



INFRARED AND MULTISPECTRAL IMAGING OF MANUSCRIPTS

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Studies 2015

THIS PRESENTATION

...demonstrates the usefulness of multispectral imaging through examples of unreadable Old-Norse texts, concluding with, and expanding on, the text of *Arinbjarnarkviða*, the subject of my doctoral thesis.

Multispectral imaging uses UV reflectance, UV fluorescence, infrared sensitive cameras and methods for combining images from different parts of the spectrum of light.

Choosing the particular image and the reading of it, gives room to subjectivity that one must be wary of.

Porgeir Sigurdsson University of Iceland

THE UNREADABLES

- ❑ A poem, that Finnur Magnússon read from a cracked rock, *Runamo* in the early 19th century.
- ❑ Page 69v in *Mödruvallabók*, M read by Finnur Jónsson in the late 19th century.
- ❑ *Grettisfærsla*, a scraped out medieval poem. Partly read by Ólafur Halldórsson, mid 20th century.
- ❑ *Arinbjarnarkviða*, a eulogy in M for a 10th century kingmaker, read by Guðbrandur Vigfússon and Finnur Jónsson in the late 19th century.

THE RUNAMO RUNES

... are now believed to be natural scratches on a stone in Blekinge, Sweden. For centuries they were thought to be runes that recorded the deeds of kings in the 10th century. That wishful thinking was already reported by Saxo Grammaticus in the 12th century.

A poem was eventually read (backwards) from the scratches by Finnur Magnússon, but it was refuted by the respected Jöns Jacob Berzelius.

The lesson learned: Independent validations are necessary. Propositions that fail validation should however not be judged harshly. Readers of unclear texts are constantly facing the dilemma of whether or not to publish readings that might be erroneous, e.g. because a large number of different methods may eventually have yielded what was wished for!

THE RUNAMO RUNES



[Jens Jacob Asmussen Worsaae](#)'s illustration of a part of the "inscription". He made a study at the location in 1844, which turned the general scholarly opinion towards Berzelius' theory. From Wikipedia.

PAGE 69V

This unreadable page from Egils saga in *Möðruvallabók* was somehow successfully read by Finnur Jónsson when he prepared his edition of Egils saga in the latter half of the 19th century.

Was this another example of a premature publishing?

The most recent scientific edition of Egils saga, 2003 opted to use a 17th century copy for the left hand column, rather than use the text from Finnur. This copy differs in many details from Finnur's reading and contains lacunae. No copy exists for the right column.

PAGE 69V



PAGE 69V

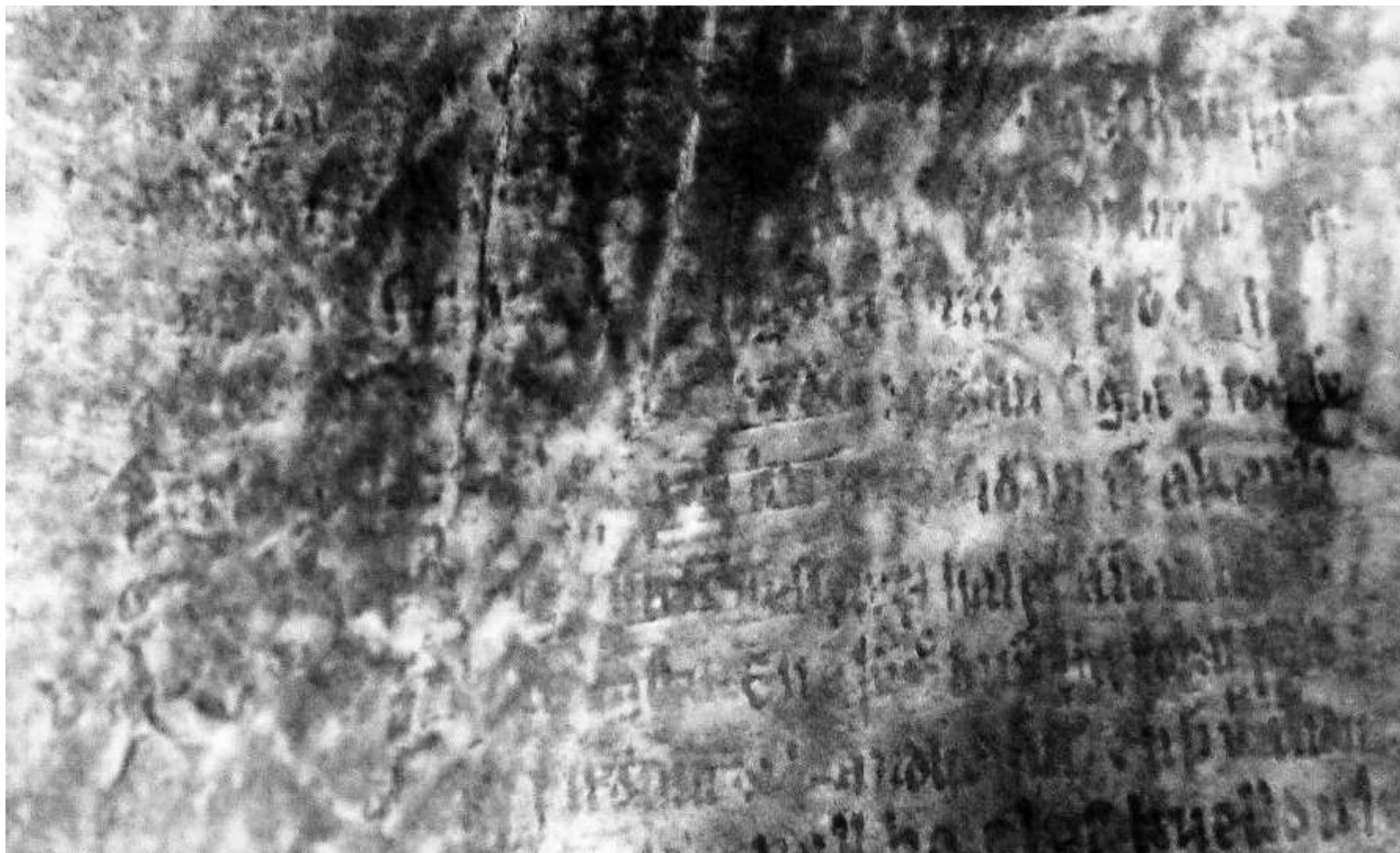
Fortunately, large parts of page 69v can be read from infrared photographs of the page. These photographs reveal that Finnur Jónson's text is accurate and much better than the text from the 17th century.

A part in the upper left corner that no one has deciphered is also partially revealed (see next slide). The text is notable for containing a travel description for northern Norway. Note the name **þrándheimi** in line no 8. It clarifies which fjord is referred to, but it is not present in any other version or manuscript of the saga.

See reference:

2013. Þorgeir Sigurdsson, Guðvardur Már Gunnlaugsson & Haukur Þorgeirsson. Ofan í sortann, Egils saga í Möðruvallabók. *Gripla* 24, pages 93–120. [PDF](#). English summary: [PDF](#).

PAGE 69V (UPPER LEFT)



PAGE 69V (UPPER LEFT)

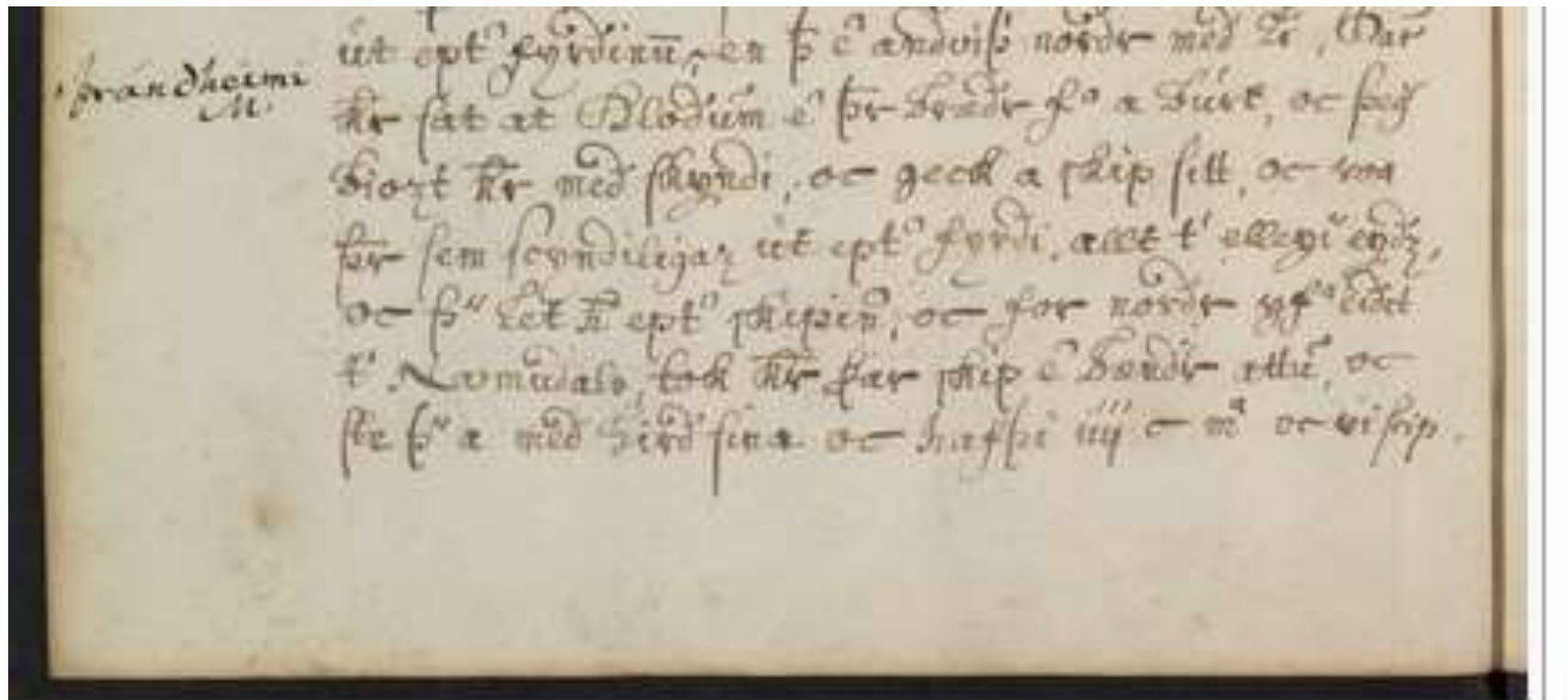
1. [S] g[a] g[ð₁] ñ a[t] þ₁ð
- 2.
3. g[eta fu]m̃ e[ʃ] þ₁ð f[ig]l[it]
4. [b]æð₁ [nozð]an figla ɛ roa þ₂
5. [p]ock biu[ggu]z [f]iðan f[ē] akaʃ[l₁]
6. gɛ halʃ[t] aña[t h]...
7. V [i]gft[u.]En è þ₂ v̇ bu[ñ þa] toku þ[₂ l]ð
8. [ʃ]irðinū oz þ₂andhe[im₁]. en þ v̇ [an]ðu
9. ð[₂] m; lð₁ ʃall þozolʃf kuellðul[ʃ]f

PAGE 69V AND ÁRNI MAGNÚSSON

Árni Magnússon famously made it a mission in life to delete and stop errors from procreating.

He and his scribes did not leave us a transcript of page 69v which is regrettable because in their time the page was probably in a more readable state (~1700). In writing Egils saga in AM 146 fol. they filled the resulting lacuna by a text from other (paper) sources. Árni did however add in the margin the word **þrándheimi** from page 69v. See next slide where the 'M.' is probably for 'membrana' a reference to *Möðruvallabók* that was the basis of AM 146 fol.

PAGE 69V (ÁM IN AM 146 FOL.)



18r

18v

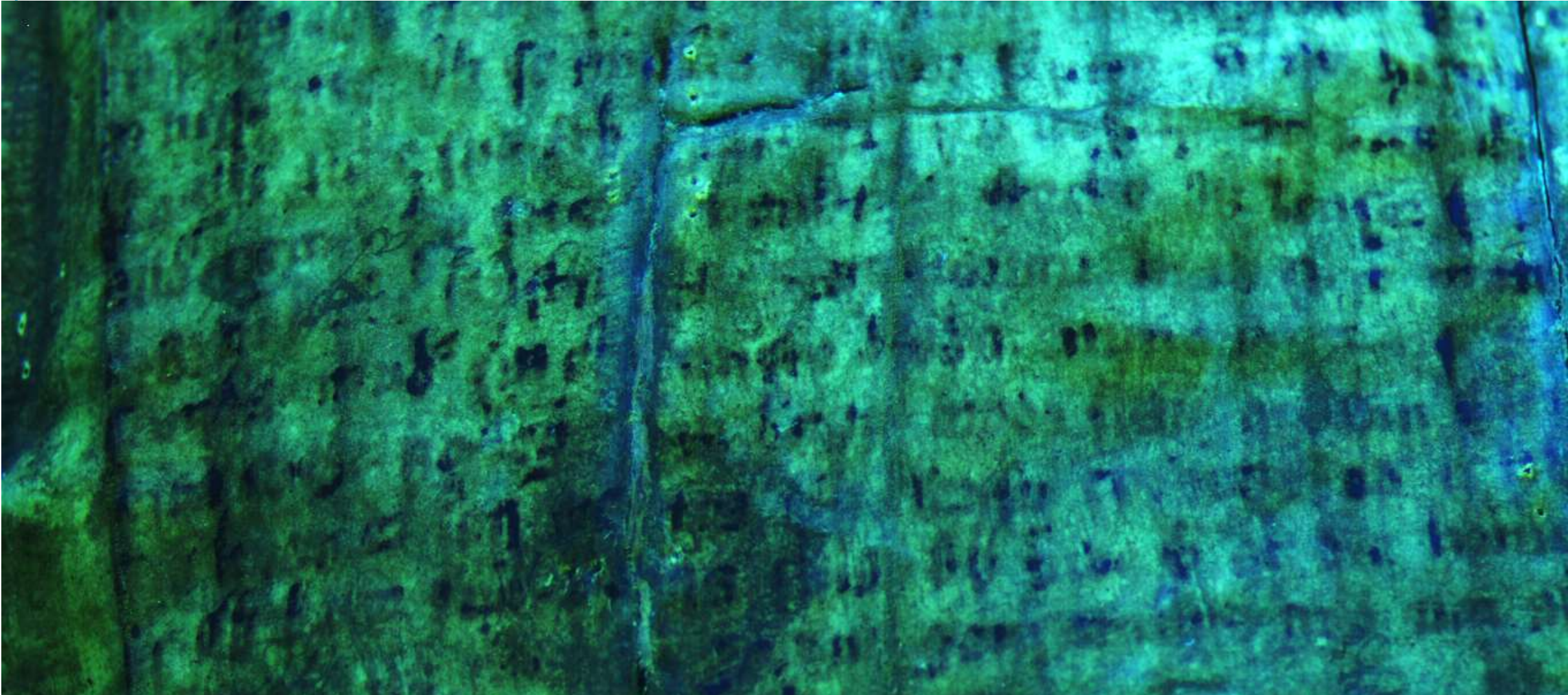
GRETTISFÆRSLA

... is a long poem in AM 556 4to that has been scraped out and is unreadable.

It became known in the middle of the 20th century that UV-fluorescence could be very helpful in reading manuscripts. With the aid of UV-light, Ólafur Halldórsson, 1960 published a partial reading of the poem. The poem appears to be vulgar and pornographic which explains why someone would want to delete it.

Ólafur's text is not easily verified because UV-pictures of the text are not easily read. See next slide with a UV-picture in colour from the end of the poem.

GRETTISFÆRSLA



GRETTISFÆRSLA

For *Grettisfærsla*, infra-red pictures seem not to be useful.

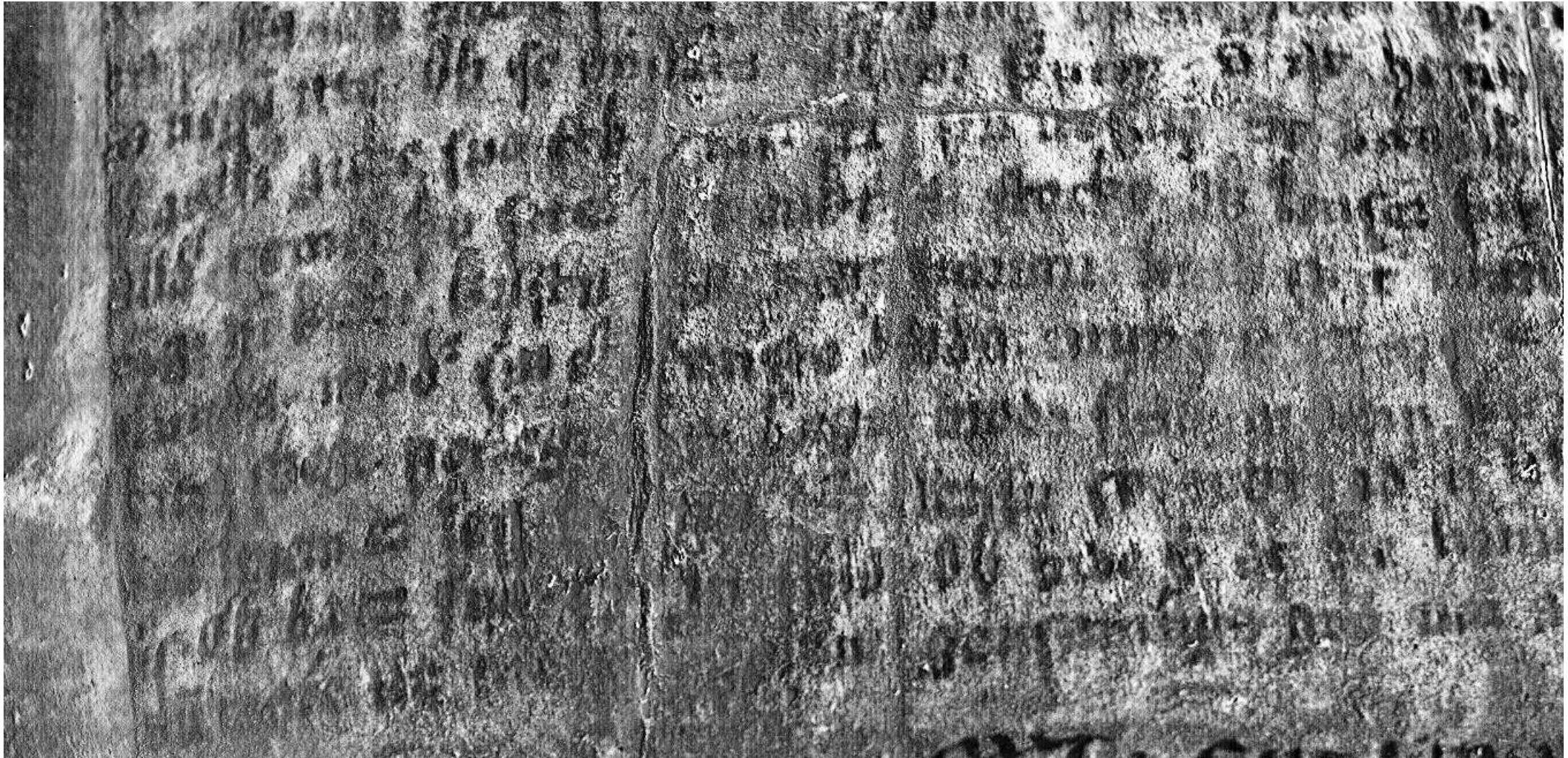
In some cases a technique called Principal Component Analysis produces almost magical results (see e.g. the *Archimedes Palimpsest Project* in Wikipedia for an example).

The next slide is made by using this technique, combining the red, green and blue channel from the previous colour picture. This results in a clearer picture (this is a very simple application of PCA).

From what is seen, the text of Ólafur appears quite good.

A number of other findings, claimed by users of UV-fluorescence may possibly benefit from multispectral imaging.

GRETTISFÆRSLA



ARINBJARNARKVIÐA

Arinbjarnarkviða is a 10th century poem that is only preserved on page 99v in the 14th century *Möðruvallabók*. It is currently unreadable.

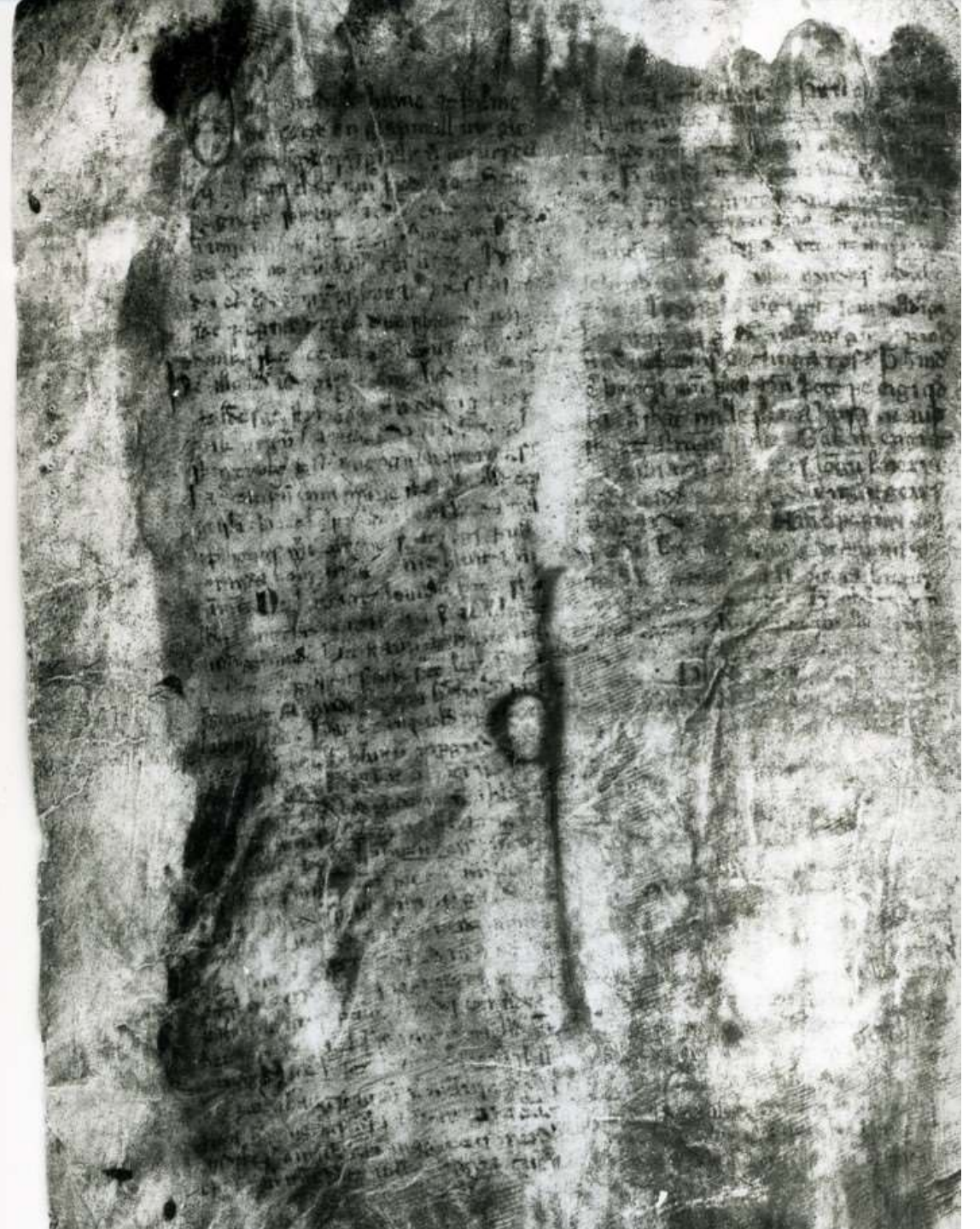
It was read by Finnur Jónsson and Guðbrandur Vigfússon in the late 19th century. They were assisted by a text of the poem in AM 146 4to (previously mentioned) that stemmed from M through a transcript from Árni Magnússon around 1700 (more on this later).

The poem can be partly read from old photographs taken in UV-light, see next slide (Guðbrandur and Finnur did not have access to UV).

UV-photographs have not brought into light any new readings or corrections of previous readings from the 19th century.

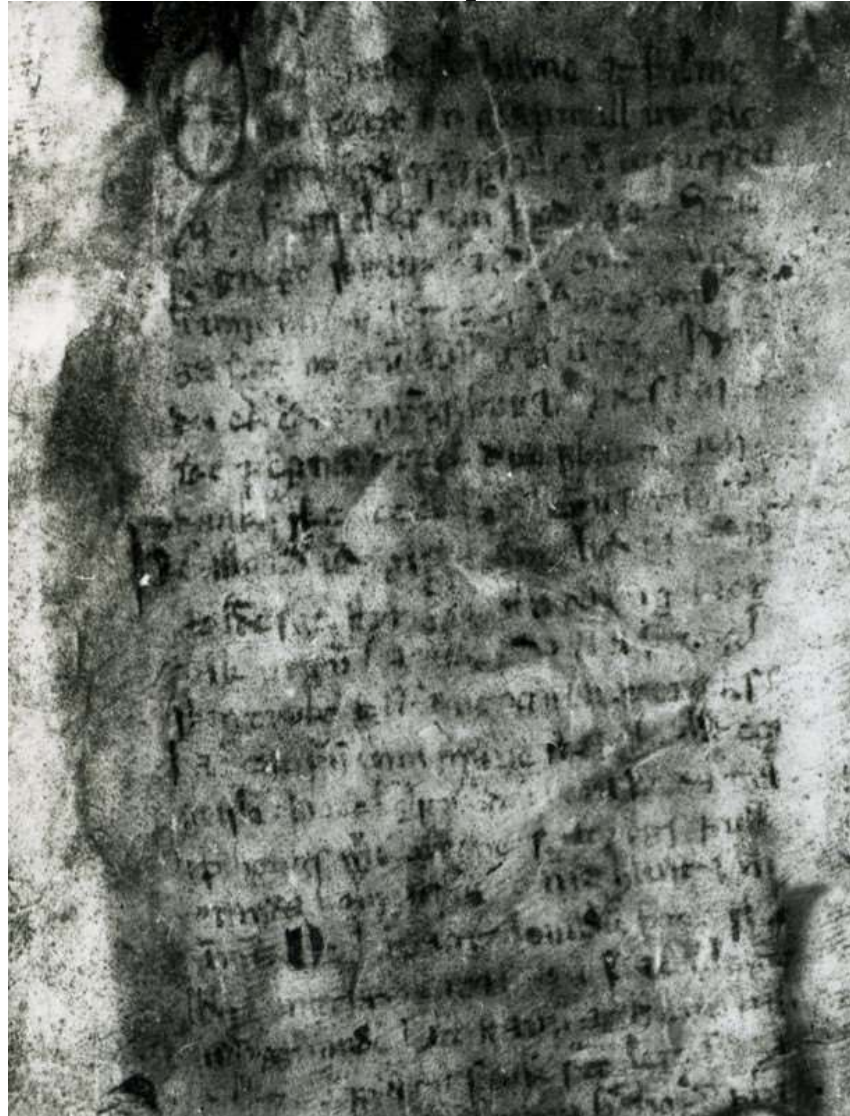
ARINBJARNARKVI

The page can be divided into four parts that differ with respect to readability. See next four slides:



ARINBJARNARKVIÐA (TOP LEFT)

The top left half of the page was read by Finnur Jónsson, and Guðbrandur Vigfússon. Most of this text has also been read recently, presumably from the picture on the right under the auspices of the Skaldic Poetry Project (see its web).



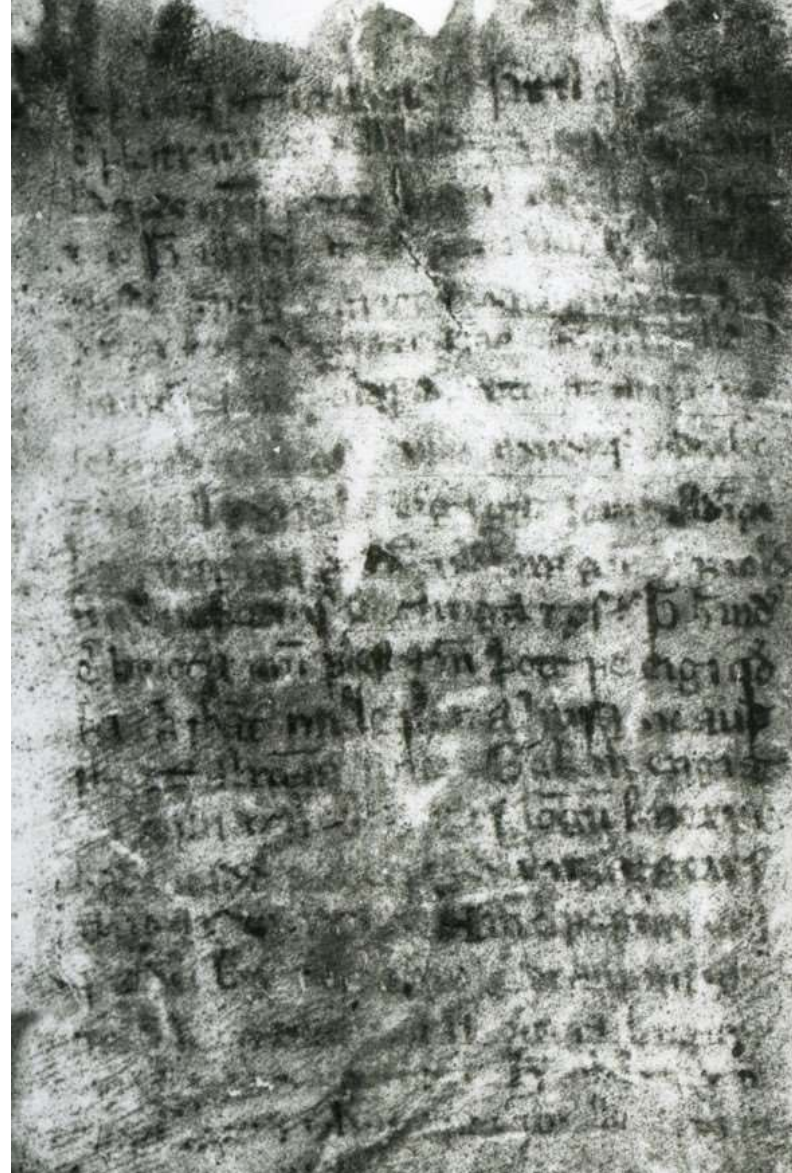
ARINBJARNARKVIÐA (BOTTOM LEFT)

The bottom left part has only been transcribed diplomatically by Finnur Jónsson because Guðbrandur lost his transcript. Very little has been read under the auspices of the Skaldic Poetry Project (according to its web-site).



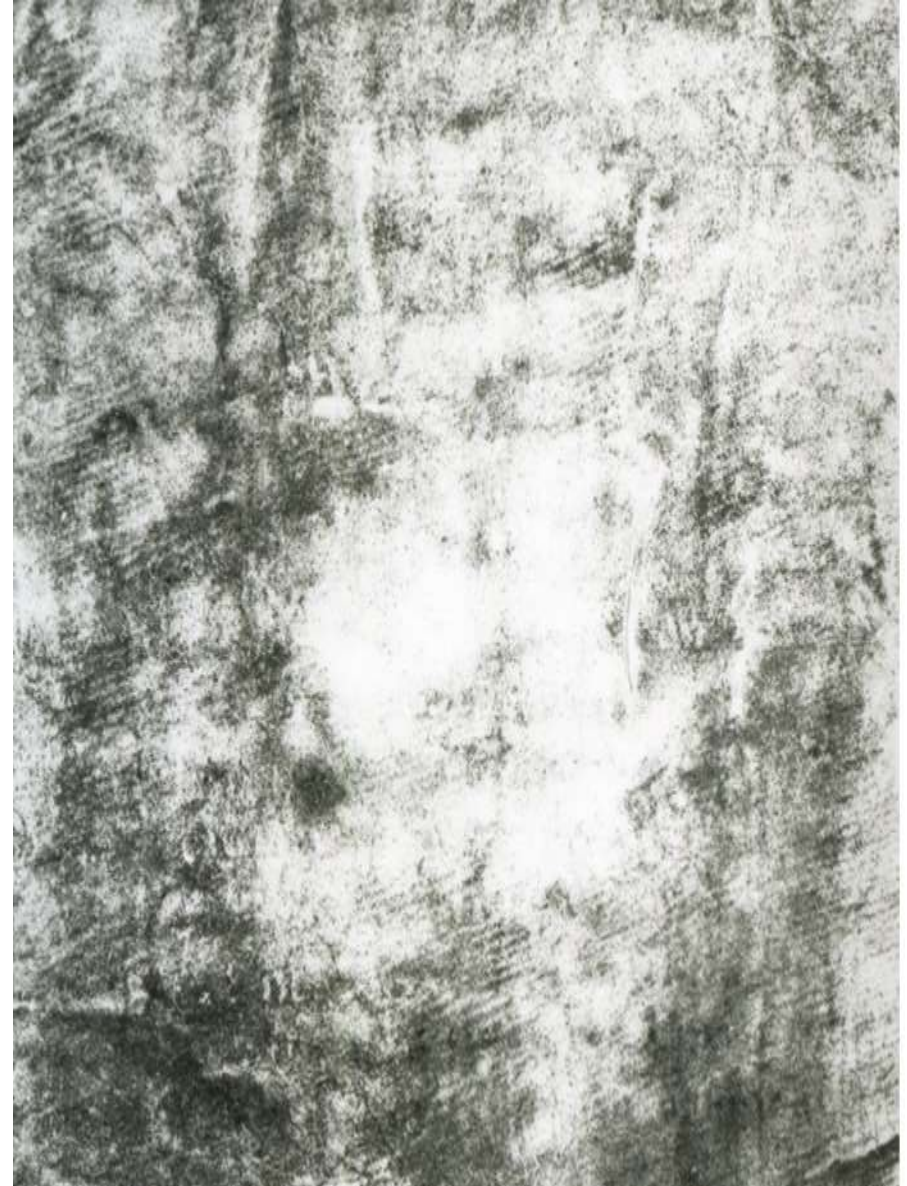
ARINBJARNARKVIÐA (TOP RIGHT)

The top right part was read by Finnur Jónsson and Guðbrandur Vigfússon. A large part of it was recently read under the auspices of the Skaldic Project.



ARINBJARNARKVIÐA (BOTTOM RIGHT) 'THE VOID'

The bottom right part has been impossible to read. Only Guðbrandur has published some remains of a text that he could glimpse. No-one has validated his reading and it cannot be seen in the UV picture on the right or in normal light.



ARINBJARNARKVIÐA (BOTTOM RIGHT GV)

On the right is the text that
Guðbrandur Vigfússon, published
1883.

Take note of the word **astrad**
(loving conduct or loving advice) in
line 10 from below. Who was
loved?

ia . . . nautr . . . nar hvinna h'ngum
. H . . . ū
ega f'de spiollū
. þ' e'
vaūodr S . . .
. hu'
. liome. Ok
ill spiollū
þ . . . sa k. ek skalld k'di ok
. Ok m; heidn hr.
. astrad þau
.
i brimsker. . . rodnr
e' fram stafn i folke
d' brande birt' blarra geira
hars veðri . . . þ' e'
. knegv þ
.
. mekiss egg

ARINBJARNARKVIÐA AND IR

Photographs taken with infrared sensitive cameras reveal some text that cannot be seen otherwise.

These are especially good for the right column of the page.

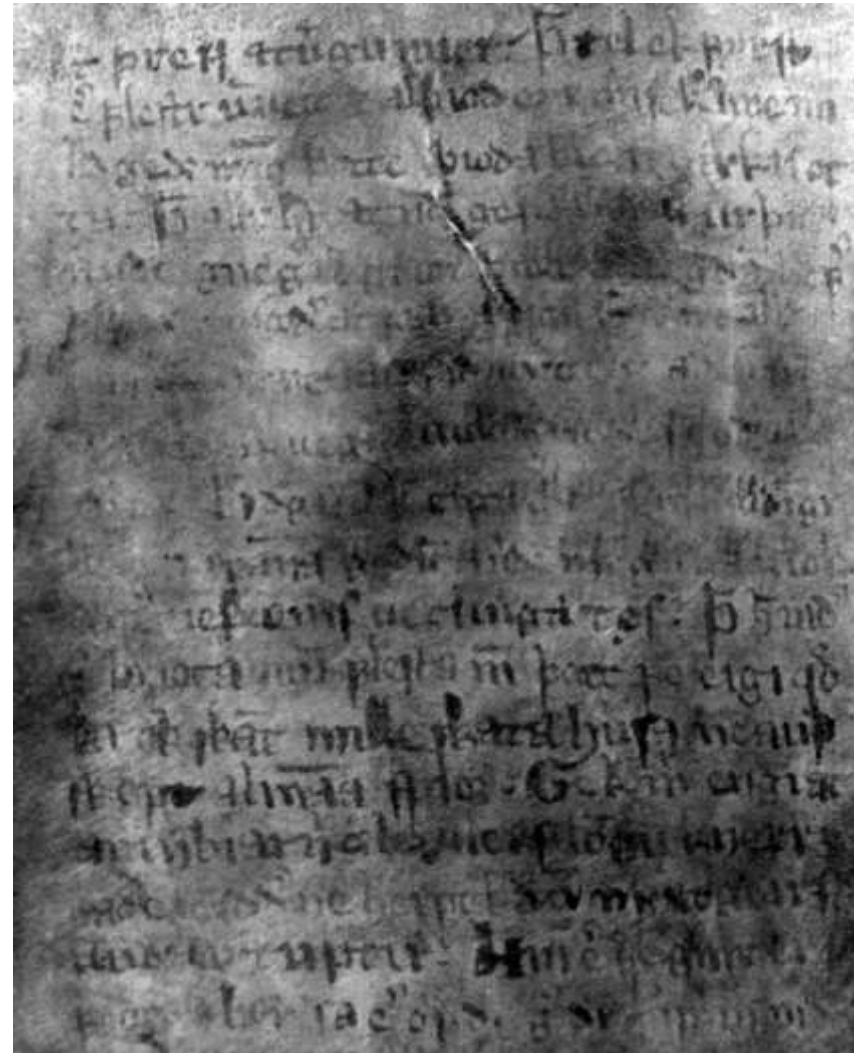
See next three slides:

ARINBJARNARKVIÐA TOP RIGHT INFRA RED

Most of upper half of right column can be read from IR pictures.

Two corrections attributed to Jón Helgason in the 2001 edition of Egils saga can be refuted by this picture. One has to do with “allz heri” and the other with “tøs”. See reference and next slide:

2013. Þorgeir Sigurdsson.
Arinbjarnarkviða – vardveisla. *Són* 11,
pages 13–33. [PDF](#). A note in English
on the content: [PDF](#).



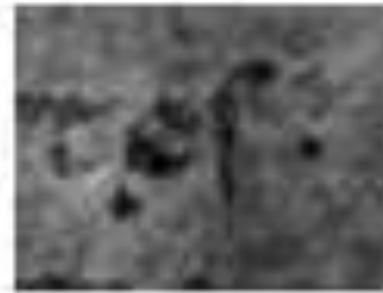
ARINBJARNARKVIÐA

The letter 'r' is written like 'v' in 'þat allr herr'. Jón Helgason read it as 'z'.

The punctuation mark ˇ is frequently used and looks like an 'r' on top of a dot.

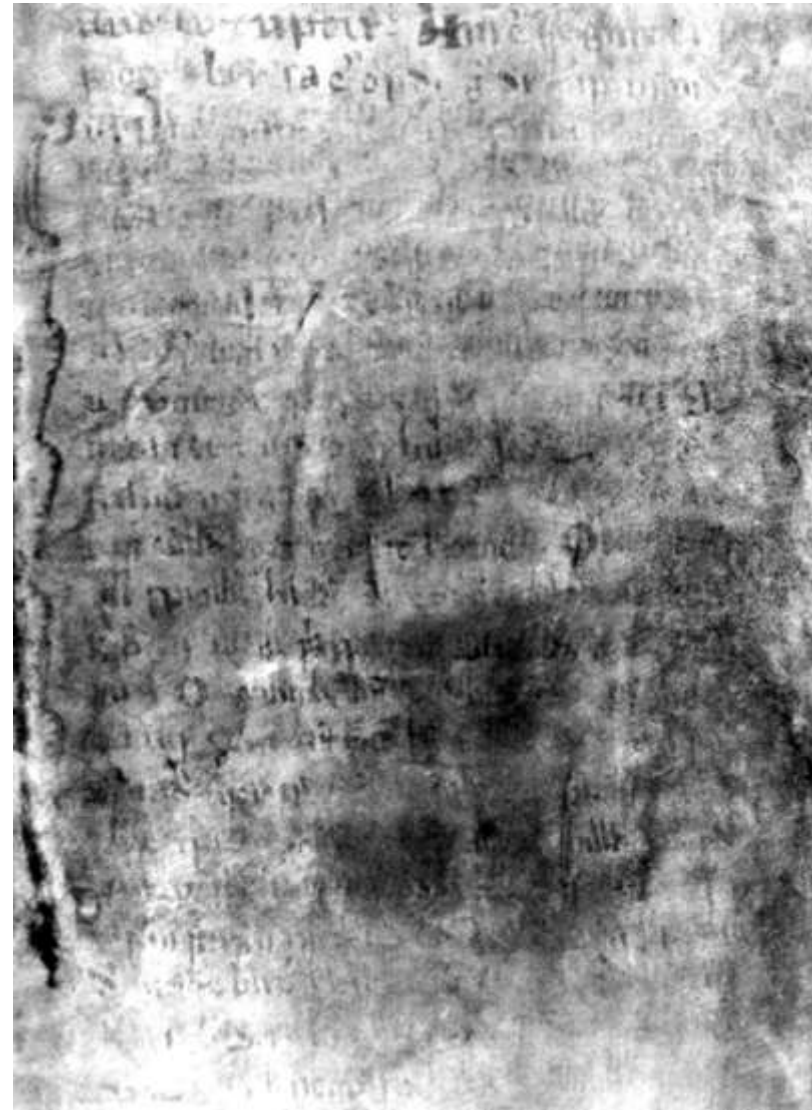
Jón Helgason only saw the 'r' and read 'tøsar'.

(note that these readings by JH were published posthumously)



ARINBJARNARKVIÐA BOTTOM RIGHT IR

Much of what Guðbrandur claimed to have seen can be validated by the picture on the right.



ARINBJARNARKVIÐA COLOUR COMPOSITES

For *Arinbjarnarkviða*, the PCA technique can be used with good results to combine pictures in different wavelengths, including UV. An improvement comes also from combining infrared and PCA enhanced pictures in a single colour photograph.

The following pictures have an IR picture in the red channel, an enhanced picture in the blue channel and their average in the green channel (variations on this scheme give similar results).

The pictures were taken with a modified (full-spectrum) Canon digital DSLR camera. (Many details for doing that are here left out.)

Specific multispectral camera systems with programs included can be bought that can produce similar pictures and more e.g. the Danish Videometer.

ARINBJARNARKVIÐA COMPOSITE



ARINBJARNARKVIÐA COMPOSITE



ARINBJARNARKVIÐA IN VIS FOR COMPARISON



ARINBJARNARKVIÐA VIS

Page 99v as seen in
normal light.

Nothing can be read in
the lower right part.

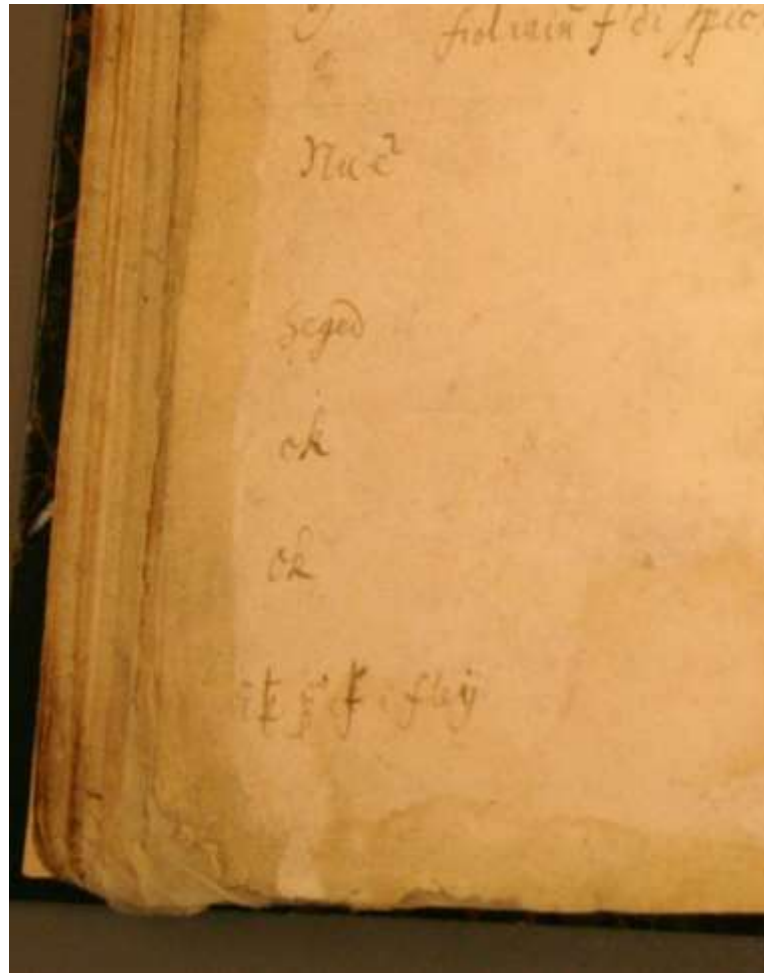
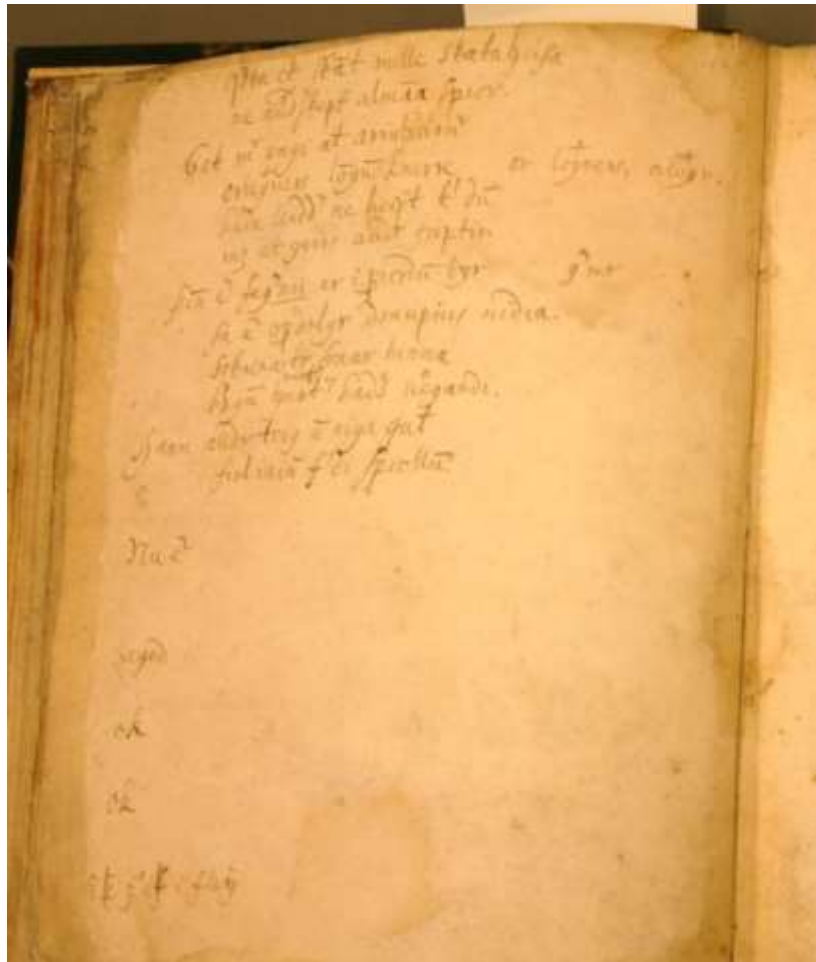


ARINBJARNARKVIÐA & ÍB 169 4TO

The composite images display the text that has been read earlier, in most cases clearly. The diplomatic text of Finnur Jónsson appears to be good, but a still better text is found in ÍB 169 4to, by an unknown scribe.

Much of the text that Guðbrandur read in the last quarter can be validated and so can the text that appears in ÍB 169 4to for the beginning of five stanzas in that part (see next three slides).

ARINBJARNARKVIÐA ÍB 169 4TO



The beginning of five stanzas in the void is given in ÍB 169 4to.

What is written in IB 169 4to can be seen wholly or in part in the composite images, see next slide (i.e. Gudbrandur was not alone in attempting to read this part of 99v)

ARINBJARNARKVIÐA STANZAS

Stanza	Guðbrandur	ÍB 169 4to	Porgeir
24	þ' e'	Nu e'	þ
25	S	Seged	S
26	O[k]	ok	O[k]
27	Ok	Ok	Ok
28	-	Ek fra ef i fley	E ...f ifle...
29	... e' fram stafn i f[olke]	-	þ [e] f'msta[fn]
30	þ' e'	-	þ

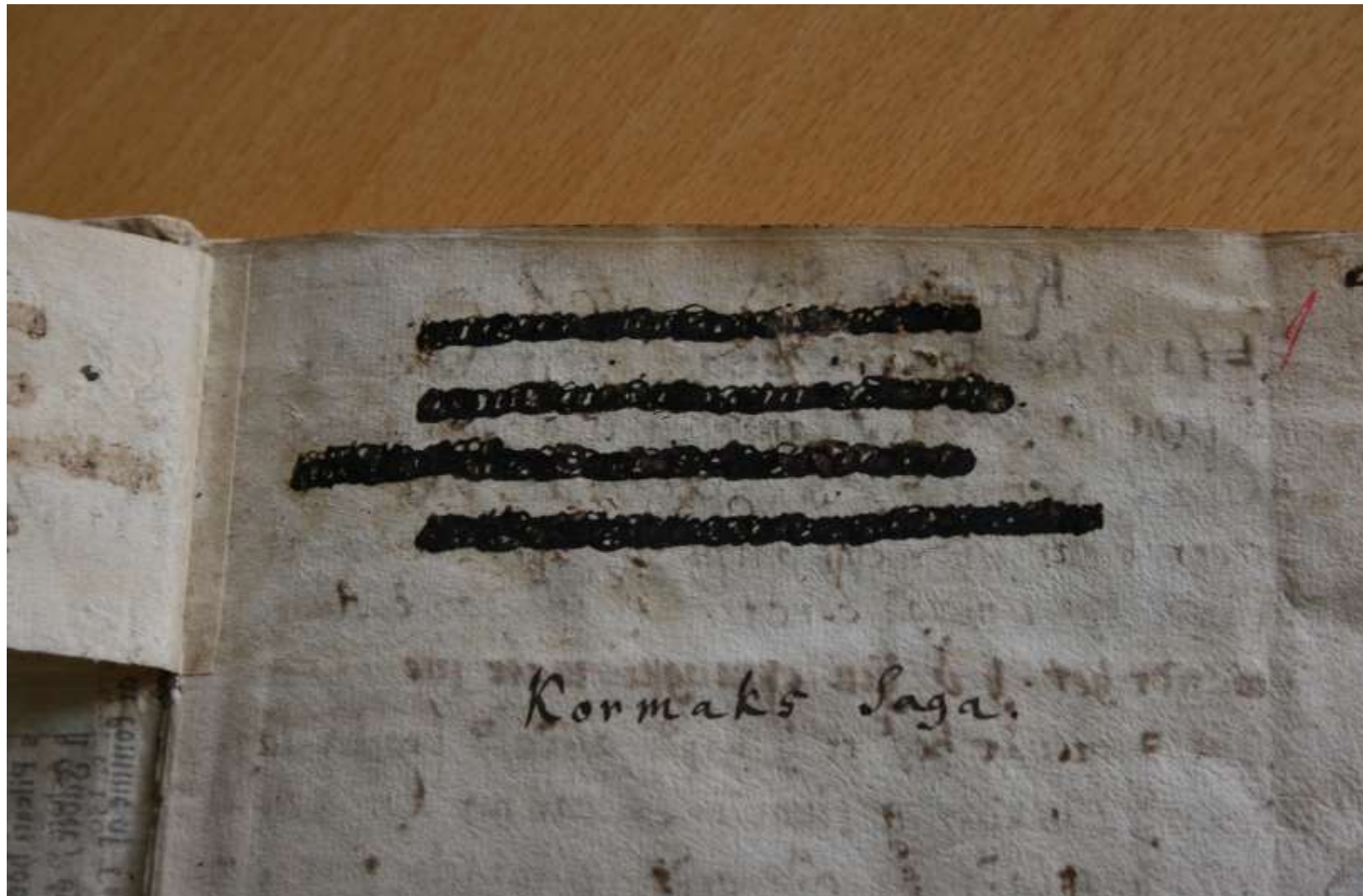
ARINBJARNARKVIÐA –ÍB 169 4TO

Árni Magnússon knew ÍB 169 4to and had it copied and sent to Norway where it was used in preparing AM 146 fol. The last part was left out, probably because Árni did not trust its authenticity. The last lines of the text he sent are partly preserved, see the next slide: (Árni recycled the paper and scribbled over the lines).

See my arguments for the above in:

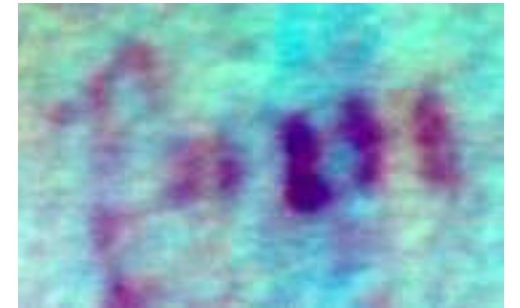
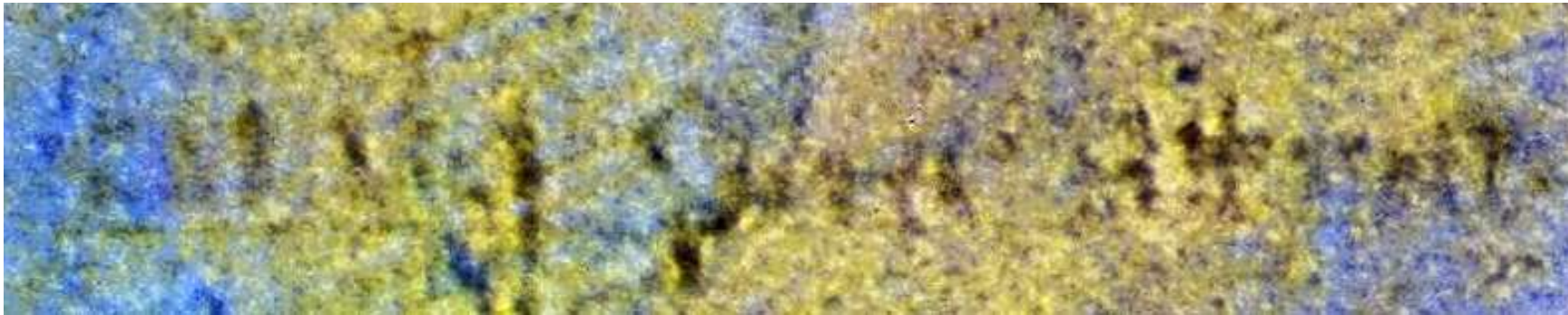
2014. Þorgeir Sigurðsson. Arinbjarnarkviða. Uppskrift frá Árna Magnússyni. *Gripla* 25, pages 129–141. [PDF](#). English name: The lay of Arinbjorn. A transcript from Árni Magnússon. Summary: [PDF](#).

ARINBJARNARKVIÐA- THE VERSION ÁRNI PROVIDED TO AM 146 FOL.



ARINBJARNARKVIÐA – AN UNCLEAR TEXT

Some interesting text may be read in addition to what Guðbrandur published.
The name of Eiríkr bloodaxe seems to appear in the void:



Guðbrandur had earlier read the words ,astrad þau'. Even if the context is not clear these words appear to refer to Eiríkr's son with the text: [e]I[r]ikf sʏnir aft[ra]ð). In support of this reading I display on the right how 'synir' is written elsewhere in the poem according to IB 169 4to.

This text demonstrates the dilemma of unclear texts: Is it clear enough to warrant publication, or not?

THANKS

I acknowledge my indebtedness to M.B. Toth and Bill Christens-Barry of the Archimedes palimpsest project for introducing me to the Principal Component Analysis for reading of manuscripts.

I thank Guðvardur Már Gunnlaugsson & Haukur Þorgeirsson at Árnastofnun for critical discussions and contributions to my work. Haukur helped me develop the set-up for the composite pictures.

I have not made public before the following readings: ‘Eiríks syni’ and ‘E...f ifle...’ in AM 132 99v and ‘þrándheimi” in AM 146 fol. 18v. I give references to where I have published other readings.

I plan to make these slides available on my web site at <http://uni.hi.is/th185/> and I will be update, modify and correct them if needed.