Lower Cretaceous basin studies in the Arctic (LoCrA) is a collaboration between seven universities from the United States of America, Norway, Denmark, and Russia and the geological survey of Denmark and Greenland. Each collaborator is lending expertise from leading scientists as well as current research supported by the efforts of Master of Science and PhD students and post-doctoral researchers.

Twenty oil companies financially support LoCrA and the National Petroleum Directorate of Norway (NPD) provides data support.

Coordination of efforts is organized from the University of Stavanger (UiS) and the University Centre in Svalbard (UNIS).

Learn more at http://locra.ux.uis.no.

Focus Area
LoCrA is focusing its beginning efforts on mapping the Lower Cretaceous from Greenland to the Barents Sea. The approximate area is shown on the topography-bathymetry map by the white box (below).
Recent Activities and Data Release

Collaborator & Sponsor meeting October 14-15, 2013

On October 14th, researchers and students from the collaborating universities met to discuss the working plan and to allow all persons to meet. It was followed on October 15th by a meeting with the sponsors where collaborators presented research and plans for the coming year and longer-term projects. The presentations from October 15th are available on the website as a booklet.

GIS data release

The first annual data delivery is available for download. You can download the data by following the “Year 1 Delivery” link on the sponsor home page. This data delivery contains GIS data compiled from literature and other sources. A key aspect of the literature compilation is that each data feature includes an image from the publication to help you quickly orient yourself with the subsurface data that cannot be displayed properly in a 2D map setting. Below are two figures showing this arrangement.

The red line in the map above shows the location of the seismic line displayed below. By using the link tool, this is accomplished completely within the GIS software.

We have included two versions of the shapefiles. One version is in North Pole Gnomonic projection and the other version is in Geographic Coordinate System, both have a datum of WGS84. The GCS version is included for use in Landmark Decision Space. All GIS data released contains metadata including source information. All reference information is included in an Endnote library; however, due to copyright restrictions we cannot share the actual publications. Please be sure to read the “ReadMe” file for information regarding the data release.

Please note that previous data deliveries from May 2013 and October 2013 are not duplicated in the January 2014 delivery file.

AAPG 3P Arctic Meeting

From October 16th-18th, LoCrA collaborators participated in the AAPG 3P Arctic meeting in Stavanger. Poster presentations made by LoCrA researchers at the meeting are available on the website.

Staff Additions

Post-docs

Congratulations to Dr. Kasia Sliwinska (GEUS) who gave birth to a girl earlier in January! Kasia will be on maternity leave until September, at which time she will continue with biostratigraphy studies. In the meantime, other researchers at GEUS will continue her studies.

Dr. Naomi Matthews (UiS) joined LoCrA this January 2014 and will be focusing on provenance analysis. She was involved in collecting samples from Barents Sea cores from industry wells that have collected Lower Cretaceous in the Norwegian sector of the Barents Sea at NPD last October. These samples are currently being processed for thin sections, XRD, geochemistry, and zircon separation. Initial heavy mineral separation has been undertaken in collaboration with Dr. Sergio Andò at Milan, and this work is ongoing. Heavy minerals will subsequently be analyzed by Raman Spectroscopy (Milan) and MLA (Freiburg) later this year. Zircon U-Pb geochronology will be undertaken at the University of Houston (UH) by Dr. Tom Lapen from May onwards based on the academic/researcher cooperation between UiS and UH.

New PhD candidates

The University of Stavanger is in the final stages of reviewing PhD candidate applications for seismic interpretation with focus on structural geology and the control on clastic sedimentation during the Lower Cretaceous under the supervision of Alejandro Escalona. The University of Oslo is opening a PhD position for tectonic basin studies and Dr. Alvar Braathen will supervise.

Sponsors

LoCrA is fortunate to have attracted the support of twenty industry sponsors. In the final months of 2013, three companies signed agreements to support this important research. With the increase in sponsoring companies, our budget has likewise increased. This allows us to expand the scope of work by hiring more PhDs and post-docs for research as well as allow more support for MSc students conducting field and lab work.
**Current work**

**Svalbard fieldwork**

Fieldwork continues in Svalbard led by Snorre Olaussen and Sten-Andreas Grundvåg. During the summer of 2013, several locations were visited in order to collect samples and record observations. Mads Jelby, Sara Sandvik, and Tore Aadland participated in the fieldwork in 2013. More fieldwork is planned for this summer. The map below shows the visited localities of summer 2013 (black) and the planned areas for 2014 (purple); some locations from 2013 will be revisited due to ongoing studies.

**Scientific summary.** In Svalbard, the Lower Cretaceous succession comprises the Rurikfjellet, Helvetiafjellet, and Carolinefjellet formations, which together, form a greater than 1000-meter-thick first order R-T sequence.

Mads Jelby’s (UiCopenhagen, UNIS) work focuses on the up-to-400-meter-thick Rurikfjellet Formation of Berriasian-Hauterivian age. The formation consists of a lower mudstone dominated section and an upper sandstone-rich section. The latter part indicates regressive shelf and delta front deposits. Abundant hummocky cross-stratification (HCS) in the upper part indicates deposition on a storm-influenced shelf. Recently, onshore wells have recorded mass transport deposits with rafted blocks of coastal plain facies, indicating a hitherto unknown Valanginian to early Hauterivian shoreline progradation. On the margins of the Hammerfest Basin, thick, well-sorted sandstones of turbiditic origin occur in the time-equivalent Knurr Formation, suggesting a regional-scale relative sea level change. Southeast-directed clinoforms in the northern Barents Sea, which downlap near the base Cretaceous reflector, were probably influenced by the same event.

The well-studied Helvetiafjellet Formation (Barremian-early Aptian) is up to 155 meters thick and consists of a lower sandstone-dominated section and an upper heterolithic section. The lower part was deposited in a braid-plain setting, whereas the upper part was deposited in a paralic setting. Offshore, there are no equivalent formations to the Helvetiafjellet Formation, although, shallow marine and fan delta deposits occur along some basin margins. Of interest here is the observation of bentonite beds (below) which are now well dated to 123.3 +/-0.2 Ma (Corfu et al. 2013).

The Aptian-Albian Carolinefjellet Formation is up to 850 meters thick and consists of five units that are alternately sandy and mudstone-dominated. The sandstone-dominated units form southward-thinning wedges that are characterized by abundant HCS. The lowermost unit is suggested to represent the transgressive, storm-remodeled shelf segment of the underlying Helvetiafjellet deltaic. The Carolinefjellet Formation correlates with the Kolmule Formation offshore. Sara Sandvik and Tore Aadland (UiB/UNIS) are studying the lower unit, the Dalkjegla Member, which also locally includes organic-rich mudstones that may have source rock potential.

**Seismic interpretation**

Seismic interpretation of offshore northern Norway is in progress under the leadership of Dora Luz Marin (PhD candidate at UiS). Dora has been focusing on mapping the BCU and the distribution and geometries of the different seismic clinoforms in the region using all available 2D and 3D seismic data in the Petrobank database. A classification scheme that will allow prediction of clastic facies within the clinoform belts will be a main product of her research.

Doris Svarland is working on understanding the processes that control the deposition of the Lower Cretaceous clastic wedge penetrated by well 7039/1-1 and how this information can be used to predict the presence of similar wedges in the basin. He is expected to finish his thesis by June 15.

Zhi Chao Li is working in the Harstad basin using the available Petrobank 2D seismic data. He has started seismic interpretation from the lines with age control around well 7039/1-1 in the north and the lines near Lofoten-Vesterålen Margin in the south and will then spread out to complete the whole area. During these beginning weeks, the synthetic interpretation from the lines with age control around well 7039/1-1 in the north and the lines near Lofoten-Vesterålen Margin in the south and will then spread out to complete the whole area. During these beginning weeks, the synthetics and interpretation of BCU and Mid-Jurassic horizons have been finished at the northern and southern sides. In the coming weeks, the regional interpreted transects will be finished and during this procedure the previous onshore and offshore study will be referred to. The focus is to decipher the interaction between the southern end of the Senja fault system and the older NW-SE dipping structures in the region, which is challenging given the quality of the seismic data and the lack of age control.

Ine Reppen and Maria Nordberg (BSc. at UiS) are conducting their bachelor thesis...
on mapping those areas where the Lower Cretaceous rocks are not present and determining the processes and timing for the lack of these rocks in the Barents Sea. They are expected to finish their thesis by May 15th.

Alina Kayukova (PhD at MSU) is interpreting seismic data in the Kara Sea. The Norwegian and Russian seismic interpretation results will be joined together at a later date once interpretation is completed.

**Plate tectonic model**

Alejandro Escalona visited UTIG researchers, Larry Lawver, Ian Norton and Lisa Gahagan, to discuss the plate model at the end of January. The main focus will be given to the opening of the Canadian basin in order to understand the northern Barents Sea uplift and the location of northeast Greenland relative to the Barents Sea and its importance as a sediment source during the Lower Cretaceous.

**Upcoming Meetings**

**February 2014: Arctic Technology Conference**

The 2014 ATC will be held in Houston, Texas. You may be interested to attend. You can read more about the conference on the AAPG website.

**EAGE St. Petersburg**

Dora Luz Marin (UiS) and Torbjørn Fjeld (UiS) will be presenting results of their work at the EAGE conference in St. Petersburg, Russia, which will be held 7-10 April. In addition to the conference, both Dora and Torbjørn will be visiting collaborators from MSU for two days after the conference to exchange ideas on the interpretation of the Barents Sea.

9 April at 11:00 in the Poster Area - Architecture and Distribution Analysis of the Lower Cretaceous Clinoforms in the Western Barents Sea – Dora Luz Marin and Alejandro Escalona

9 April at 16:50 in the Congress Hall - Subsurface Interpretation of the Lower Cretaceous Clastic Wedges, Tromsø and Harstad Basins, South Western Barents Sea – Torbjørn Fjeld and Alejandro Escalona

**NGF Arctic Conference Days**

PhD and MSc students working for the LoCrA project from UiS and UNIS will be presenting progress of their work during the Arctic Conference Days in Tromsø 2-6 June. The abstract acceptance is expected in late spring.