



ERCIM "ALAIN BENSOUSSAN"
FELLOWSHIP PROGRAMME



Scientific Report

First name / Family name

Thorgeir /Sigurdsson

Nationality

Icelandic

Name of the *Host Organisation*

NTNU Colourlab Gjøvik Norway

First Name / family name
of the *Scientific Coordinator*

Jon Yngve /Hardeberg

Period of the fellowship

01/06/2021 to 31/05/2022

I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

The scientific activity was mostly in line with the Research Training Programme prepared at the beginning of my fellowship. It involved two tasks: Finding out how faded texts could be recovered with multispectral imaging. Also, to try to understand why dark inks appeared in 14th century in Icelandic manuscripts. The first task has not yet provided definite results, the second task has, however, provided publishable results.

During his stay at NTNU, the fellow went three times to the National archives in Oslo (Riksarkivet) for multispectral imaging of dated documents. He went twice for visits to the National archives in Reykjavík (Þjóðskjalasafn) for the same purpose. These images provided a statistical evidence for the appearance of black inks in Norway and resulted in a published, peer-reviewed conference article (see under II).

The fellow visited the Arnamagnæan institute in Copenhagen for inspecting manuscripts with multispectral equipment. This visit provided an impetus for an article on an incorrectly dated manuscript (see end of part II).

When this report was finalized on the 15th of May 2022, the fellow has arranged a visit to Museo di San Marco – Firenze, on the 18th of May for multispectral imaging, which continues the above described work, using Italian manuscripts instead of Nordic ones. This is part of an ERCIM Research Exchange Program, see IV REP below.

For testing how a faded text might be recovered, different types of inks were purchased and an unused parchment was obtained for testing. Also, a parchment leaf of a 13th century Paris bible was obtained from a private collection. This leaf has three colours, black, red and blue, which seem to be of typical medieval composition. Various non-destructive methods were tested on this leaf and on “mock-ups.”

NTNU is a member of the Dead sea scroll EU project “Lying Pen.” In the winter of 2021-2022, this project had a zoom meeting nearly every week. Often, some participant gave a presentation. The fellow participated in most of these meetings and investigated, prepared, and gave a lecture on the Hebrew language in Old Norse manuscripts.

The fellow, used three different computers at the NTNU, to try out, and compare a multi-dimensional FFT algorithm with a novel type of architecture that he had designed earlier, together with two professors in Iceland. The interesting results were presented at a NOBIM conference (see III below), but no attempts at publication were made.

The fellow prepared two articles for linguistic journals before joining NTNU. Both of them were accepted and one published during his stay (see II).

The fellow participated in normal activities of the Colourlab entity at NTNU. This included listening to lectures where other participants presented their previous or ongoing work. The fellow gave one such presentation shortly after his arrival. He also gave a rehearsal presentation for the Heri-Tech 2022 conference in Florence. The fellow plans to give a presentation at the end of his stay at NTNU, reporting on the work done (the content of this report).

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

An article on a Norwegian poem (*Haustlǫng*) was accepted and published in the main linguistic journal in Iceland:

2021. Þorgeir Sigurðsson. *Haustlǫng* – How rhyme and syntax interact in early Old Norse dróttkvætt. *Íslenskt mál* 43, pages 13–32. A peer-reviewed article. **Published.** The following is the abstract/summary:

Dróttkvætt is an Old Norse court meter, originating in the 9th century. It has a regular line internal rhyme of syllables. The first line of any four-line dróttkvætt half-stanza is well known to have a specific syntactic structure. Often, the third line has this structure as well. In these lines, the line-internal rhyme is optional in old poems. This conditional license has not been noted previously. It is valid in the poem *Haustlǫng* and in younger poems of the 10th century, but it expires in the 11th century

Another peer-reviewed article on inaccurate rhyme and phonemes in Old Norse poetry was **accepted** for publication in the Norwegian journal *Mål og minne*, but it will not be printed until the autumn of 2022.

Manuscripts in Norway and Iceland started using a similar dark inks in the 14th century. The fellow prepared an article and a presentation for the Heri-Tech 2022 Florence conference. He did this with three co-authors who improved, or added to this work:

2022. Þorgeir Sigurðsson, Tor Weidling, Haukur Þorgeirsson, Jon Yngve Hardeberg. Darker inks in Norway in the 14th century. A peer-reviewed article in the conference proceedings of Heri-Tech 2022 conference in Florence 16-18 May. **Published.**

The following is the abstract/summary:

This article demonstrates a transition in 14th-century Norway to the use of darker inks, visualized with low-cost digital photographs in 950 nm infrared light (IR). In these photographs, the transition manifests itself in increased contrast, on average, in 101 Norwegian dated documents (charters) written immediately after the year 1400, as compared to 56 charters written at the beginning of the 14th century. Similar results were obtained from Iceland by a more subjective method of visually inspecting IR pictures of 64 charters from the period 1300–1450. These results may assist in detecting incorrectly dated manuscripts in Norway and Iceland.

The above article suggests that dated manuscripts in Norway and Iceland do not have dark inks before the year 1300. A visit to Copenhagen revealed, however, that some manuscripts exist with dark inks that are believed to be older. The most prestigious of these is AM 673 b 4to. On closer examination, this manuscript appears, however, to be young. An article is currently **pending** under double blind review by the Icelandic journal *Gripla*, where this is maintained by the fellow (without mentioning the dark ink). If successful, this article will support the conclusion of the Heri-Tech 2022 article and call for more work.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

The fellow participated in two conferences:

The **NOBIM 2021** conference was held in Gardermoen, Oslo 13-14 September 2021. The fellow gave two lectures. The first was on text that can be retrieved from the 14th century Möðruvallabók by multispectral means. The second on optimized computing:

- a) The hidden information in the Book of Sagas
- b) The Diagonal Multidimensional FFT versus the polynomial transform

NOBIM does not publish proceedings.

The Heri-Tech 2022 conference was to be held 16th to 18th of May in Florence, Italy. At this conference the fellow will present:

Darker inks in Norway in the 14th century

See section II on the article that will be published in the conference proceedings.

IV – RESEARCH EXCHANGE PROGRAMME (REP)

The fellow is currently participating in a two week research exchange programme at CNR Perugia supervised by Francesca Rosi (9th to 15th of May and again 18th to 26th of May). UNIPG - Department of Chemistry, Biology and Biotechnology in Perugia was the first of so-called MOLAB institutes in Europe. They provide portable non-destructive analyses of cultural heritage items. The CNR MOLAB has a large repertoire of methods and equipment, together with the expertise to use them.

In a meeting on the 12th of May, the fellow presented to the MOLAB experts, and discussed with them, the technical problems that he saw with Nordic medieval manuscripts.

The fellow brought with him a 13th century manuscript leaf to test the potential of the methods. A 2D XRF scan was made of the leaf, revealing the chemical composition of the parchment and the inks. This makes it possible to map the distribution of different material that “gave a signal.” A 2d image of the distribution of iron, was prepared. Because of the small writing and low resolution, the text was not readable, but, in principle, this showed how a writing with iron-gall ink might be recovered. An informal rapport is planned for the results of the different techniques used on the leaf.

The fellow will obtain infrared images in Florence of Italian manuscripts at Museo di San Marco – Firenze, on the 18th of May. He will consult with the expert group afterwards in Perugia.

Even if this program is not finished yet. It has already proved to be very useful and educating and it may impact further research on old manuscripts.