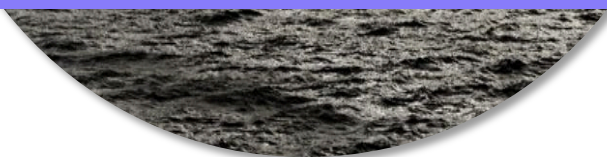




Dansk Geologisk Forening

ÅRSMØDE 2017

Det der i Grunden er vigtigt



Geocenter København
Øster Voldgade 10, Auditorium A
Lørdag den 11. marts

Årsmødets tema "*Det der i grunden er vigtigt*" handler om, hvordan vores viden om geologi kan understøtte et bæredygtigt samfund. Det handler om værdier - om det vi har brug for til det liv og det samfund, vi gerne vil opbygge og understøtte. Det handler også om, hvordan vi bruger naturen og ressourcerne i et perspektiv af cirkulær økonomi og bæredygtighed.

PROGRAM

09.30	Registrering og evt. betaling, samt morgenmad og kaffe på Institut for Geovidenskab og Naturforvaltning
10.00	Velkomst ved formand Karen Hanghøj
10.10	Den store omstilling <i>Jørgen Steen Nielsen (Information)</i>
11.00	Implementering af FNs Verdensmål i virksomheder og institutioner <i>Anders Bækgaard (VandCenterSyd)</i>
11.30	Kaffepause i rotunden
12.00	Beton, Cement og cirkulær økonomi <i>Jesper Sand Damtoft (Cementir Holding S.p.A.)</i>
12.30	Oprensning af forurenede grunde, ”set fra et geologisk perspektiv” <i>Knud Erik Klint (GEO)</i>
13.00	Frokost i kantinen
13.45	”What happens after the geologists have done their job?” <i>Gang Liu (SDU)</i>
14.15	Genbrug – den nye ressource? <i>Jonas Nedenskov (Amager Ressource Center)</i>
14.45	Kaffepause i rotunden
15.15	Bæredygtig råstofindvinding og påvirkning og beskyttelse af landskaber <i>Anette Petersen (GEON)</i>
15.45	En Havmøllepark – i Bund og Grund <i>Jeppe Bloch Lauridsen (DONG Energy Wind Power)</i>
16.15	Posters, forfriskninger og fri snak i rotunden
17.30	Generalforsamling
18.30	Festmiddag med uddeling af Danmarks Geologipris 2016

Sponsorer:



SAMMENDRAG AF FOREDRAG

DEN STORE OMSTILLING

JØRGEN STEEN NIELSEN (INFORMATION)

Meget tyder på, at den kendte model for en globaliseret vækstøkonomi er kommet til kort. Klimaet og miljøet kan ikke holde til den, ressourcerne rækker ikke til, og dertil kniber det med at genskabe tidligere tiders økonomiske vækstrater. Senest er modellen løbet ind i folkelig modvilje og mistillid i en række vestlige lande. Jørgen Steen Nielsen, biolog, forfatter og journalist ved Dagbladet Information, fortæller om udfordringerne og lægger op til diskussion om mulighederne for at gå nye, mere bæredygtige veje.

Implementering af FNs Verdensmål i virksomheder og institutioner”

ANDERS BÆKGAARD (VANDCENTERSYD)

Danmark forpligtede sig på FNs Generalforsamling den 25. september 2015 til at implementere FNs 2030 Dagsorden for bæredygtig udvikling – bedre kendt som Verdensmålene. For at muliggøre dette for Danmark som nation, skal alle dele af samfundet bidrage. Oplægget vil præsentere en model for praktisk implementering af Verdensmålene via en virksomheds eller institutions strategi og forretningsplan med eksempel fra VandCenter Syd.

Beton, Cement og cirkulær økonomi

JESPER SAND DAMTOFT (AALBORG PORTLAND, CEMENTIR HOLDING S.P.A.)

Beton er en kunstig bjergart, der består af sand og sten, bundet sammen af en matrix bestående af hydratiseret Portland cement. Efterspørgslen af cement på verdensplan er stigende, da cement er uundværligt til at efterkomme vækstøkonomiernes behov for byggeri og infrastruktur.

Dette er både en mulighed og en udfordring for cementindustrien. Udfordringen er at udvikle produktionsformer og produkter, der kan efterkomme den øgede efterspørgsel og samtidig reducere udledningen af CO₂ fra produktionen.

Aalborg Portland er Danmarks eneste cementproducent. Virksomheden udnytter de meget store ressourcer af kridt og sand i Aalborgområdet. Tidligere anvendtes ler som råmateriale, men dette er i dag afløst af flyveaske fra kulfyrede kraftværker. Endvidere anvendes restprodukter både som alternative råmaterialer og brændsler i produktionen. Endelig har fabrikken etableret et varmegenvindingsanlæg, der leverer fjernvarme til hvad svarer til 25.000 husstande i Aalborg.

Der er gode muligheder for at etablere flere løsninger inden for den cirkulære økonomi. Dette kunne f.eks. være øget anvendelse af alternativt brændsel fra affald med indhold af biomasse, fjernkøling ved hjælp af det kolde vand i kridtgraven eller brug af nedknust betonaffald som tilslag i ny beton. Der er også mulighed for at erstatte noget af den del af cementen, der har været gennem cementovnen med restprodukter som f.eks. flyveaske

Imidlertid er der begrænsede ressourcer af genbrugsmaterialer. Teknologisk ville cement kunne fremstilles med lavere CO₂ udledning på verdensplan end i dag ved at øge anvendelsen af f.eks. flyveaske. Imidlertid er ressourcerne ikke ubegrænsede og kulfyrede kraftværker forventes udfaset på sigt. Derfor er der udvikling i gang for at anvende naturlige råmaterialer, der findes i stor mængde og som ikke behøver brænding ved høj temperatur. Dette omfatter brændt ler, findelt kridt og vulkansk aske. Aalborg Portland er aktiv i denne udvikling.

Oprensning af forurenede grunde, "Set fra et geologisk perspektiv"

KNUD ERIK KLINT (GEO)

Forurenede grunde udgør en stor risiko for grundvand og overfladevand, da de indeholder miljøfremmede

organiske og uorganiske stoffer, som kan skade drikkevand og økosystemer.

Med over 30.000 potentielt forurenede grunde i Danmark, et landbrug der anvender både sprøjtemidler og gødning i stor stil, og en drikkevandsforsyning der er 99% baseret på grundvand, er der lagt op til en større udfordring for myndighederne. Omkostningerne og investeringer i grundvandsbeskyttelse løber således op i milliarder af kroner, og Danmark står derfor også som et af de lande der er længst fremme i udvikling af nye innovative metoder til rensning af forurenede grunde. Det har gjort os til attraktive samarbejdspartnere internationalt, og dansk teknologi og knowhow er efterspurgt i mange områder i verden.

Set fra et geologisk perspektiv, har forureningsundersøgelser traditionelt handlet om geologisk karakterisering af forurenede grunde, for at kunne afgrænse udbredelse af forureningsfaner og levere rumlige geologiske modeller til simulering af transport og nedbrydning af forurening, hvorimod ingeniørerne har fokuseret på at implementerer afværgemetoder, til fjernelse af forureningen. Forskningen har imidlertid også fokuseret på udvikling af nye oprensningsmetoder, og én af de nyeste metoder omhandler forsøg med efterligning af naturens egne processer, for at kunne oprense især chlorerede opløsningsmidler i moræneler, ved at fryse jorden.

Dette oplæg demonstrerer hvordan simulering af geologiske processer kan bringes til anvendelse til oprensning af forurenede moræneler.

“What happens after the geologists have done their job? - Addressing societal resource and environmental issues using a socioeconomic metabolism approach”

GANG LIU (SDU LIFE CYCLE ENGINEERING, DEPARTMENT OF CHEMICAL ENGINEERING, BIOTECHNOLOGY, AND ENVIRONMENTAL ENGINEERING, UNIVERSITY OF SOUTHERN DENMARK)

Industrialization and urbanization are moving natural resources at a growing pace from the lithosphere underground into products, buildings, and infrastructure above ground. Understanding the pathways, scales, and dynamics of these material stocks and flows in societies would help us better understand future demand for raw materials, availability for recycling, and their socioeconomic and environmental impacts. In this presentation, I will use examples of three bulk materials, iron, aluminium, and cement, as examples to show patterns of our societal use of resources and their accumulation in our built environment in different countries in the past decades. I will also illustrate how such an understanding can be used to inform both industry and governmental policy making.

Genbrug – den nye ressource?

JONAS NEDENSKOV (ARC – I/S AMAGER RESSOURCECENTER)

I overensstemmelse med grundtanken i en cirkulær økonomi ønsker vi, at råstoffer og materialer skal holdes i cirkulation så længe som muligt - de skal genbruges og genanvendes mest muligt. Dette betyder samtidigt, at lækagerne som lavværdi materialenyttiggørelse, energiudnyttelse eller deponering skal minimeres. At holde råstoffer og materialer i cirkulation er imidlertid ikke uden udfordringer; farlige stoffer skal tages ud af cirkulation, hvad man kan/vil man sortere og der findes ikke egnede genanvendelsesløsninger til alle slags affald. Lækagerne i den cirkulære økonomi kan aldrig lukkes helt, og det er derfor nødvendigt, at vi ikke kun arbejder for at lukke lækagerne, men også arbejder på, at kunne fange nogle af de råstoffer, der forlader cirkulationen igennem lækagerne.

Bæredygtig råstofindvinding og påvirkning og beskyttelse af landskaber

ANETTE PETERSEN (GEON)

Om benyttelse og beskyttelse af de geologiske aflejringer – geologi set fra to perspektiver.

Hvilke redskaber kan sikre en bæredygtig udnyttelse af de danske råstoffer (med danske råstoffer menes sand, grus og sten). Der er et øget pres på arealerne. Det stiller krav til at ressourcerne kan indvindes så optimalt som muligt og anvendes i overensstemmelse med deres kvalitet. Har vi redskaberne til det?

I vores del af verden omformer vi landskabet i et stort omfang. Efter råstofferne er indvundet i et område hvad sker der så med arealet? Efter endt råstofindvinding kan der genskabes natur som ellers er gået tabt i effektiviseringen af landbrugets udnyttelse af jorden. Man kan hævde at vi tjener på gyngerne, hvad vi har mistet på karrusellen. Er alt så fryd og gammen?

En Havmøllepark – i Bund og Grund

JEPPE BLOCH LAURIDSEN (DONG ENERGY WIND POWER)

Hvad laver en geolog i DONG Energy Wind Power?

Dong Energy Wind Power har et geofysik-team under deres *Site Investigation Management* enhed. Teamet består hovedsageligt af geologer som varetager en lang række af forskellige geofysiske opgaver inden for både udvikling, opførelse, samt drift og vedligeholdelse af havmølleparker.

Konkurrencen i branchen er knivskarp og flere firmaer presser konstant hinanden for at opnå den laveste *LCoE* (Levelized Cost of Electricity) på deres havmøllepark-projekter. Derfor er det i grunden vigtigt for en geolog i DEWP at kunne omsætte komplekse opgaver, analyser og tolkninger inden for geologi og geofysik til værdiskabende inputs og produkter, som de forskellige interessenter (fx geoteknikere, arkæologer og projekt-ledere) kan bruge i praksis.

Dette oplæg handler først og fremmest om gøre publikummet opmærksom på teamets eksistens, og at der findes en fremtid for geologer i offshore vind-branchen. Dernæst vil eksempler på nogle af de tekniske og kommunikationsmæssige udfordringer, vi arbejder med i vores dagligdag, blive belyst, bl.a. med eksempler fra et igangværende udviklingsprojekt fra Nordsøen.

POSTER SAMMENDRAG

The Rise of South Greenland: A new model with implications for orogenic gold genesis - Katrine Baden^{1,2}, Tod E. Waight¹, Tonny B. Thomsen², Jochen Kolb³

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Abstract

South Greenland is underlain by rocks from the ca. 1855-1735 Ma Ketilidian Orogen developed at the southern margin of the North Atlantic Craton. It is interpreted as an external orogen during supercontinent formation that originated through northward subduction and subsequent magmatism, deformation and metamorphism, comparable to an Andean-type orogeny (Chadwick & Garde, 1996, Garde et al. 2002). The study area covers the boundary between the Ketilidian Julianehåb Igneous Complex (Central domain) and the Southern Domain in Southwest Greenland (Steenfelt et al., 2016).

Several gold occurrences (viz. Nalunaq, Vagar and Hugin) are spatially associated along this contact in a belt several kilometers wide (Steenfelt et al., 2016). The most recent geological model is based on data from 1998, mainly comprising regional geochronological and reconnaissance data from detailed mapping during the 1960s to 1970s (Garde et al. 2002). Since then, field data relevant to this study have been collected by GEUS and by NunaMinerals A/S through exploration programs. A comprehensive data collection is, however, not available, which would allow detailed characterization and interpretation of orogenic and gold mineralizing processes. Thus, different conceptual models are currently used to explain the gold mineralization system: (1) remobilization of sediment-hosted gold (Stendal & Frei 2000); (2) intrusion-related gold mineralization similar to Fort Knox in Alaska (NunaMinerals, 2013); (3) and orogenic gold (Bell & Kolb, 2013).

In order to establish the Paleoproterozoic evolution, detailed structural and metamorphic mapping as well as integrated isotopic, geochemical and geochronologic data is required. The combination of multiple datatypes will advance the characterization of the Ketilidian in 4D (time-space model). The aim is then to integrate the gold mineralization processes and the hydrothermal evolution into the geologic processes, which requires detailed understanding of the mineral system.

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Lithological and geochemical transitions between the lower units of the Mesoproterozoic Xiamaling Formation, Xiahuayuan area, North China Craton - Emma R. Haxen¹

Supervisors: Christian J. Bjerrum¹, Emma U. Hammarlund², Donald E. Canfield²

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Abstract

In recent years, the Mesoproterozoic Xiamaling Formation has begun to attract the attention of researchers studying redox proxies and the evolution of atmospheric oxygen during Earth's middle age. However, geochemical data are usually unaccompanied by new sedimentological insights, as the majority of authors rely on highly generalised previous research to provide a stratigraphic framework. This tendency is hampering evaluation of contending hypotheses, namely whether the setting was a stratified shallow-shelf sea (e.g. Luo et al., 2014), an oxic deep-marine setting (Wang et al., in review; Zhang et al., 2016) or a lacustrine basin subject to anoxic marine incursion (Diamond et al., July 2016). If the emerging controversy is to be resolved, detailed sedimentological studies integrating all parts of the formation are needed. With this in mind, we conducted a study of lithological, mineralogical and geochemical transitions in the neglected lower Xiamaling Formation, the aim being to (1) evaluate proposed interpretations, and (2) provide additional insights on redox-conditions and depositional environment for future studies.

Based on initial observations, it was not possible to reconcile the studied facies with the traditional interpretation of intertidal to offshore deposition, and sediments are more consistent with accumulation below wave-base, basinward of a depositional slope. In this setting, ferruginous conditions prevailed, with abundant early siderite forming through microbial Fe(III) reduction. Hydrothermally sourced iron was oxidized abiotically during cyanobacterial blooms, resulting in low sedimentary Fe(III):C ratios. However, moving upwards in the stratigraphy, a gradual mineralogical transition from siderite to iron oxides signals an increase in sedimentary Fe(III):C signatures. Above an overlying flooding surface, pelagic sedimentation of red mudstone alternated with emplacement of reducing silty turbidites, and complex sedimentary redox-cycling was controlled by the influx of labile organic material. At this time, iron speciation also points to a ferruginous setting, but this does not immediately accord with a combined lack of redox-sensitive trace-element enrichment, negligible organic content, and ubiquitous iron oxides. The inconsistency could be explained by invoking deposition under weakly oxic bottom waters in a locally ferruginous setting, as explored by Wang et al. (in review). For the present study, no unequivocal depth or marine (tidal) indicators could be identified, and further studies are imperative in the evaluation of the contrasting depositional environments being debated at present.

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Basin-scale facies model of spectacular storm deposits in the High Arctic - Mads E. Jelby^{1,2*}, Sten-Andreas Grundvåg³, William Helland-Hansen^{4,2}, Snorre Olaussen² & Lars Stemmerik^{1,2}

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Abstract

During storms, amplified hydrodynamic conditions cause erosion in nearshore areas and large quantities of sand may get transported across the shore and shelf, resulting in the deposition of relatively discrete event beds, called tempestites. For the past three to four decades, the hydrodynamics and facies variability of tempestites in the offshore transition to lower shoreface have been the subject of intense debate, with particular focus on the formative processes of hummocky cross-stratification (HCS). Despite numerous accounts in the stratigraphic record, the origin of HCS remains uncertain. In addition, only few studies report proximal–distal tempestite facies relationships across large-scale basin transects, inhibiting the rectification of solid hydrodynamic models of their various stratification and architectural types. The Lower Cretaceous (Valanginian–Hauterivian) Rurikfjellet Formation in Spitsbergen, Svalbard, exhibits a spectacular variety of tempestites in a ramp succession of traceable offshore to lower shoreface facies belts. The formation is exposed at many localities across Spitsbergen, and along with a number of drill cores, this permits reconstruction of near-basin scale proximal–distal facies and hydrodynamic relationships. Based on detailed sedimentological investigations of >750 tempestites across the entire transect of the outcrop belt, we demonstrate how their deposition was controlled by cross-shore variability in flow stability and relative currents strengths, with important implications for tempestite facies models and the formation of HCS.

Geochemical Mapping of the Deerhorn Copper-Gold Porphyry Deposit and Associated Alteration through Transported Cover, Central British Columbia - Shane Rich¹ and Peter Winterburn²

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Abstract

Anomalous geochemical responses in the Ah soil horizon over the blind Deerhorn Cu-Au porphyry in central British Columbia (BC), were documented by Bissig et al. [1] and over similarly buried sulphide deposits by Eppinger [2] and Hamilton [3]. Improvements remain in our ability to interpret these geochemical responses so as to develop robust exploration tools for the discovery of economic, but concealed mineralisation.

Discoveries of porphyry copper deposits (PCDs) in BC have declined over the past 20 years. Undiscovered PCDs are predicted to occur in the Intermontane Belt, an assemblage of volcanic arc terranes considered important for hosting large porphyry deposits. The Deerhorn Cu-Au porphyry, located within this belt, is covered with up to 60 m of undisturbed moraine. Detailed regolith mapping based on a new classification scheme for BC, combined with aqua regia and deionised water assays, sequential leaching, physicochemical measurements and hydrocarbon analysis, was undertaken to determine the response in the till to buried mineralisation.

Geochemical relationships dependent on the regolith type were identified and are particularly evident in organic rich areas. To minimise background noise, data analysis was constrained to the dominant regolith unit: the undisturbed moraine (DrM), resulting in enhanced anomaly identification. Regolith mapping in advance of a soil survey can therefore allow targeted efficient sampling. Normalisation to organic carbon (Corg) to counteract the influence of organic matter on trace element variability resulted in anomalous response for elements As, Cs, Cu, Mo, Ti, U and W by conventional aqua regia on a 180-micron fraction B-upper-horizon soil. The response for six of these elements is peripheral to mineralisation in the surface environment. Multi-element evaluation is superior for mineralisation detection than individual element evaluation. Light hydrocarbon results indicate a surface response with a distinct depletion over mineralisation. Sequential leaching on selected anomalous Cu samples indicates that an aqua regia extraction was the optimal first choice for anomalous Cu detection.

Copper-Fe-oxide-bearing grains interpreted as oxidised sulphides were recovered from an anomalous Cu-bearing sample and confirm a contribution of glacial clastic transport. Visual screening for clastic fragments allows a reprioritisation of anomalous response. Copper isotope results do not support Cu-ion migration from the buried mineralisation, but instead support a clastic contribution. Anomaly formation is interpreted as a combination of clastic transport, ionic migration of H⁺, vegetation uptake and surface redistribution.

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A survey of potential carcinogenic compounds in Danish private wells – nitrate and arsenic - Nanna Linn

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Abstract

Private wells for drinking water purposes in Denmark are known to contain higher levels of nitrate than drinking water from public waterworks. Only nitrate, phosphate and microbiological parameters are normally included in the mandatory water quality analysis program for private wells. In addition, public waterworks are extensively registered while private wells are neither monitored nor registered sufficiently (Schullehner & Hansen, 2014). Thus, little is known about concentrations of the potential carcinogenic compounds as arsenic and nitrate in the drinking water from private wells. Accordingly, the aim of the present study is to compare concentrations of these potential carcinogenic compounds in private wells with public waterworks in the same area.

In a field campaign in 2015, we collected water samples for analysis of nitrate and arsenic from private wells in two municipalities in the western Denmark (81 nitrate & 81 arsenic analyses). Historical data from private wells were also obtained from a public-accessible database (3,953 nitrate & 11 arsenic analyses), and from the two municipalities (4,328 nitrate & 0 arsenic analyses).

The nitrate and arsenic concentrations from the private wells are compared with data from GRUMO and the Danish public water supplies. The study showed that private wells contain more nitrate than the public supplies and GRUMO, and the highest arsenic concentrations were found in data belonging to GRUMO.

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Abnormalities in pygidia of chasmopine trilobites from the Upper Ordovician of the Oslo Region, Norway

- Morten Lunde Nielsen & Arne Thorshøj Nielsen

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Abstract

Three pygidia of trilobites assigned to the subfamily Chasmopinae from the Upper Ordovician of the Oslo Region, Norway, exhibit different types of abnormalities. A juvenile pygidium treated as *Toxochasmops* sp. A has a partially developed axial ring restricted to the right side of the axis and is interpreted as a teratology (i.e. abnormalities with genetic or developmental origins). A pygidium treated as *Toxochasmops* sp. B shows a local fusion of two pleural ribs with a poorly developed furrow crossing the fused area. It may either represent a teratology or regeneration after an injury. In the latter case, it could represent a rare example of metaplasia in trilobites with the replacement of a pleural furrow by an interpleural furrow during regeneration. A partial pygidium currently treated as *Valdariops* sp. shows three local constrictions of pleural ribs. The position of at least two of these constrictions appears to be mirrored on each side of the sagittal line, which likely suggests a teratological origin. The material is currently treated in open nomenclature pending revision of the subfamily (ongoing).

Internal structure of a cold glacier in Svalbard - L.U. Hansen¹, J. A. Piotrowski¹, and D.I. Benn²

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² The University Centre in Svalbard, Pb. 156 , 9171 Longyearbyen, NORWAY

Abstract

A combination of speleological exploration and high resolution radar survey was conducted to investigate the englacial and subglacial drainage system of Longyearbreen. The direct observations was compared with the remotely sensed data in a 3D visualization of the glacier system using Petrel software package. In addition, a radar survey covering the entire glacier providing information regarding the change in the glacier thermal regime over time.

Previously it was assumed that no englacial- and subglacial systems form in cold glaciers because cold ice would act as a barrier to water flow (Hodgkins, 1997); see also model of Shreve (Shreve, 1972) for the evolution of the englacial melt systems. However, our data shows that the meltwater conduits of Longyearbreen were formed through the cut-and-closure process as first described conceptually by (Gulley, 2009) and that englacial and subglacial drainage conduits indeed can develop in an un-crevassed, cold glacier.

It is important to investigate whether the meltwater reach the bed of a cold glacier because this would significant influence its dynamic behavior of the glacier and its response to the rising temperatures. Minor valley glaciers in Spitsbergen will be one of the main contributors to the near-future sea level rise (Meier et al., 2007).

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Sedimentology and carbon-isotope stratigraphy of the Late Cretaceous Chalk Group in the Höllviken-1 core (SW Sweden) - Dorthe Bøttger (1), Nicolas Thibault (1), Kresten Anderskov (2)

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Abstract

The Höllviken-1 borehole is situated in the Skåne peninsula (SW Sweden) which was part of the Danish Basin in the Late Cretaceous. 1415 metres have been cored among which ca. 1100 metres cover the complete Late Cretaceous to early Danian Chalk Group. Besides the publication of a synthetic log and detailed foraminifer biozonation, supplemented by a number of rare macrofossil findings and description of a number of foraminifer holotypes (Brötzen, 1944), very few has actually been performed on that core since the mid 1940s. A new project has thus been undertaken aiming at improving the stratigraphy of the Chalk Group in the Höllviken-1 core. The data presented here comprise the detailed logging from 837 to 489 m covering a large part of the Campanian and the early Maastrichtian. Two intervals with the presence of sand are noted in the Campanian and two intervals showing progradation sequences of arenaceous marls to sand are present in the Maastrichtian. The purpose of this new study is to revise the foraminifer biostratigraphy of Brötzen and complement it with high-resolution carbon-isotope stratigraphy in order to establish a new age-model for the core and better constrain the timing of sand progradation in the Danish Basin. In addition, high-resolution sedimentological data will be used as a preliminary test for cyclostratigraphy of the chalk-marl intervals.

Geochronology of the 1.9 Ga Ammassalik Intrusive Complex, SE Greenland - Trygvi Bech Ártíng^{1,2,*}, Thomas Find Kokfelt², Erwann Lebrun³, Marco Fiorentini³, Paul Martin Holm¹, Jochen^{2,4}

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Abstract

The Paleoproterozoic Ammassalik Intrusive Complex is part of the Nagssugtoqidian Orogen in South-East Greenland, and it is located on the margin of the North Atlantic Craton to the south and the Rae Craton to the north. The Ammassalik Intrusive Complex comprises three intrusive centres arranged in an en-echelon fashion, the Tasiilaq intrusive centre making up the central intrusion, and together these intrusive centres form a 30 by 70 km ESE trending belt stretching from the inland ice to the sea. Previous studies suggest that the intrusions were emplaced in the middle to lower crust in a continental arc setting at about 1.9 Ga ago (Andersen et al. 1989; Nutman et al. 2008; Kolb, 2014). The Tasiilaq Intrusive Centre mainly comprises leucocratic norite, which is cross cut by melanocratic norite and gabbro-norite in dyke-like mingling zones, and by garnet bearing granite which has locally reacted with the leuconorite. The intrusive centre was emplaced into a host rock comprising metasedimentary garnet biotite gneiss that was variably remobilized and partial melted at the contact. This work forms part of a MSc project that aimed to (1) update the existing geological map of the central Tasiilaq Intrusive Centre through new field mapping and sample collection, and (2) to establish a detailed understanding of its intrusion history using zircon U-Pb geochronology.

The new U-Pb data were performed at Curtin University, Western Australia, using Sensitive High Resolution Ion Microprobe (SHRIMP). In total six samples were dated including the wall rock paragneiss, garnet bearing granite, a melanocratic gabbro, and three leuconorites. In contrast to the published age data established by Nutman et al. (2008), the new U-Pb ages show that the intrusive centre most likely was emplaced over an extended period of time from 1908 to 1864 Ma, and during three separate intrusive events. These are: (1) detrital grains provide an upper age limit for paragneiss protolith source at 1990.0 ± 9.0 Ma; (2) crystallization of leuconorite and garnet bearing granitoids 1908.3 ± 7.2 Ma, coeval with the youngest zircon peak in the country rock north of the intrusion; (3) magma replenishment occurred at 1889 ± 8.3 Ma, agreeing with the previously published ages for the Tasiilaq Intrusive Centre; and (4) late stage formation of elongated dike like mingling zones at 1864.1 ± 9.5 Ma. Combined these data imply that the Tasiilaq Intrusive Center was active over a period of 46 Myr, with discrete pulses of new magma forming dyke like mingling zones.

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Relating zoning in allanites to the origin of petrological environment - Kasper B. Jensen, Tonny B.

Thomsen and Tod E. Waight

Abstract

Allanite is a sorosilicate and part of the epidote group. Its general chemical formula is $A_2M_3Si_3O_{12}(OH)$, where the A-site includes Ca, REE, Th, Y, and M-site Al, Fe, Ti, Mg. Mn can occur in both the A and M sites. Allanite occurs in evolved magmatic rocks and in many metamorphic environments. Allanite is a chemically complex mineral including many elements that are incorporated into the crystal structure in a number of ways, which most probably are related to the origin of the allanite. Allanites often show highly irregular zoning – a feature that is poorly understood. This zoning is associated to the elemental distribution in the allanites, and most probably fingerprints the origin of the allanite. In addition, allanite is, with its high Th, useful for U-Th/Pb geochronology, thus allanite has the potential to constrain the timing and mechanisms of the elemental (e.g. REE) distribution in the crust and subduction zones (Regis et al. 2012). Thus, allanite is a mineral that has large potential for studying geological problems related to timing and formation of rocks during magmatism as well as metamorphism. Compared to commonly used minerals like zircon and monazite, allanite unfortunately sometimes shows metamictization. Thus, dating and element distribution can be severely disturbed, and extremely difficult or impossible to use. This M.Sc. study will investigate several allanite samples from locations in Japan, Greenland, Norway, Romania/Hungary, Russia and the Alps. Electron Microprobe analysis are used to collect major and minor elemental data and for characterization of the studied allanites. LA-ICP-MS will be used to obtain trace element concentrations and for U-Th/Pb dating of single allanite grains. This study will focus on allanite's potential capability for fingerprinting the internal elemental distribution recorded in the allanite zoning and to what degree this can be associated to the origin – either magmatic or metamorphic.

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A Petrological-Geochemical Investigation of the Volcano Katla, Iceland - Tove Eggert Olsen¹, Emil Aarestrup¹ and Paul Martin Holm¹

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Abstract

The Katla volcanic system is located in southern Iceland and is part of the Eastern Volcanic Zone (EVZ). The system consists of a central volcano capped by the glacier of Mýrdalsjökull, and a related NE-trending fissure swarm (e.g. Jakobsson 1979). Explosive volcanism from the ice filled caldera has led to a well constrained tephra chronology and understanding of magma chamber evolution at Katla (e.g. Oláðottir et al., 2008).

Today, Katla is surrounded by isolated topographic highs predominantly consisting of hyaloclastite deposits whereas lava flows are commonly found proximal to the central volcano. Fieldwork carried out in the summer of 2015 resulted in 87 lava and pyroclastic samples collected all around the volcano, providing us with the most extensive Katla sample suite obtained yet.

The presence of recycled heterogeneities in the mantle influence mantle melting, and chemistry of the resulting basaltic melts as already discussed for some Icelandic rocks (e.g. Chauvel & Hémond, 2000, Skovgaard et al., 2001, Macpherson et al., 2005, Kokfelt et al., 2006 and Shorttle et al., 2015). The scope of this project is to constrain the composition of, and identify heterogeneities (if any) in the source for basaltic magmas of Katla. Fractional crystallisation of olivine, clinopyroxene, plagioclase and FeTi-oxides plays important roles in controlling basalt chemistry, but systematics of incompatible trace elements, e.g. Zr/Nb ratios, cannot all be explained by magma chamber processes or by variable degree or depth of melting, and must relate to source composition.

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