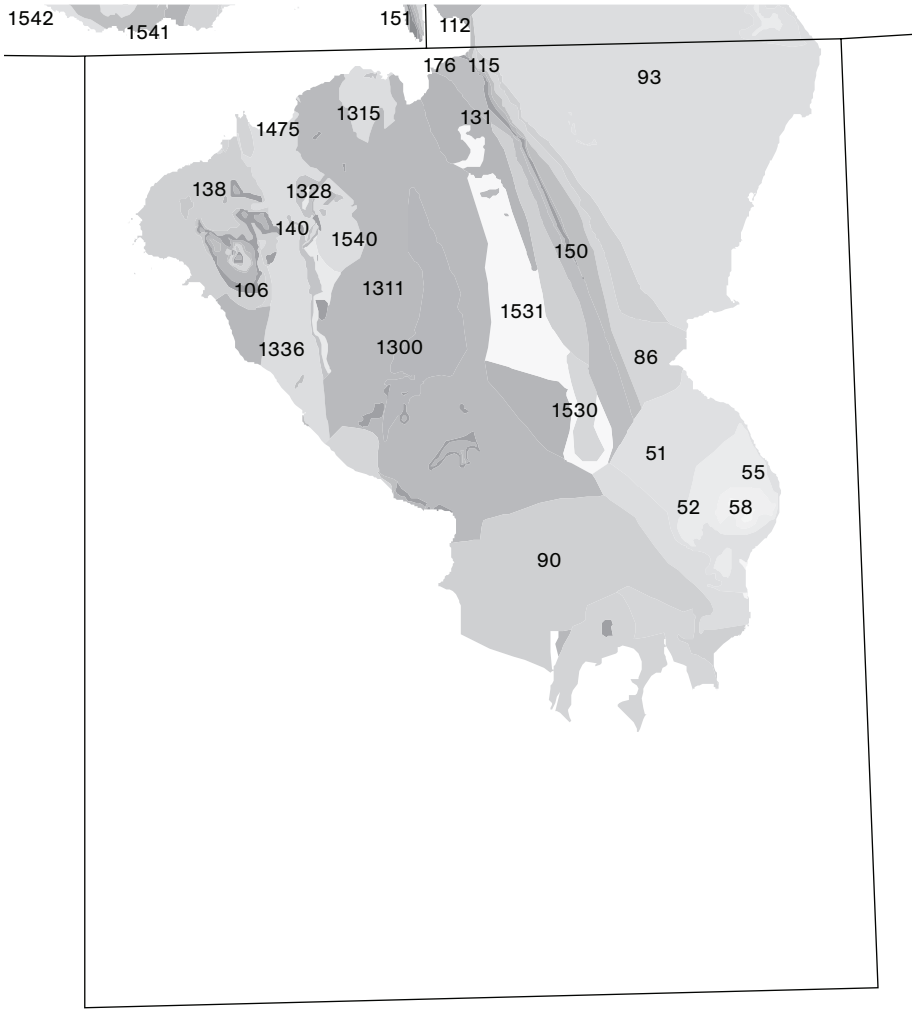
Marietoppen Formation
Grid code 222

Volume m³	24402660
Volume km³	0,02440266
Rock type	Sandstone

Gåshamn Formation og mulige ekvivalenter
Grid code 1542

Volume m³	52580
Volume km³	0,00005258
Rock type	Phyllite

C13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90

C13

Firkanten Formation
Grid code 51

Volume m³	7212866123
Volume km³	7,212866123
Rock type	Sandstone, shale, coal

Basilika Formation
Grid code 52

Volume m³	5472405825
Volume km³	5,472405825
Rock type	Shale, mudstone, siltstone

Frysjaodden Formation
Grid code 55

Volume m³	1898844950
Volume km³	1,89884495
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	313498963
Volume km³	0,313498963
Rock type	Sandstone, siltstone, shale

Janusfjellet Subgroup
Grid code 86

Volume m³	9097146529
Volume km³	9,097146529
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 90

Volume m³	19403380796
Volume km³	19,4033808
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	52344708285
Volume km³	52,34470828
Rock type	Shale, siltstone, sandstone

Vardebukta and Tvillingodden Formations
Grid code 106

Volume m³	6298480339
Volume km³	6,298480339
Rock type	Shale, siltstone, sandstone

Bravaisberget Formation
Grid code 112

Volume m³	4788449622
Volume km³	4,788449622
Rock type	Mudstone, siltstone, sandstone

Kapp Toscana Group
Grid code 115

Volume m³	7882806750
Volume km³	7,88280675
Rock type	Shale, siltstone, sandstone

Adriabukta Formation
Grid code 131

Volume m³	11598866452
Volume km³	11,59886645
Rock type	Shale, sandstone, conglomerate

Hornsundneset Formation
Grid code 138

Volume m³	16398332092
Volume km³	16,39833209
Rock type	Sandstone

Sergeijevfjellet Formation
Grid code 140

Volume m³	917976249
Volume km³	0,917976249
Rock type	Sandstone, shale

Hyrnefjellet Formation
Grid code 150

Volume m³	7421302951
Volume km³	7,421302951
Rock type	Conglomerate, sandstone

Treskelodden Formation
Grid code 151

Volume m³	588170374
Volume km³	0,588170374
Rock type	Conglomerate, sandstone

Kapp Starostin Formation
Grid code 176

Volume m³	243078
Volume km³	0,000243078
Rock type	Siltsone, sandstone, limestone (1:1)

Arkfjellet unit
Grid code 1300

Volume m³	16158319656
Volume km³	16,15831966
Rock type	Carbonate

Sørkapp Land Gr without Wiederfjellet F
Grid code 1311

Volume m³	76531721293
Volume km³	76,53172129
Rock type	Carbonate

Wiederfjellet Formation
Grid code 1315

Volume m³	112655931
Volume km³	0,112655931
Rock type	Quartzite

Sofiekammen Gr without Vardepiggen F
Grid code 1328

Volume m³	2262103175
Volume km³	2,262103175
Rock type	Carbonate

Vardepiggen Formation
Grid code 1336

Volume m³	1912302899
Volume km³	1,912302899
Rock type	Breccia

Deilegga Group
Grid code 1475

Volume m³	82125
Volume km³	8,21246E-05
Rock type	Conglomerate, dolomite, slate

Proterozoic marbles
Grid code 1530

Volume m³	3995871515
Volume km³	3,995871515
Rock type	Marble

Proterozoic quartzites and mica schists
Grid code 1531

Volume m³	17753330681
Volume km³	17,75333068
Rock type	Quartzite

Slyngfjellkonglomeratet og mulige ekvivalenter
Grid code 1540

Volume m³	108235
Volume km³	0,000108235
Rock type	Conglomerate

Höferpynt Formation og mulige ekvivalenter
Grid code 1541

Volume m³	6398228362
Volume km³	6,398228362
Rock type	Dolomite

Gåshamn Formation og mulige ekvivalenter
Grid code 1542

Volume m³	15973859833
Volume km³	15,97385983
Rock type	Phyllite

D5

D5

Billefjorden Group
Grid code 130

Volume m³	1656526889
Volume km³	1,656526889
Rock type	Sandstone, shale, conglomerate

Wordiekammen Formation
Grid code 162

Volume m³	27016318861
Volume km³	27,01631886
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	45303368483
Volume km³	45,30336848
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Malte Brunfjellet Formation
Grid code 164

Volume m³	427685491
Volume km³	0,427685491
Rock type	Sandstone, conglomerate, limestone

Kapp Starostin Formation
Grid code 176

Volume m³	84917857414
Volume km³	84,91785741
Rock type	Siltstone, sandstone, limestone (1:1)

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	7744290776
Volume km³	7,744290776
Rock type	Dolerite

Unknown
Grid code 341

Volume m³	720117891
Volume km³	0,720117891
Rock type	Unknown

Glasgowbreen Formation
Grid code 344

Volume m³	1949590575
Volume km³	1,949590575
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	6070281511
Volume km³	6,070281511
Rock type	Quartzite, shale

Kortbreen Formation
Grid code 351

Volume m³	4014021265
Volume km³	4,014021265
Rock type	Quartzite, limestone

Akademikarbreen Group
Grid code 355

Volume m³	12196596076
Volume km³	12,19659608
Rock type	Dolomite, limestone

Unknown
Grid code 365

Volume m^3	250565924
Volume km^3	0,250565924
Rock type	Unknown

Oslobregruppen (kambrium-ordovicium)
Grid code 385

Volume m^3	798441988
Volume km^3	0,798441988
Rock type	Limestone, dolomite

D6


164
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176

D6

Kapp Toscana Group
Grid code 115

Volume m³	56340477518
Volume km³	56,34047752
Rock type	Shale, siltstone, sandstone

Wordiekammen Formation
Grid code 162

Volume m³	1,38578E+11
Volume km³	138,5782888
Rock type	Carbonate

Gipshuken Formation
Grid code 163 **57040378784**

Volume km³	57,04037878
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Malte Brunfjellet Formation
Grid code 164

Volume m³	71715602,42
Volume km³	0,071715602
Rock type	Sandstone, conglomerate, limestone

Kapp Starostin Formation
Grid code 176

Volume m³	73291727587
Volume km³	73,29172759
Rock type	Siltstone, sandstone, limestone (1:1)

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	46748191295
Volume km³	46,74819129
Rock type	Dolerite

Unknown
Grid code 341

Volume m³	2214443471
Volume km³	2,214443471
Rock type	Unknown

Glasgowbreen Formation
Grid code 344

Volume m³	22622846475
Volume km³	22,62284647
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	21817633201
Volume km³	21,8176332
Rock type	Quartzite, shale

Kortbreen Formation
Grid code 351

Volume m³	22907063933
Volume km³	22,90706393
Rock type	Quartzite, limestone

Akademikarbreen Group
Grid code 355

Volume m³	69585479750
Volume km³	69,58547975
Rock type	Dolomite, limestone

Unknown
Grid code 365

Volume m³	12257644530
Volume km³	12,25764453
Rock type	Unknown

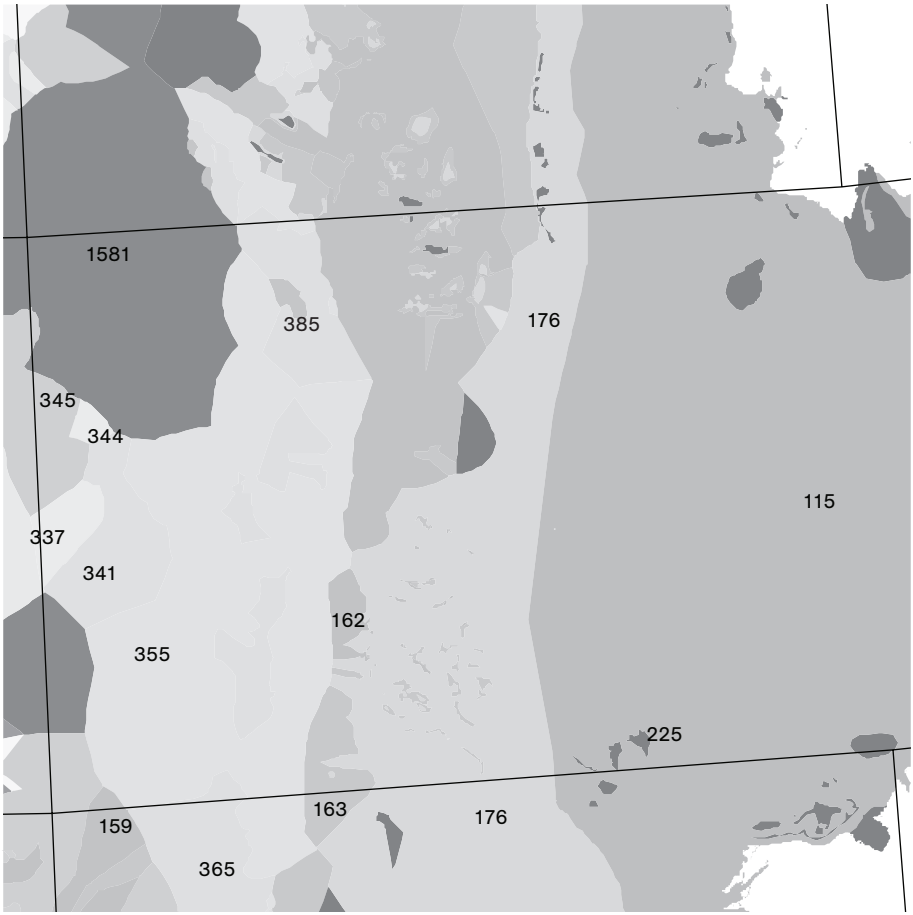
Oslobregruppen (kambrium-ordovicium)
Grid code 385

Volume m³	4778241902
Volume km³	4,778241902
Rock type	Limestone, dolomite

Granitt, kaledonsk
Grid code 1581

Volume m³	1,24947E+11
Volume km³	124,9474425
Rock type	Granite

D7



D7

Kapp Toscana Group
Grid code 115

Volume m³	36659664671
Volume km³	36,659664671
Rock type	Shale, siltstone, sandstone

Minkinfjellet Formation
Grid code 159

Volume m³	10475313290
Volume km³	10,47531329
Rock type	Dolomite, sandstone, gypsum

Wordiekammen Formation
Grid code 162

Volume m³	1,05044E+11
Volume km³	105,0435544
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	24525107918
Volume km³	24,52510792
Rock type	Dolomite, limestone, anhydrite/gypsum, breccias

Kapp Starostin Formation
Grid code 176

Volume m³	1,61242E+11
Volume km³	161,2422619
Rock type	Siltstone, sandstone, limestone

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	17337607037
Volume km³	17,337607037
Rock type	Dolerite

Flåen subunit
Grid code 337

Volume m³	1407583004
Volume km³	1,407583004
Rock type	Semipelite, psammite, quartzite

Unknown
Grid code 341

Volume m³	55972211486
Volume km³	55,97221149
Rock type	Unknown

Glasgowbreen Formation
Grid code 344

Volume m³	25520068536
Volume km³	25,52006854
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	25915121736
Volume km³	25,91512174
Rock type	Quartzite, shale

Akademikarbreen Group
Grid code 355

Volume m³	2,69886E+11
Volume km³	269,8857118
Rock type	Dolomite, limestone

Unknown
Grid code 365

Volume m³	71843122011
Volume km³	71,84312201
Rock type	Unknown

Oslobregruppen (kambrium-ordovicium)
Grid code 385

Volume m³	3341319814
Volume km³	3,341319814
Rock type	Limestone, dolomite

Granitt, kaledonsk
Grid code 1581

Volume m³	2,15019E+11
Volume km³	215,0192445
Rock type	Granite

D8

D8

Agardhfjellet Formation
Grid code 87

Volume m³	41478280
Volume km³	0,04147828
Rock type	shale

Vikinghøgda Formation
Grid code 109

Volume m³	47562281340
Volume km³	47,56228134
Rock type	Shale, siltstone

Botneheia Formation
Grid code 113

Volume m³	52439550390
Volume km³	52,43955039
Rock type	Shale

Kapp Toscana Group
Grid code 115

Volume m³	65238388320
Volume km³	65,23838832
Rock type	Shale, siltstone, sandstone

Wordiekammen Formation
Grid code 162

Volume m³	71933661000
Volume km³	71,933661
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	50188551440
Volume km³	50,18855144
Rock type	Dolomite, limestone, anhydrite/gypsum, carbonate breccias

Malte Brunfjellet Formation
Grid code 164

Volume m³	1733280960
Volume km³	1,73328096
Rock type	Sandstone, conglomerate, limestone

Kapp Starostin Formation
Grid code 176

Volume m³	98179012560
Volume km³	98,17901256
Rock type	Siltstone, sandstone, limestone (1:1)

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	4138201600
Volume km³	4,1382016
Rock type	Dolerite

Kortbreen Formation
Grid code 351

Volume m³	533423760
Volume km³	0,53342376
Rock type	Quartzite, limestone

Akademikarbreen Group
Grid code 355

Volume m³	12494949900
Volume km³	12,4949499
Rock type	Dolomite, limestone

D9

D9

Agardhfjellet Formation
Grid code 87

Volume m³	66463528800
Volume km³	66,4635288
Rock type	Shale, siltstone

Rurikfjellet Formation
Grid code 88

Volume m³	22875162420
Volume km³	22,87516242
Rock type	Shale, siltstone, sandstone

Helvetiafjellet Formation
Grid code 89

Volume m³	6830057940
Volume km³	6,83005794
Rock type	Sandstone, shale, coal, conglomerate

Carolinefjellet Formation
Grid code 93

Volume m³	1080181080
Volume km³	1,08018108
Rock type	Shale, siltstone, sandstone

Vikinghøgda Formation
Grid code 109

Volume m³	1649242170
Volume km³	1,64924217
Rock type	Shale, siltstone

Botneheia Formation
Grid code 113

Volume m³	20674225920
Volume km³	20,67422592
Rock type	Mudstone, calcareous siltstone

Wilhelmøya Subgroup
Grid code 121

Volume m³	21636065850
Volume km³	21,63606585
Rock type	Sandstone, shale, mudstone, conglomerate

Gipshuken Formation
Grid code 163

Volume m³	195090900
Volume km³	0,1950909
Rock type	Dolomite, limestone, anhydrite/gypsum, Breccias

Kapp Starostin Formation
Grid code 176

Volume m³	6831787200
Volume km³	6,8317872
Rock type	Siltstone, sandstone, limestone

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	9000780460
Volume km³	9,00078046
Rock type	Dolerite

Total volume per formation

Firkanten Formation
Grid code 51

Volume m³	1,52613E+11
Volume km³	152,61
Rock type	Sandstone, shale

Basilika Formation
Grid code 52

Volume m³	2,30337E+11
Volume km³	230,34
Rock type	Shale, mudstone, siltstone

Sarkofagen Formation
Grid code 53

Volume m³	60178829451
Volume km³	60,18
Rock type	Sandstone

Grumantbyen Formation
Grid code 54

Volume m³	2,73221E+11
Volume km³	273,22
Rock type	Sandstone

Frysjaodden Formation
Grid code 55

Volume m³	2,0798E+11
Volume km³	207,98
Rock type	Shale, sandstone

Battfjellet Formation
Grid code 58

Volume m³	1,51496E+11
Volume km³	151,50
Rock type	Sandstone, siltstone, shale

Aspelintoppen Formation
Grid code 59

Volume m³	1,69292E+11
Volume km³	169,29
Rock type	Sandstone, siltstone, mudstone

Kongsfjorden Formation
Grid code 61

Volume m³	98710859,34
Volume km³	0,10
Rock type	Sandstone, shale

Brøggerbreen Formation
Grid code 62

Volume m³	204895569
Volume km³	0,20
Rock type	Sandstone, shale, conglomerate

Sarsbukta conglomerate
Grid code 74

Volume m³	868411804,1
Volume km³	0,87
Rock type	Conglomerate

Calypsostranda Group
Grid code 78

Volume m³	170345,625
Volume km³	0,00
Rock type	Sandstone, siltstone, shale

Janusfjellet Subgroup
Grid code 86

Volume m³	1,05414E+11
Volume km³	105,41
Rock type	Shale

Agardhfjellet Formation
Grid code 87

Volume m³	1,20169E+11
Volume km³	120,17
Rock type	Shale

Rurikfjellet Formation
Grid code 88

Volume m³	67003347757
Volume km³	67,00
Rock type	Shale, siltstone, sandstone

Helvetiafjellet and Carolinefjellet Formations
Grid code 89

Volume m³	1025136864
Volume km³	1,03
Rock type	Sandstone, siltstone, shale, conglomerate

Helvetiafjellet Formation
Grid code 90

Volume m³	1,89206E+11
Volume km³	189,21
Rock type	Sandstone, shale

Carolinefjellet Formation
Grid code 93

Volume m³	9,34042E+11
Volume km³	934,04
Rock type	Shale, siltstone, sandstone

Sassendalen Group
Grid code 105

Volume m³	46805978152
Volume km³	46,81
Rock type	Shale, siltstone, sandstone

Vardebukta and Tvillingodden Formations
Grid code 106

Volume m³	6374079639
Volume km³	6,37
Rock type	Shale, siltstone, sandstone

Vardebukta Formation
Grid code 107

Volume m³	57657848411
Volume km³	57,66
Rock type	Shale, siltstone, sandstone

Tvillingodden Formation
Grid code 108

Volume m³	78615481969
Volume km³	78,62
Rock type	Shale, siltstone, sandstone

Vikinghøgda Formation
Grid code 109

Volume m³	1,71683E+11
Volume km³	171,68
Rock type	Shale, siltstone

Bravaisberget Formation
Grid code 112

Volume m³	1,07983E+11
Volume km³	107,98
Rock type	Mudstone, siltstone, sandstone

Botneheia Formation
Grid code 113

Volume m³	1,43605E+11
Volume km³	143,60
Rock type	Shale

Kapp Toscana Group
Grid code 115

Volume m³	2,14784E+11
Volume km³	214,93
Rock type	Shale, siltstone, sandstone

Storfjorden Subgroup
Grid code 116

Volume m³	1,17124E+11
Volume km³	117,12
Rock type	Shale, siltstone, sandstone

Tschermakfjellet Formation
Grid code 117

Volume m³	1386792945
Volume km³	1,39
Rock type	Shale

Wilhelmøya Subgroup
Grid code 121

Volume m³	21926947528
Volume km³	21,93
Rock type	Sandstone, shale, mudstone, conglomerate

De Geerdalen F and Wilhelmøya SG
Grid code 128

Volume m³	648804613,3
Volume km³	0,65
Rock type	Sandstone, shale

Billefjorden Group
Grid code 130

Volume m³	57972869297
Volume km³	57,97
Rock type	Sandstone, shale, conglomerate

Adriabukta Formation
Grid code 131

Volume m³	11640345210
Volume km³	11,64
Rock type	Shale, sandstone, conglomerate

Hornsundneset Formation
Grid code 138

Volume m³	16398332092
Volume km³	16,40
Rock type	Sandstone

Orustdalen Formation
Grid code 139

Volume m³	13660490996
Volume km³	13,66
Rock type	Sandstone

Sergeijevfjellet Formation
Grid code 140

Volume m³	917976249,3
Volume km³	0,92
Rock type	Sandstone, shale

Vegardfjella Formation
Grid code 141

Volume m³	3363195782
Volume km³	3,36
Rock type	Mudstone, sandstone, shale

Gipsdalen Group
Grid code 148

Volume m³	176596145,9
Volume km³	0,18
Rock type	Carbonate, clastic rocks, evaporites

Treskelen Subgroup
Grid code 149

Volume m³	605865712,5
Volume km³	0,61
Rock type	Conglomerate, sandstone

Hyrnefjellet Formation
Grid code 150

Volume m³	10500551548
Volume km³	10,50
Rock type	Conglomerate, sandstone

Treskelodden Formation
Grid code 151

Volume m³	13437696875
Volume km³	13,44
Rock type	Conglomerate, sandstone

Petrellskaret Formation
Grid code 153

Volume m³	1702053733
Volume km³	1,70
Rock type	Shale, sandstone

Tårnkanten Formation
Grid code 154

Volume m³	1208979348
Volume km³	1,21
Rock type	Sandstone

Brøggertinden Formation
Grid code 155

Volume m³	1233370906
Volume km³	1,23
Rock type	Conglomerate, sandstone, shale

Scheteligfjellet Formation
Grid code 156

Volume m³	1043015825
Volume km³	1,04
Rock type	Carbonate, sandstone, conglomerate, breccia

Ebbadalen Formation
Grid code 158

Volume m³	46855231007
Volume km³	46,86
Rock type	Clastic rock, carbonate, evaporites

Minkinfjellet Formation
Grid code 159

Volume m³	96164721512
Volume km³	96,16
Rock type	Dolomite, sandstone, gypsum

Wordiekammen Formation
Grid code 162

Volume m³	5,04023E+11
Volume km³	504,02
Rock type	Carbonate

Gipshuken Formation
Grid code 163

Volume m³	3,4877E+11
Volume km³	348,77
Rock type	Dolomite, limestone, anhydrite/gypsum, breccia

Malte Brunfjellet Formation
Grid code 164

Volume m³	14442234306
Volume km³	14,44
Rock type	Sandstone, conglomerate, limestone

Hultberget Formation
Grid code 172

Volume m³	5039771708
Volume km³	5,04
Rock type	Shale, sandstone, conglomerate

Kapp Starostin Formation
Grid code 176

Volume m³	1,03481E+12
Volume km³	1034,81
Rock type	Siltstone, sandstone, limestone

Lilljeborgfjellet Formation
Grid code 181

Volume m³	3894592477
Volume km³	3,89
Rock type	Conglomerate

Albertbreen Formation
Grid code 182

Volume m³	3635382955
Volume km³	3,64
Rock type	Sandstone

Red Bay Group
Grid code 183

Volume m³	144206768,2
Volume km³	0,14
Rock type	Sandstone, conglomerate

Wulffberget Formation
Grid code 185

Volume m³	2,86539E+11
Volume km³	286,54
Rock type	Conglomerate

Rabotdalen Formation
Grid code 186

Volume m³	326955069,7
Volume km³	0,33
Rock type	Sandstone

Princesse Alicefjellet Formation
Grid code 187

Volume m³	21166451243
Volume km³	21,17
Rock type	Conglomerate

Småbreen sandstones
Grid code 189

Volume m³	6694246523
Volume km³	6,69
Rock type	Sandstone

Andréebreen Group
Grid code 190

Volume m³	11070418625
Volume km³	11,07
Rock type	Sandstone

Frænkelrygg Formation
Grid code 191

Volume m³	8511695851
Volume km³	8,51
Rock type	Sandstone, siltstone

Ben Nevis Formation
Grid code 192

Volume m³	49694790860
Volume km³	49,69
Rock type	Sandstone

Brotfjellet conglomerate
Grid code 194

Volume m³	292933730,2
Volume km³	0,29
Rock type	Conglomerate

Germaniabekken conglomerate
Grid code 195

Volume m³	152340941,2
Volume km³	0,15
Rock type	Conglomerate

Schivefjellet Member
Grid code 196

Volume m³	5493516175
Volume km³	5,49
Rock type	Conglomerate

Fotkollen sandstones upper division
Grid code 202

Volume m³	278432007,9
Volume km³	0,28
Rock type	Sandstone

Austfjorden Member
Grid code 204

Volume m³	1,15661E+11
Volume km³	115,66
Rock type	Sandstone

Dicksonfjorden Member
Grid code 205

Volume m³	1,67717E+12
Volume km³	1677,17
Rock type	Sandstone

Verdalen Member
Grid code 208

Volume m³	30929282925
Volume km³	30,93
Rock type	Carbonate

Wijde Bay Formation
Grid code 214

Volume m³	16173138983
Volume km³	16,17
Rock type	Sandstone

Wijde Bay Formation
Grid code 216

Volume m³	243774125
Volume km³	0,24
Rock type	Sandstone

Fiskekløfta Member
Grid code 217

Volume m³	33339031043
Volume km³	33,34
Rock type	Mudstone, siltstone, sandstone

Fiskekløfta Member
Grid code 218

Volume m³	7276851344
Volume km³	7,28
Rock type	Mudstone, siltstone, sandstone

Plantekløfta Member
Grid code 220

Volume m³	2083549251
Volume km³	2,08
Rock type	Conglomerate

Mimerbukta sandstones
Grid code 221

Volume m³	5200111626
Volume km³	5,20
Rock type	Sandstone

Marietoppen Formation
Grid code 222

Volume m³	3128680253
Volume km³	3,13
Rock type	Sandstone

Mesozoic dolerite = Diabasodden Suite
Grid code 225

Volume m³	1,06289E+11
Volume km³	106,29
Rock type	Dolerite

Tertiary basalt
Grid code 227

Volume m³	16022536725
Volume km³	16,02
Rock type	Basalt

Quaternary basalt
Grid code 228

Volume m³	149728680,3
Volume km³	0,15
Rock type	Basalt

Other Quaternary volcanic rocks
Grid code 229

Volume m³	582663870,4
Volume km³	0,58
Rock type	Volcanites

Erosive remains of basalt
Grid code 230

Volume m³	112221124,5
Volume km³	0,11
Rock type	Basalt

Skamdalen Member
Grid code 240

Volume m³	34340812420
Volume km³	34,34
Rock type	Siltstone, mudstone

Tavlefjellet Member
Grid code 243

Volume m³	1,60113E+11
Volume km³	160,11
Rock type	Mudstone

Forkdalen Member
Grid code 244

Volume m³	1,50734E+11
Volume km³	150,73
Rock type	Siltstone, mudstone, sandstone

Smutsbreen unit
Grid code 303

Volume m³	1612054655
Volume km³	1,61
Rock type	Semipelite, marble

Eskolabreen unit
Grid code 306

Volume m³	23387820254
Volume km³	23,39
Rock type	Gneiss

Instrumentbergenheten
Grid code 315

Volume m³	2491034308
Volume km³	2,49
Rock type	Granitoid

Sørbreen unit
Grid code 321

Volume m³	222130,6152
Volume km³	0,00
Rock type	Quartzite, amphibolite

Vassfaret unit
Grid code 322

Volume m³	35866421538
Volume km³	35,87
Rock type	Metasediment

Bangenhuk unit
Grid code 323

Volume m³	1,97065E+11
Volume km³	197,06
Rock type	Gneiss

Polhem- og Rittervatnenheten
Grid code 329

Volume m³	6,77963E+11
Volume km³	677,96
Rock type	Psammites, amphibolites

Unknown
Grid code 332

Volume m³	1,37265E+11
Volume km³	137,26
Rock type	Unknown

Unknown
Grid code 333

Volume m³	2,00339E+11
Volume km³	200,34
Rock type	Unknown

Flåen subunit
Grid code 337

Volume m³	4,86577E+11
Volume km³	486,58
Rock type	Semipelite, psammite, quartzite

Veteranen Group
Grid code 340

Volume m³	10358095724
Volume km³	10,36
Rock type	Quartzite, shale, limestone

Unknown
Grid code 341

Volume m³	78845397047
Volume km³	78,85
Rock type	Unknown

Glasgowbreen Formation
Grid code 344

Volume m³	97198717530
Volume km³	97,20
Rock type	Graywacke, quartzite

Kingbreen Formation
Grid code 345

Volume m³	2,35083E+11
Volume km³	235,08
Rock type	Quartzite, shale

Kortbreen Formation
Grid code 351

Volume m³	2,70907E+11
Volume km³	270,91
Rock type	Quartzite, limestone

Akademikarbreen Group
Grid code 355

Volume m³	6,46462E+11
Volume km³	646,46
Rock type	Dolomite, limestone

Unknown
Grid code 365

Volume m³	1,07493E+11
Volume km³	107,49
Rock type	Unknown

Oslobregruppen (kambrium-ordovicium)
Grid code 385

Volume m³	13103074533
Volume km³	13,10
Rock type	Limestone, dolomite

Richarddalen Complex
Grid code 401

Volume m³	4869345667
Volume km³	4,87
Rock type	Metamagatite

Biscayarhuken unit (mica schist and psammitic schist)
Grid code 406

Volume m³	22544678583
Volume km³	22,54
Rock type	Schist

Metagabbro
Grid code 415

Volume m³	215152499,3
Volume km³	0,22
Rock type	Metagabbro

Generalfjella Formation
Grid code 431

Volume m³	3,50181E+11
Volume km³	350,18
Rock type	Marble

SC: fine grained felsic gneisses
Grid code 440

Volume m³	6508808243
Volume km³	6,51
Rock type	Gneiss

SC: porphyroblastic gneisses
Grid code 441

Volume m³	22336819956
Volume km³	22,34
Rock type	Gneiss

SC: granitic orthogneisses
Grid code 442

Volume m³	1576824854
Volume km³	1,58
Rock type	Gneiss

SC: banded gneisses
Grid code 443

Volume m³	15933576870
Volume km³	15,93
Rock type	Gneiss

SC: migmatites
Grid code 444

Volume m³	7,20226E+11
Volume km³	720,23
Rock type	Migmatites

SC: migmatites with aplites
Grid code 445

Volume m³	1590975604
Volume km³	1,59
Rock type	Migmatites

SC: late tectonic granites
Grid code 446

Volume m³	45064074704
Volume km³	45,06
Rock type	Granite

SC: amphibolite
Grid code 447

Volume m³	47965103,11
Volume km³	0,05
Rock type	Amphibolite

SC: marble/skarn
Grid code 449

Volume m³	1708395341
Volume km³	1,71
Rock type	Marble

SC: migmatite with aplites
Grid code 450

Volume m³	20573936,46
Volume km³	0,02
Rock type	Migmatite

GF: upper banded marbles
Grid code 451

Volume m³	37459143990
Volume km³	37,46
Rock type	Marble

GF: lower banded marbles
Grid code 452

Volume m³	1031205068
Volume km³	1,03
Rock type	Marble

GF: graphitic carbonate schist
Grid code 453

Volume m³	16809940,68
Volume km³	0,02
Rock type	Schist

Unknown
Grid code 454

Volume m³	672294033
Volume km³	0,67
Rock type	Unknown

Unknown
Grid code 455

Volume m³	5589967223
Volume km³	5,59
Rock type	Unknown

Unknown
Grid code 456

Volume m³	166690375,4
Volume km³	0,17
Rock type	Unknown

SF: micaceous schist
Grid code 460

Volume m³	1,02946E+11
Volume km³	102,95
Rock type	Schist

SF: garnet-mica schist
Grid code 461

Volume m³	78390739189
Volume km³	78,39
Rock type	Schist

SF: (garnet-)mica schist w. aplites
Grid code 462

Volume m³	91159815156
Volume km³	91,16
Rock type	Schist

SF: quartzite
Grid code 463

Volume m³	2584900324
Volume km³	2,58
Rock type	Quartzite

SF: various metasediments
Grid code 464

Volume m³	46991275696
Volume km³	46,99
Rock type	Metasediment

SF: marble
Grid code 465

Volume m³	4594237642
Volume km³	4,59
Rock type	Marble

NF: banded garnet-biotite gneiss
Grid code 470

Volume m³	2551944150
Volume km³	2,55
Rock type	Gneiss

NF: banded gneiss with aplites
Grid code 471

Volume m³	666223198,1
Volume km³	0,67
Rock type	Gneiss

SC: quartzite
Grid code 481

Volume m³	197982925,2
Volume km³	0,20
Rock type	Quartzite

Hornemantoppen Granite
Grid code 490

Volume m³	63822439465
Volume km³	63,82
Rock type	Granite

HG: xenolith-rich marginal zone
Grid code 491

Volume m³	1908071126
Volume km³	1,91
Rock type	Granite

Holmeslettfj F without Bullt cgl
Grid code 604

Volume m³	4797741302
Volume km³	4,80
Rock type	Slate

Bulltinden Conglomerate Member
Grid code 605

Volume m³	3279713340
Volume km³	3,28
Rock type	Conglomerates

Motalafjella Formation
Grid code 606

Volume m³	2710261818
Volume km³	2,71
Rock type	Slate, limestone

Sarsøyra Formation
Grid code 607

Volume m³	184729612,3
Volume km³	0,18
Rock type	Marble

Aavatsmarkbreen Formation
Grid code 608

Volume m³	1496622497
Volume km³	1,50
Rock type	Phyllite, vulcanites, psammites, carbonate

Vestgøtabreen Complex
Grid code 610

Volume m³	4291710,296
Volume km³	0,00
Rock type	Phyllite, carbonate

Vestgøtabreen Complex: magnesite rocks
Grid code 611

Volume m³	199999342,4
Volume km³	0,20
Rock type	Carbonate

Vestgøtabreen Complex: greenstone
Grid code 613

Volume m³	608871597,5
Volume km³	0,61
Rock type	Greenstone

Vestgøtabreen Complex: phyllite w greenst serpent qtze lmst lenses
Grid code 617

Volume m³	1423579807
Volume km³	1,42
Rock type	Phyllite

Vestgøtabreen Complex: schistose limestone
Grid code 618

Volume m³	402278301,8
Volume km³	0,40
Rock type	Schist

Vestgøtabreen Complex: gnt-chl-mica schist glaucoph sch eclogite
Grid code 619

Volume m³	519802723,2
Volume km³	0,52
Rock type	Schist, eclogite

Nielsenfjellet unit
Grid code 626

Volume m³	17707389000
Volume km³	17,71
Rock type	Phyllite

Steenfjellet unit
Grid code 629

Volume m³	2115848237
Volume km³	2,12
Rock type	Marble

Bogegga unit
Grid code 630

Volume m³	2,82575E+11
Volume km³	282,57
Rock type	Schist

Comfortlessbreen Group, quartzite
Grid code 635

Volume m³	1164956584
Volume km³	1,16
Rock type	Quartzite

Comfortlessbreen Group, diamictite
Grid code 636

Volume m³	71686445547
Volume km³	71,69
Rock type	Diamictite

Comfortlessbreen Group, carbonate rocks
Grid code 637

Volume m³	392428112
Volume km³	0,39
Rock type	Carbonate

Daudmannsodden Group carbonate rocks
Grid code 651

Volume m³	1229491060
Volume km³	1,23
Rock type	Carbonate

Daudmannsodden Group slate and pyllite/phyllitic pelite
Grid code 652

Volume m³	1853477092
Volume km³	1,85
Rock type	Slate, phyllite

Daudmannsodden Group metasandstone
Grid code 653

Volume m³	2801787384
Volume km³	2,80
Rock type	Metasediment

Daudmannsodden Group quartzite bands
Grid code 654

Volume m³	432949505,9
Volume km³	0,43
Rock type	Quartzite

Alkhornet Formation
Grid code 668

Volume m³	123069572,9
Volume km³	0,12
Rock type	Marble, limestone

Alkhornet Formation carbonate rocks
Grid code 669

Volume m³	48920550098
Volume km³	48,92
Rock type	Carbonate

Alkhornet Formation phyllite
Grid code 670

Volume m³	26896617340
Volume km³	26,90
Rock type	Phyllite

Trollheimen Volcanic Mb
Grid code 673

Volume m³	3041810434
Volume km³	3,04
Rock type	Volcanites

Løvliebreen F areno-argillaceous phyllite
Grid code 675

Volume m³	28237481747
Volume km³	28,24
Rock type	Phyllite

Moefjellet unit
Grid code 676

Volume m³	32721933357
Volume km³	32,72
Rock type	Dolostone

Trondheimfjella unit
Grid code 677

Volume m³	5144592565
Volume km³	5,14
Rock type	Phyllite

Arkfjellet unit
Grid code 1300

Volume m³	16158319656
Volume km³	16,16
Rock type	Shale

Sørkapp Land Gr without Wiederfjellet F
Grid code 1311

Volume m³	1,06007E+11
Volume km³	106,01
Rock type	Carbonate

Wiederfjellet Formation
Grid code 1315

Volume m³	1023876377
Volume km³	1,02
Rock type	Quartzite

Sofiekammen Gr without Vardepiggen F
Grid code 1328

Volume m³	44974135007
Volume km³	44,97
Rock type	Carbonate

Vardepiggen Formation
Grid code 1336

Volume m³	1912303707
Volume km³	1,91
Rock type	Breccia

Bellsund Diamictite Group
Grid code 1350

Volume m³	47705154045
Volume km³	47,71
Rock type	Diamictite

Kapp Lyell unit: phyllite with clasts
Grid code 1363

Volume m³	571352239,7
Volume km³	0,57
Rock type	Phyllite

Lågneset Formation phyllite shale qtze
Grid code 1369

Volume m³	670766216,6
Volume km³	0,67
Rock type	Phyllite, shale, quartzite

Jens Erikfjellet volcanites
Grid code 1397

Volume m³	4306137770
Volume km³	4,31
Rock type	Volcanites

Thiisfjellet Formation
Grid code 1405

Volume m³	1628072070
Volume km³	1,63
Rock type	Limestone, conglomerate

Diabasodden Suite
Grid code 1412

Volume m³	1438250855
Volume km³	1,44
Rock type	Dolerite

Asbestodden ultramafites
Grid code 1413

Volume m³	391950,8124
Volume km³	0,00
Rock type	Ultramafites

Dunderdalen Formation calcareous green phyllite
Grid code 1418

Volume m³	482208320,3
Volume km³	0,48
Rock type	Phyllite

Skoddefjellet Formation
Grid code 1442

Volume m³	4079517975
Volume km³	4,08
Rock type	Schist

Ariekammen Formation
Grid code 1443

Volume m³	2080740508
Volume km³	2,08
Rock type	Marble

Revdalen Formation
Grid code 1444

Volume m³	440110538,8
Volume km³	0,44
Rock type	Schist

Eimfjellet Group: tuffaceous quartzites
Grid code 1447

Volume m³	1208029589
Volume km³	1,21
Rock type	Quartzite

Eimfjellet Group: amphibolites undiff
Grid code 1448

Volume m³	7383151520
Volume km³	7,38
Rock type	Amphibolite

Gulliksenfjellet quartzites
Grid code 1451

Volume m³	875268102,8
Volume km³	0,88
Rock type	Quartzite

Eimfjellet Group: dark phyllites locally w qtze layers
Grid code 1454

Volume m³	78998905,41
Volume km³	0,08
Rock type	Phyllite

Eimfjellet Group: quartzites and quartz mica schists
Grid code 1456

Volume m³	833765436,1
Volume km³	0,83
Rock type	Quartzite, Schist

Eimfjellet Group: diamictites
Grid code 1457

Volume m³	13071383
Volume km³	0,01
Rock type	Diamictite

Deilegga Group
Grid code 1475

Volume m³	37020710844
Volume km³	37,02
Rock type	Conglomerate, dolomite, slate

Malmberget unit undiff
Grid code 1484

Volume m³	7359254761
Volume km³	7,36
Rock type	Marble

Kapp Berg Formation
Grid code 1486

Volume m³	27643376706
Volume km³	27,64
Rock type	Phyllite, quartzite

Peder Kokkfjellet Formation
Grid code 1488

Volume m³	1498396602
Volume km³	1,50
Rock type	Carbonate

Botnedalen Formation
Grid code 1489

Volume m³	3826634010
Volume km³	3,83
Rock type	Carbonates, phyllite

Unknown
Grid code 1490

Volume m³	1551261384
Volume km³	1,55
Rock type	Unknown

Seljehaugen Formation: lower part black limestone
Grid code 1491

Volume m³	164085187
Volume km³	0,16
Rock type	Limestone

Seljehaugen Formation: upper part grey dolomite
Grid code 1492

Volume m³	73632684,72
Volume km³	0,07
Rock type	Dolomite

Trinutane Formation: lower part pink quartzite
Grid code 1494

Volume m³	1497664662
Volume km³	1,50
Rock type	Quartzite

Trinutane Formation: upper part ferrous dol and pink marble
Grid code 1495

Volume m³	407687774,4
Volume km³	0,41
Rock type	Dolomite, marble

Thiisdalen Formation
Grid code 1496

Volume m³	298581746,9
Volume km³	0,30
Rock type	Phyllite, quartzite

Dørdalen Formation
Grid code 1497

Volume m³	247151682,4
Volume km³	0,25
Rock type	Carbonate, phyllite

Magnethøgda unit
Grid code 1499

Volume m³	3733994496
Volume km³	3,73
Rock type	Carbonate, phyllite, quartzite

Massive dolomite Upp Prot to Late Pal
Grid code 1511

Volume m³	44518743173
Volume km³	44,52
Rock type	Dolomite

Carbonate rocks and phyllite probably Upp Prot
Grid code 1515

Volume m³	140914164,1
Volume km³	0,14
Rock type	Carbonate, phyllite

Proterozoic marbles
Grid code 1530

Volume m³	5392106125
Volume km³	5,39
Rock type	Marble

Proterozoic quartzites and mica schists
Grid code 1531

Volume m³	17753330681
Volume km³	17,75
Rock type	Quartzite

Proterozoic quartzite
Grid code 1532

Volume m³	1352218403
Volume km³	1,35
Rock type	Quartzite, schist

Proterozoic phyllite
Grid code 1533

Volume m³	2596860133
Volume km³	2,60
Rock type	Phyllite

Green phyllite and greenschist (B)
Grid code 1534

Volume m³	238352760,8
Volume km³	0,24
Rock type	Phyllite, schist

Diamictite (F)
Grid code 1536

Volume m³	430918703,7
Volume km³	0,43
Rock type	Diamictite

Slyngfjellkonglomeratet og mulige ekvivalenter
Grid code 1540

Volume m³	53074129086
Volume km³	53,07
Rock type	Conglomerate

Höferpynt Formation og mulige ekvivalenter
Grid code 1541

Volume m³	38463939706
Volume km³	38,46
Rock type	Dolomite

Gåshamn Formation og mulige ekvivalenter
Grid code 1542

Volume m³	2,24782E+11
Volume km³	224,78
Rock type	Phyllite

Granosyenite Caledonian
Grid code 1570

Volume m³	6707797183
Volume km³	6,71
Rock type	Granosyenit

Dolerite and metagabbro probably Upp Prot
Grid code 1580

Volume m³	261354195,5
Volume km³	0,26
Rock type	Dolerite, metagabbro

Granitt, kaledonsk
Grid code 1581

Volume m³	4,10386E+11
Volume km³	410,39
Rock type	Granite

Unknown
Grid code 3003

Volume m³	174501125,4
Volume km³	0,17
Rock type	Unknown

Unknown
Grid code 3005

Volume m³	461843801,1
Volume km³	0,46
Rock type	Unknown

Unknown
Grid code 3007

Volume m³	2089208012
Volume km³	2,09
Rock type	Unknown

Svalbards geologi – fra natur til kart

Da Kong Shaka av zulu-folket i det sørlige Afrika for nesten 200 år siden for første gang så skrevne ord, tegnet med trekull på et geiteskinn, ble han fortalt at de hvite brukte disse for å nedtegne kunnskap og tanker. Dermed kunne senere generasjoner huske og gjenoppleve dem. "Hos oss hører vi vinden som hvisker hva forfedrene tenkte for generasjoner siden", svarte kongen. Men det kunne neppe skade å tilegne seg denne nye formen å kommunisere på. Snart kunne han skrive navnet sitt.

For oss geologer er historien skrevet med mineralkorn i stein, ordene er strukturer på fjellvegger, hvalbein og skjellfragmenter på gamle strandflater. Etter hvert lærer vi oss å lese disse ordene, men ennå er det mange vi ikke forstår.

Ordene ligger spredt i landskapet – noen åpent i dagen, andre godt skjult. Vi setter sammen brikker i et ofte motstridende puslespill. Bildet blir klarere jo flere brikker som faller på plass, men de vil aldri være fulltallige. Noen ganger er vi helt sikre på at en brikke *må* ligge akkurat der hvor vi la den, for da blir bildet riktig. Likevel kan vi være på blindspor. Én enkel brikke, én liten detalj, kan velte hele vår forestilling om det ferdige bildet. Geologiske modeller og kart bærer preg av denne prosessen. Siden vi ikke ønsker at de skal ha hull, vil de alltid vise hvordan vi tror ting henger sammen. De tar hensyn til alle fakta, men er i realiteten et kompromiss mellom det vi kan si med sikkerhet, det vi antar, og det vi ennå ikke har forstått.

Svalbard

Svalbard inntar en geologisk nøkkelposisjon i Arktis. Ingen andre steder i Nord-Europa finnes et slikt mangfold av geologiske formasjoner, og ingen andre steder er så mange geologiske tidsepoker bevart i stein. Samtidig er fjellet for det meste nakent, uten jordsmonn og vegetasjon, og berggrunnen kan derfor studeres sammenhengende over store arealer. Alt dette gjør Svalbard til et unikt sted for studier av geologiske prosesser – et utmerket ekskursjons-, undervisnings- og forskningsområde.

Svalbards øyer har elementer fra eldgammelt grunnfjell, fra den kaledonske fjellkjeden som også strekker seg gjennom Norge, fra Den arktiske cordillera som danner fjellene helt i nord på de canadiske øyene, fra forskjellige sedimentbassenger og kontinentalsokler gjennom jordas old- og mellomtid, og fra den nordatlantiske vulkanprovinsen som også Island er en del av. I tillegg finnes det utallige strukturer i fjellet som stammer fra opprinnelsen av Nordatlanteren og Polhavet i paleogen tid, hvor Svalbard med Barentshavet og Grønland drev fra hverandre. Kullet, som i lang tid har vært grunnpilar for menneskets tilstedeværelse på øygruppa, oppsto i sumpskoger på samme tid.

I mesteparten av den geologiske historien har Svalbard ikke ligget i Arktis, men i varmere strøk. Men i det lange løp forflytter både kontinentene og jordens akse seg. I dag preger det polare klimaet landskapet og jordoverflaten på øyene. Selv om den siste istid ligger over 10 000 år tilbake, er fortsatt 60% av landområdet på øygruppa dekket av isbreer. Mange brefronter ender i sjøen, hvor det stadig brekker av isfjell – breene kalver. Isen har under sin tilbaketrekning lagt igjen utallige morener som ofte gir landskapet et måneaktig preg. Det polare preget understrekes av prosesser som permafrosten er ansvarlig for, som for eksempel polygonmark – kantede og runde sprekkmønstre på jordoverflaten – steinbreer, pingoer og en rekke andre spesielle arktiske landformer.

Geologisk kartlegging

Geologisk kartlegging er en registrering av ulike bergarters forekomst og utbredelse. Ordet 'kartlegging' må i denne forbindelse tolkes i vid forstand. Det rommer opparbeidelsen av kunnskap om berggrunnens geologiske oppbygning og utviklingshistorie, inkludert de prosessene som har virket inn for å danne berggrunnen. Denne kunnskapen systematiseres og publiseres, adressert til fagfolk, publikum og forvaltning. Kunnskap om prosessene er ikke bare interessant i akademisk øyemed, men også for å kunne sette ulike observasjoner i sammenheng. Slik kan man forutsi forhold der de ikke er observerbare – som under jordoverflaten og på havbunnen.

Resultatene av geologisk kartlegging fremstilles som geologiske kart (f.eks. berggrunnsgeologiske og kvartærgeologiske kart) med tilhørende kartbeskrivelser. Kart og beskrivelser utgjør et datagrunnlag som gir brukerne en oversikt over områdets geologiske oppbygging og utviklingshistorie. Utover dette kan kartene brukes som grunnlag for videre forskning, undervisning, vurdering

av ressurspotensial, og i ressurs- og miljøforvaltning. Selv om geologiske oversiktskart over Svalbard har vært publisert i snart 40 år, er de ikke nødvendigvis pålitelige. Dette skyldes at man gjerne vil sammenfatte det man vet til enhver tid, selv om detaljforståelsen ikke nødvendig er på plass. Oversiktskartene krever stadig oppdatering for å kunne fange detaljer mest mulig korrekt.

Geologiske undersøkelser og kartlegging av Svalbards berggrunn gjennomføres av Norsk Polarinstitutt i oppdrag fra den norske stat. Kartserien over Svalbard innbefatter geologiske kart i oversikts- og detaljmålestokker. Den moderne kartdatabasen over Svalbard, som er basert på målestokkene 1:750 000, 1:250 000 og 1:100 000, oppdateres fortløpende i digital form og gis ut som trykte kart.

Detaljkartserien er nå langt på vei fullført. Selv om det mangler kart over de østlige øyene Edgeøya, Barentsøya og Kong Karls Land, er geologien stort sett kjent, og det forventes ingen store overraskelser. Edgeøya og Barentsøya har ikke hatt prioritet, en mer detaljert kartlegging vil sannsynligvis ikke føre til vitenskapelige nyvinninger og vil i liten grad forandre kartbildet fra oversiktskartene. Grunnen til dette er den nokså enkle geologien i området, med bare flatliggende lag. Kong Karls Land kan derimot by på spennende overraskelser, men øyene er på grunn av sine isbjørnhiområder et strengt regulert naturreservat.

Det mangler også kart over Prins Karls Forland, som nå er i ferd med å kartlegges. Her er det mye ukjent og nytt å forvente. På 80- og begynnelsen av 90-tallet ble det laget en del kart over vestkysten av Spitsbergen, som ligger i et komplisert foldebelte. Mye av det som ble tolket og tegnet inn på kartene denne gang tilfredsstiller ikke dagens krav og må bearbeides med en ny forståelse av den geologiske sammenhengen.

Hvordan blir et geologisk kart til?

Utgangspunktet for et geologisk kart er innsamling og studier av eksisterende materiale som kart, vitenskapelige artikler og rapporter om geologien i det aktuelle området. Enkelte kartblad i godt undersøkte områder ha blitt til på dette grunnlaget, gjerne i samarbeid med lokalkjente, eksterne geologer. Men vanligvis er kunnskapsnivået mangelfullt.

Derfor studerer man de geologiske forholdene gjennom feltarbeid, som på Svalbard krever mye logistikk. Feltarbeidet utføres til fots og med gummibåt (unntaksvis snøskuter), i perioder på opptil seks eller åtte uker. Mer tillater

ikke den korte arktiske sommeren. Geologer fra andre institusjoner enn Norsk Polarinstitutt inviteres gjerne til å delta eller til å kombinere sine aktiviteter med instituttets, for å øke den vitenskapelige kompetansen. I mange år har det vært kontinuerlig samarbeid med russiske geologer, mens forskere fra andre norske institutter, samt fra Tyskland, Polen, Sverige, USA, Frankrike og andre land, har vært med i varierende grad.

På denne type feltarbeid gjøres det bare overflateobservasjoner, ingen boringer eller seismikk. Dersom industrielle foretak har slike data, prøver man å få adgang til dem og dra dem med inn i de faglige konklusjonene. Men vanligvis må man bruke sin geologiske forståelse i kombinasjon med kunnskap fra mange geologiske forskningsområder for å konstruere sannsynlige modeller for hvordan forholdene ser ut i dypet.

Men overflateobservasjoner har sine begrensninger. Riktignok mangler de fleste steder på Svalbard vegetasjon og jordsmonn, men grus og utrasninger fra fjellsider, samt morener fra isbreer, har ofte fylt igjen store deler av dalførene. I tillegg kommer de utstrakte isbreene som skjuler store fjellområder. Jo færre nunatakker (fjelltopper som stikker ut av isen) som finnes, jo mer må tolkningen av berggrunnen under isen baseres på det man ser langs iskanten og den generelle geologiske forståelsen av området. Det samme gjelder berggrunnen under fjordene og sundene. Vanlige geologiske kart viser ikke fjellet under is og vann, men spesielle tolkningskart, hvor dette er tegnet inn, kan lages ved behov.

Det som har prioritet er derimot å forstå utviklingen av jordskorpen i og rundt Svalbard over tid, og å få en oversikt over hvordan bergartslagene og -kroppene ligger fordelt på jordoverflaten og i de øverste kilometerne av undergrunnen. Enkelte lag eller områder er likevel grundigere undersøkt enn andre gjennom spesifikke forskningsprosjekter.

Hvor mye vet vi?

”Vanlige geologiske kart” fra Svalbard, sammen med en utførlig tegnforklaring og en kartbeskrivelse, viser et tverrsnitt av de grunnleggende geologiske forholdene, men er på ingen måte en utfyllende undersøkelse av alt man kunne ønske å vite. Hvorfor ikke? Dato for innhenting av feltpartiet er satt før feltarbeidet starter opp. Geologene opererer i et område uten infrastruktur, bor i teltleir og har en arbeidsradius som bestemmes av terreng, vær og vind. Prøver må ofte bæres ned fra fjellet til fots. Høy sjø gjør ofte at gummibåtene

må bli liggende på land. Helikoptertimer er dyre, og er det tåke blir helikopteret stående på bakken. Hva som legges vekt på i den begrensede tiden kan også være bestemt av enkelte forskeres særinteresser.

Dersom man ved endt ekspedisjon ikke har oppnådd det man ønsket, må man tenke seg godt om: Skal det brukes en halv million kroner én gang til? Eller vil gevinsten være for liten? Skal man heller lage et kart på grunnlag av det man vet, og bruke midlene neste sommer for et nytt, ukjent område, hvor gevinsten i form av ny kunnskap blir større? Ofte vil geologiske kart være basert på tolkninger ut fra et avansert kunnskapsnivå. Andre forskere vil kunne legge dem til grunn for egne prosjekter, og eventuelt utbedre dem gjennom nye erfaringer og observasjoner. Kanskje vil prosjektet fylle viktige gap i den geologiske forståelsen av området, eller til og med i den geologiske forståelsen av en geohistorisk tidsepoke eller en geologisk prosess.

Mesteparten av kunnskapen vi har er fortsatt kvalitativ fremfor kvantitativ. For eksempel er det kjent at mineralet pyroxen forekommer i en bergart, men ikke hvor mange prosent. Vi vet at det finnes tynne kullag i en formasjon, men kjenner ikke hele forekomsten. Vi vet at det finnes fossile trilobitter i en lagrekke, men vet ikke hvor utbredt de er i hele formasjonen. Formasjoner er ofte undersøkt stedvis, eksempelvis, ikke over hele sin forekomst. Det gjøres ikke mineralanalyser for alle formasjoner. Mye beskrives bare med det blotte øyet i felten.

Dermed er det slik at vi, på tross av mange data og mye kunnskap, på mange spørsmål fortsatt må svare med vage ord. Vil vi unngå skråsikre påstander, er vendinger som ”mest sannsynlig”, ”trolig”, ”antas å være…” uunngåelige. Ord som gjør legfolk fortvile, fordi de ikke er klar over hvor mye som må til for å ha helt klare svar på alt. Ord som kan høres ut som om vi ikke har gjort en ordentlig jobb, men bare forteller det som vinden har hvisket om.

Winfried Dallmann
Geolog ved Norsk Polarinstitutt

The geology of Svalbard – from nature to map

When, some 200 years ago, King Shaka of the Zulu people in Southern Africa first saw written words, drawn with charcoal on a goatskin, he was told that this is how the whites recorded knowledge and thoughts, which, by this technique, could be recovered and relived by later generations. "With us, we hear the wind whispering what our ancestors thought many generations ago," replied the king. Even so, there could be no harm in acquiring this new form of communication, and soon he could write his name.

For geologists, history is written with grains of minerals in rocks; words are structures on rock faces, whale bones and shell fragments on old shorelines. Gradually, we learn to read these words, but still there are many we do not understand.

The words are scattered across the landscape – some exposed to the sky, others well hidden. We put together the pieces of an often contradictory puzzle. The greater the number of pieces that fall into place, the clearer the picture becomes, but a few details will always be missing. Once in a while we are absolutely convinced that a certain piece *must* fit where we've put it, because then the picture makes sense. Even so, it might still be a false trail. A single piece, one tiny detail, can upset our whole conception of the final picture. Geological models and maps bear the traces of this process. Because we don't want there to be gaps in them, they will always show our best inference as to how things hang together. They take all the facts into account, but are in reality a compromise between what we can say with certainty, what we assume to be the case, and things we still haven't understood.

Svalbard

Svalbard occupies a key position in the geology of the Arctic. Nowhere else in northern Europe does one find such a diversity of geological formations, and nowhere else are so many geological eras preserved in stone. In addition, the bedrock is for the most part exposed, without topsoil or vegetation, meaning it can be studied continuously over large areas. All this makes Svalbard a

unique place for the study of geological processes – an excellent destination for excursions, teaching and research.

Svalbard's islands have elements of truly ancient bedrock – from the Caledonian mountain chain, which also extends through Norway, from the Arctic Cordillera that forms the mountains along the north-eastern flank of Canada's Arctic Archipelago, from various sedimentary basins and continental shelves formed in the Palaeozoic and Mesozoic periods, and from the North Atlantic Igneous Province, of which also Iceland is a part. In addition, there are numerous structures in the rock originating from the time when the North Atlantic and Arctic Ocean formed in the Palaeogene period, when Svalbard and the Barents Sea drifted away from Greenland. Svalbard's coal, which has long been the main reason for the human presence on these islands, originated in the swampy forests of this period.

For most of its geological history, Svalbard lay not in the Arctic, but in warmer climes. But over millions of years, the continents have drifted, and even the earth's axis has shifted. Today it is the polar climate that shapes the landscape and the exposed surfaces of the islands. Although the last ice age is over 10,000 years in the past, some sixty percent of the islands' land mass is still covered by glaciers. Many glaciers terminate in the sea, where icebergs are constantly breaking off from them; the glaciers calve. As the glaciers retreat, they leave numerous moraines in their paths, forming landscapes reminiscent of the moon. The polar climate adds its own characteristic features, with the permafrost responsible for processes that create, for example, patterned ground – angular and circular patterns of cracks on the earth's surface – rock glaciers, pingos and a variety of other special arctic landscape features.

Geological mapping

Geological mapping involves recording the location and extent of various types of rock. In this context, the word "mapping" has to be understood in a broad sense. For it also covers the reassessment of earlier knowledge about the bedrock's geological structure and developmental history, including the processes that have helped to form the bedrock. This knowledge is systematised and published for the benefit of professionals, the public and government authorities. It isn't only academics who find this information about geological processes interesting; it also provides context for a variety of other

observations. For example it allows one to predict conditions where they cannot be directly observed – such as beneath the surface of the ground or on the seabed.

The results of geological mapping are presented as geological maps (e.g. bedrock and Quaternary geological maps) with corresponding map descriptions. The map and descriptions provide a fundamental overview of the area's geological structure and developmental history. Beyond this, the maps can be used as a basis for further research, teaching, the assessment of potentially useful deposits, and resource and environmental management. Although people have been publishing overview geological maps of Svalbard for almost forty years, not all of them are equally reliable. This is because geologists usually seek to summarise everything that is known at a particular time, even if there are still gaps at a more detailed level. Overview maps require constant updating in order to capture the details as accurately as possible.

Svalbard's geology is surveyed and mapped by the Norwegian Polar Institute on behalf of the Norwegian government. The series of Svalbard maps includes both small and large-scale geological maps. The modern map database of the region, which uses the scales 1:750,000, 1:250,000 and 1:100,000, is updated continuously in digital form and published in the form of printed maps.

The series of detailed maps is now more or less complete. Although maps of the eastern islands of Edgeøya, Barentsøya and Kong Karls Land are still missing, the geology of these areas is largely known, and nobody expects any major surprises. Edgeøya and Barentsøya have been given low priority, since more detailed surveys are unlikely to result in significant scientific discoveries and will hardly differ from the appearance of the overview maps. The reason for this is the relatively simple geology of the area, consisting entirely of horizontal strata. Kong Karls Land, however, might well hold a few interesting surprises, but because the islands are a hibernating area for polar bears, they are strictly protected as a nature reserve.

Maps of Prins Karls Forland are also lacking, although mapping is now underway. Relatively little is known about this area, and we can expect to learn a lot. During the 1980s and early 90s, a number of maps were made of the west coast of Spitsbergen, which is situated in a complex fold belt. Many of the inferences that were made back then, and the corresponding features on the maps, do not meet today's requirements and must be revised in light of our newer understanding of the geological context.

How is a geological map made?

When making a geological map, one starts by collecting and studying existing material, such as earlier maps, scientific articles and reports on the geology of the area in question. A number of maps covering well studied areas have been compiled in this way, often in collaboration with outside geologists with special knowledge of the area. But usually the level of knowledge is inadequate.

Consequently, geological conditions have to be studied by means of fieldwork, which in Svalbard requires a lot of logistical support. Fieldwork is conducted on foot and using inflatable boats (occasionally also snowmobiles), for periods of up to six or eight weeks, which is the maximum the brief Arctic summer will allow. Geologists from institutions other than the Norwegian Polar Institute are frequently invited to take part or to coordinate their own activities with those of the Institute in order to combine scientific strengths. There has been continuous cooperation with Russian geologists for many years now, while researchers from other Norwegian institutions, as well as from Germany, Poland, Sweden, the US, France and other countries, have all been present to varying degrees.

This kind of fieldwork consists entirely of surface observations, and involves no drilling or seismology. Where industrial exploration has already produced such data, one tries to get access to that information and to take it into account when drawing scientific conclusions. But usually one has to rely on one's understanding of geology and a broad knowledge of many regions where geological research is being conducted in order to construct probable models of conditions below the surface.

There are, however, limits to what one can learn from surface observation. Admittedly, few places on Svalbard have vegetation or topsoil, but many valleys are largely filled with gravel and scree from the mountain slopes and with glacial moraine. In addition, large tracts of the mountainous parts are covered by extensive glaciers. The smaller the number of nunataks (mountain peaks jutting out from the ice), the more one has to infer the nature of the bedrock beneath the ice on the basis of what can be seen along the margin of the ice and of one's general understanding of the local geology. The same is true of the bedrock beneath the fjords and the straits between the islands. Geological maps do not generally show the rocks beneath glaciers and water, but special maps in which these features are inferred can be drawn up if necessary.

The priority, however, is to understand how the earth's crust on and around Svalbard has evolved over time, and to improve our general understanding of how the strata and bodies of rock are distributed across the surface of the earth and in the top few kilometres beneath our feet. Even so, some strata and some areas have been more thoroughly investigated than others as a result of specific research projects.

How much do we know?

Although a standard geological map of Svalbard, with a detailed key of symbols and a description of what is represented, provides an outline of the basic geological conditions, it could in no way be described as an exhaustive account of everything we would like to know. Why not?

When fieldwork teams set out, a date for them to be picked up has already been set. The geologists operate in an area with no infrastructure, living in tent camps, and working within a radius that is determined by the terrain and the weather. Samples generally have to be carried down from the mountain on foot. Rough seas often mean that inflatable boats have to be left on land. Helicopters are expensive to rent, and if conditions are foggy, they too have to stay on the ground. What gets emphasised in the limited time available is also often determined by the interests of individual researchers.

If, when an expedition comes to an end, one hasn't achieved one's original objectives, then it's time for some serious thinking. Can one justify the expenditure of another half a million kroner? Or will the rewards be too small? Shouldn't one rather draw a map on the basis of what is already known and devote next year's funding to exploring a new, unfamiliar area, where the reward in terms of fresh insights is likely to be bigger? Geological maps are often based on inferences from fairly advanced knowledge. They serve as a foundation for the projects of other researchers, who might well improve them as a result of their own experiences and observations. Maybe the project will fill important gaps in our knowledge about the geology of the area, or even in our understanding of an entire geo-historical epoch or of some geological process.

Most of our knowledge is still qualitative rather than quantitative. For example, we know that the mineral pyroxene occurs in a certain type of rock, but not at what concentrations. We know that there are thin seams of coal in one formation, but we don't know the full scale of the deposit. We know there are

fossil trilobites in one set of strata, but we don't know how prevalent they are across the entire formation. Formations are often studied at single locations, for example, rather than in their full extent. Mineral analyses are not undertaken for all formations. Many descriptions are merely based on what can be seen by the observer in the field.

All this means that, despite the data and knowledge we have accumulated, many questions can still only be answered in relatively vague terms. When trying to avoid overly confident claims, you can't get by without phrases such as "most probably", "in all likelihood", "our assumption is …" – phrases that often drive the layman to despair, simply because he hasn't realised what it takes to arrive at clear answers to everything. They are phrases that sometimes make it sound as if we haven't been doing our job, or have merely been listening to what is whispered by the wind.

Winfried Dallmann
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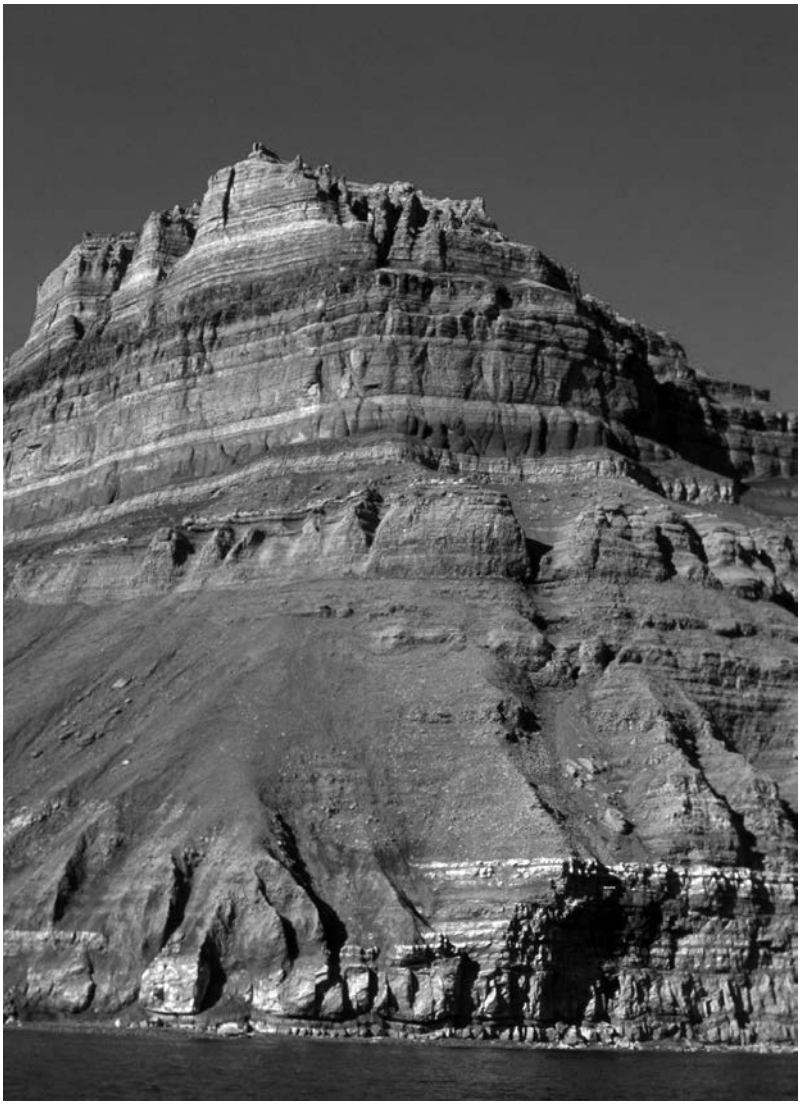

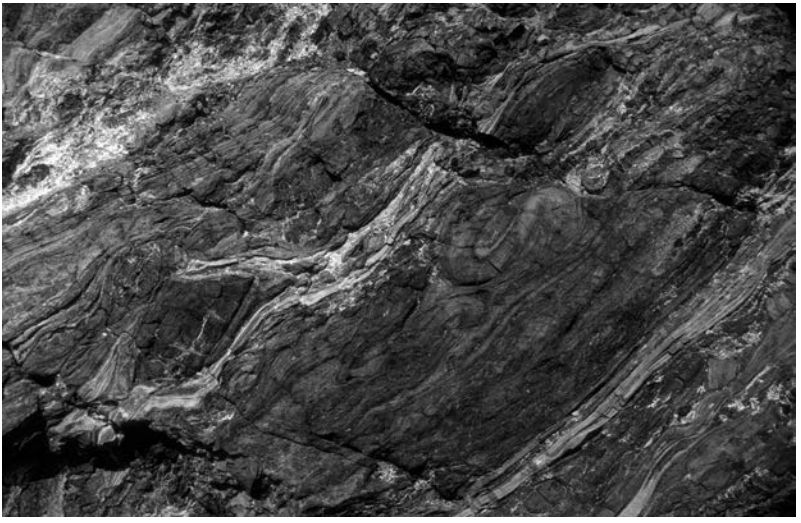

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Thanks to
Karoline Baelum (Svalbard Science Forum), Alvar Braathen (UNIS), Terje Karlsen (Store Norske Spitsbergen Grubekompani), Alejandro Cearreta (Science and Technology Faculty UPV/EMU), Winfried Dallmann (Norwegian Polar Institute), Ivar S. Fossum (Nordic Mining), Winfried Huet, Darius Ignatiuk (Polish Academy of Sciences), Arne Iversen, Aina Helgesen (Oslo Municipality), Tore Høyland (Norwegian Environment Agency), Annlaug Kjelstad (Nausterdal Municipality), Heidi Kristiansen (Oslo Municipality), Ann Lisbeth Lesto (Nausterdal Municipality), Kjetil Lønborg Jensen (Oslo Municipality), Nina Patricia Moore (Lusparken Arkitekter), Morten Mørch (Norwegian Environment Agency), Morten Often (Store Norske Spitsbergen Grubekompani), Per Terje Osmundsen (NGU and UNIS), Mari Lise Sjong (Norwegian Environment Agency), Gaute Sønstebø (Norwegian Environment Agency), Johan Steffensen (Oslo Municipality), Kristine O. Stene (Norwegian Environment Agency), Hege Husby Talsnes (Norwegian Environment Agency), Trond Enemo (Norwegian Defence Estates Agency), Ulrika Wallin (Trondheim Municipality), Kjell Winsvold (Per Knudsen Arkitektkontor).

Rocks of Spitsbergen is a project
by Lara Almarcegui commissioned
by KORO / Public Art Norway for
The Norwegian Environment Agency,
Trondheim.
Curated by the 2011-2013 Committee
for KORO's Public Art Programme for
government rented properties and older
government buildings: Marianne Heier,
Merete Røstad, Ole John Aandal and
Elisabeth Tetens Jahn.

Calculations
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in Svalbard (UNIS), Longyearbyen and
the Ruhr University, Bochum)
Calculation advice & photography
Winfried Dallmann (The Geology and
Geophysics Section of the Norwegian
Polar Institute (NPI) in Tromsø.)
Graphic design
Floor Koomen, Amsterdam
Text editor
Line Ulekleiv
Translations
Peter Cripps and Øyvind Renberg
(The Wordwrights ANS)
Printer
Drukkerij/Uitgeverij Jan Verhoeven n.v.
Sint-Pieters-Leeuw
Wall text
Indergaard & Svenil, Trondheim

Rotterdam, May 2014