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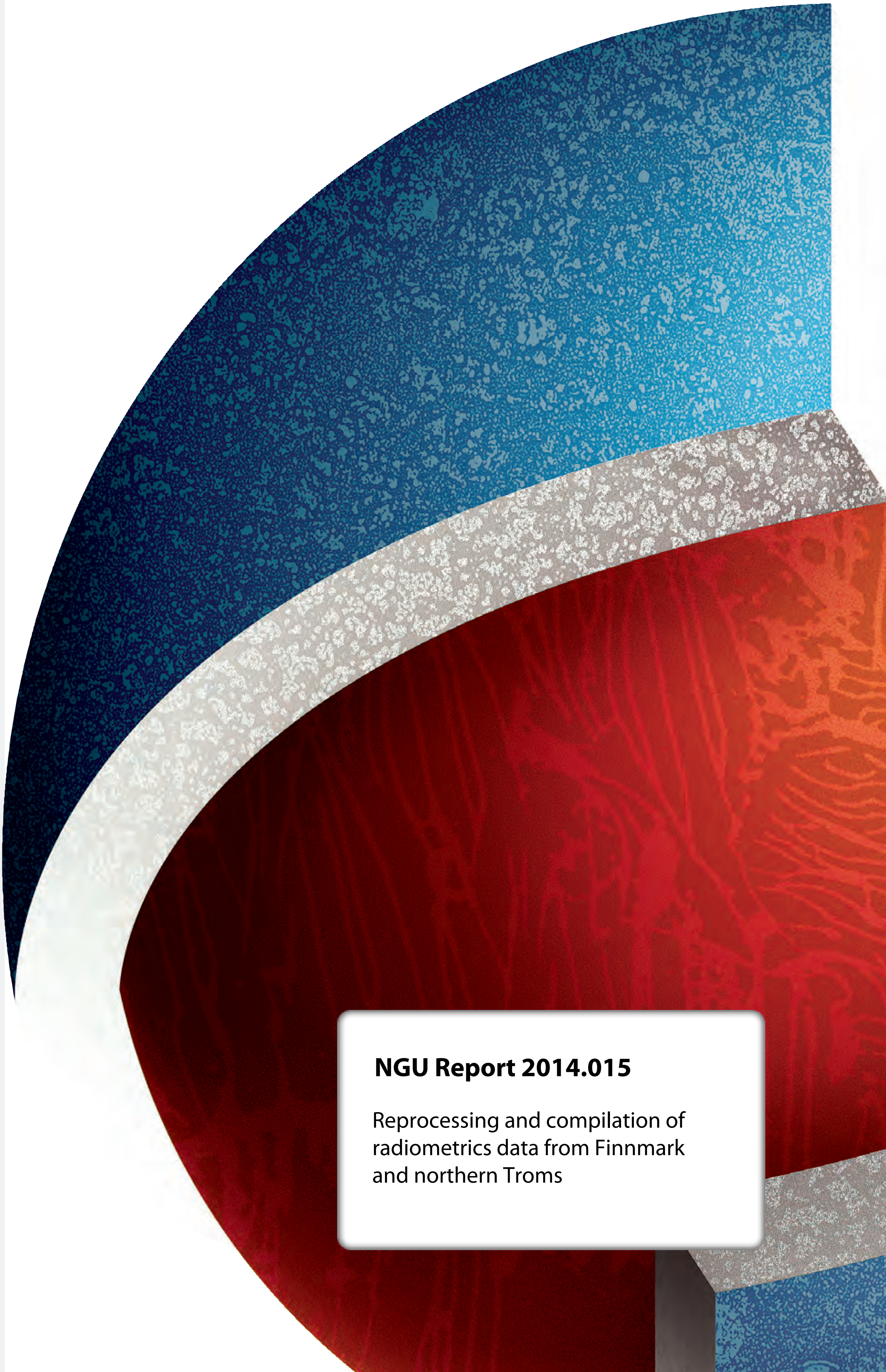

NGU Report 2014.015

Reprocessing and compilation of radiometrics data from Finnmark and northern Troms

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REPORT

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Summary:

As part of the MINN program (Mineral resources in North Norway), NGU needed a reprocessing of all radiometric data available from the Finnmark and northern Troms counties. It was also of interest to merge and compile these data with the recent radiometric data acquisition from MINN airborne surveys.

Each survey area was reprocessed separately using manual and automated procedures. Coarse manual adjustments were often needed to avoid creating artifacts from the various filters applied. Micro-leveling technique was preferred to reduce the linear trends caused along the flown lines. Each radio-element (potassium, thorium and uranium) count grid required different adjustments and filtering parameters.

Data (in counts per second) were gridded and the coefficients required for the concentration conversion were calculated from a statistical analysis using pre-existing known concentration from the Finnmark area. Concentration grids were calculated and merged to the grids obtained in the recent MINN surveys. Geosoft Oasis Montaj software was used to perform all the processing steps.

Maps of each radio-element are presented at a scale of 1:500,000 in UTM 34N projection and WGS-84 datum.

Keywords:	Compilation	
Geophysics	Radiometric data	
Airborne	Finnmark	Scientific report

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1. INTRODUCTION

The Norwegian Government has initiated the *Mineral resources in North Norway* program (MINN) to improve the basic geological information relevant to an assessment of the mineral potential in the three northernmost counties. The greatest part of MINN activities are allocated to increasing the coverage of the geophysical measurements from fixed-wing aircraft and helicopters. Between 2011 and 2013, about 13,000 km^2 was covered by helicopter-borne high-resolution geophysical surveys (magnetic, electromagnetic and radiometric). The fixed-wing FRAS-12 survey (Finnmark Region Airborne Survey 2012) covered 24,600 km^2.

In this regard, NGU has taken on the task to reprocess all airborne radiometric data digitally available in the Finnmark county acquired prior to MINN program. In addition, the objective of this project was to merge these data to the high-resolution data acquired for MINN. A compilation is available for each radio-element potassium (K), thorium (Th) and uranium (U).

2. MERGED PROJECTS

All the projects of interest for this compilation are listed below with their reference number from the DRAGON database, location and year of acquisition. They are also presented in the map below. All data were previously processed and assumed corrected for dead-time, stripping ratio, attenuation, background and standard temperature and pressure (STP) height corrections (IAEA 1991). For projects 243 to 287 and GTK data, only the count rates were available.

DRAGON #	Survey Name	Year
243	Siebe, Lavvoaivi	1979
249	Lavvoaivi, Siebe	1980
250	Mållejus, Raisjavri	1980
254	Raisjavri	1981
264	Suoluvuobmi, Carajavri	1982
268	Carajavri	1983
269	Iesjavri	1983
271	Iesjavri	1984
273	Kautokeino	1985
279	Addjit, Siebe	1989
286	Siebe, Roavvoaivi	1991
287	Kautokeino	1991
-	Karasjok (GTK)	2007-2009
640	Kvænangen	2012
645	FRAS-12 (Finnmark Region Airborne Survey)	2011-2012
646	Repparfjord	2011
-	Øksfjord	2013

Table 1. Project list and year of acquisition

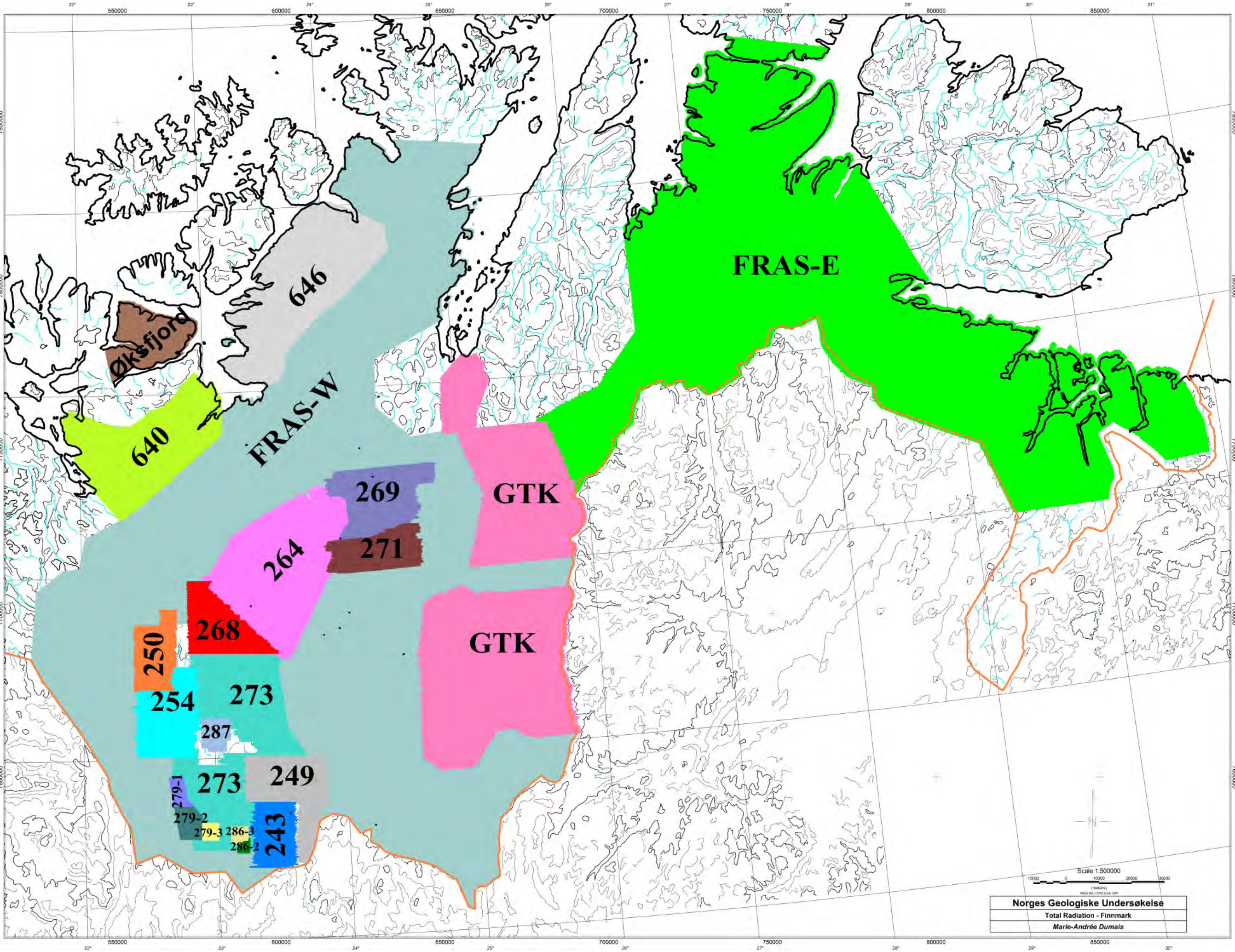

Figure 1 : Projects used in the radiometrics compilation of Finnmark

All these projects have been acquired with various survey parameters as listed below (Table 2).

DRAGON # / Name	Aircraft	Altitude (m)	Radiometric instrument	# crystals	Volume (L)
243	Helicopter - *Bell 204B*	60	*Geometrics DIGRS 3001*	4	7
249	Helicopter - unspecified model	60	*Geometrics DIGRS 3001*	4	7
250	Helicopter - unspecified model	60	*Geometrics DIGRS 3001*	4	7
254	Helicopter - unspecified model	60	*Geometrics GR-800B*	4	16.8
264	Helicopter - unspecified model	60	*Geometrics GR-800B*	4	16.8
268	Helicopter - unspecified model	60	*Geometrics GR-800B*	4	16.8
269	Helicopter - unspecified model	60	*Geometrics GR-800B*	4	16.8
271	Helicopter - unspecified model	60	*Geometrics GR-800B*	4	16.8
273	Helicopter - unspecified model	60	*Geometrics GR-800B*	4	16.8
279	Helicopter - *Eurocopter AS350 B1*	60	*Geometrics GR-800B*	4	16.8
286	Helicopter - *Eurocopter AS350 B2*	60	*Geometrics GR-800B*	4	16.8
287	Helicopter - *Eurocopter AS350 B2*	60	*Geometrics GR-800B*	4	16.8
Karasjok	Fixed-wing - *DHC-6/300 Twin Otter*	30	*Exploranium GR-820/3*	8	33.6
640	Helicopter - *Eurocopter AS350 B2*	60	*Radiation Solutions Inc. RSX-5*	4	16.8
645	Fixed-wing - Piper Navajo PA31	60	*Radiation Solutions Inc. RSX-5*	12	50.4
646	Helicopter - *Eurocopter AS350 B2*	60	*Radiation Solutions Inc. RSX-5*	4	16.8
Øksfjord	Helicopter - *Eurocopter AS350 B3*	60	*Radiation Solutions Inc. RSX-5*	4	16.8

Table 2. Survey parameters. Only downward looking detectors are considered.

3. PROCESSING METHOD

3.1 243 - Siebe, Lavvoaivi - 1979

Total count and potassium grids have small stripes along the flight lines while thorium and uranium grids show long stripes across the grids (Håbrekke 1979). For the potassium and total counts data, only a micro-leveling step was necessary. A decorrugation cutoff wavelength of 800 m and a Naudy filter of 100 m were used to smooth both potassium and total count grids.

Uranium and thorium grids showed much more noise in the initial grids. Geosoft micro-leveling helped but noise still remains in the data. A decorrugation cutoff wavelength of 16,000 m and a Naudy filter of 50 m were used. Another iteration of micro-leveling was applied to remove the smaller artifacts remaining in the dataset using a decorrugation cutoff wavelength of 800 m and a Naudy filter of 100 m.

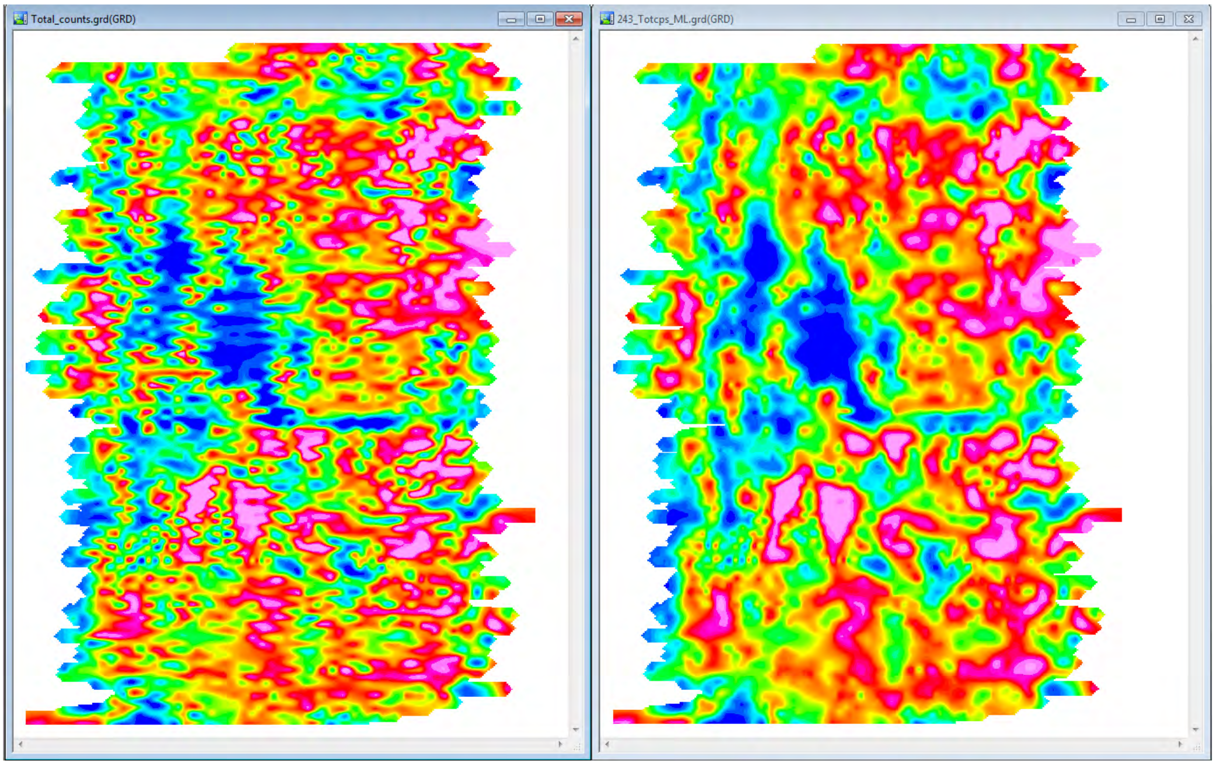

Figure 2 : 243 - Total Count

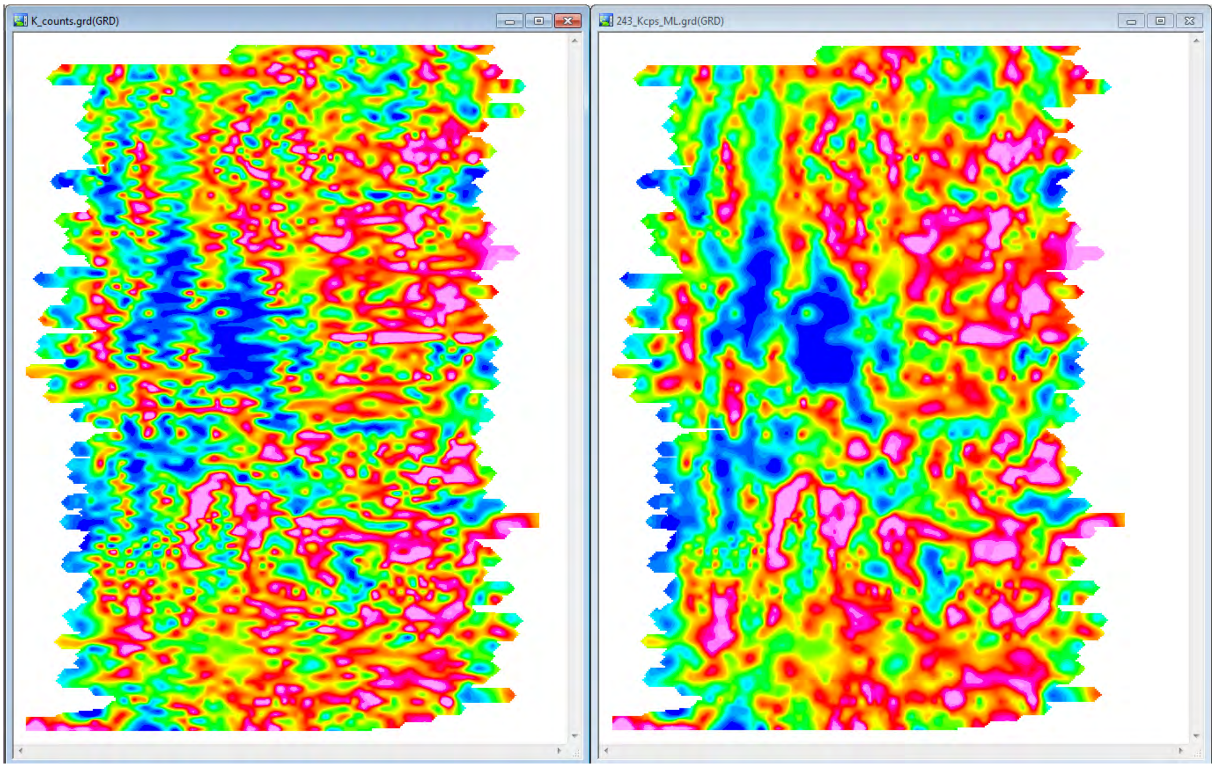

Figure 3 : 243 - Potassium Count

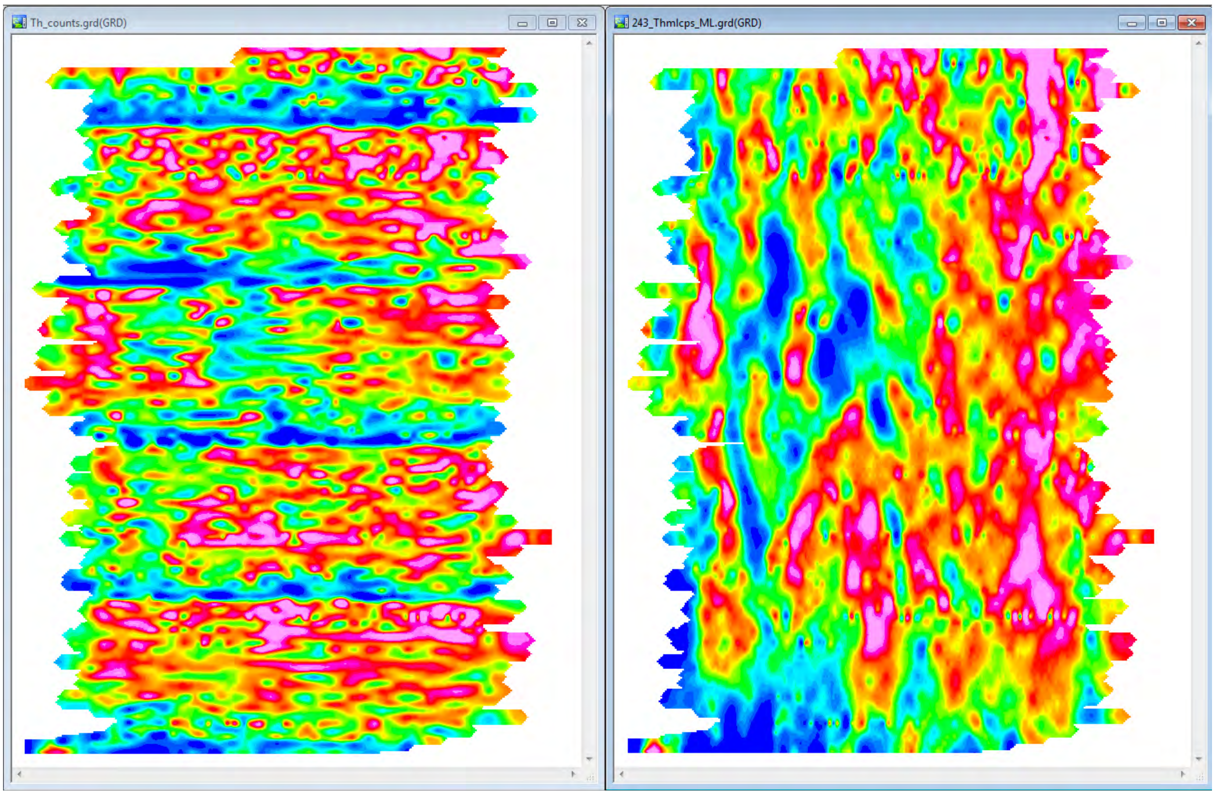

Figure 4 : 243 - Thorium Count

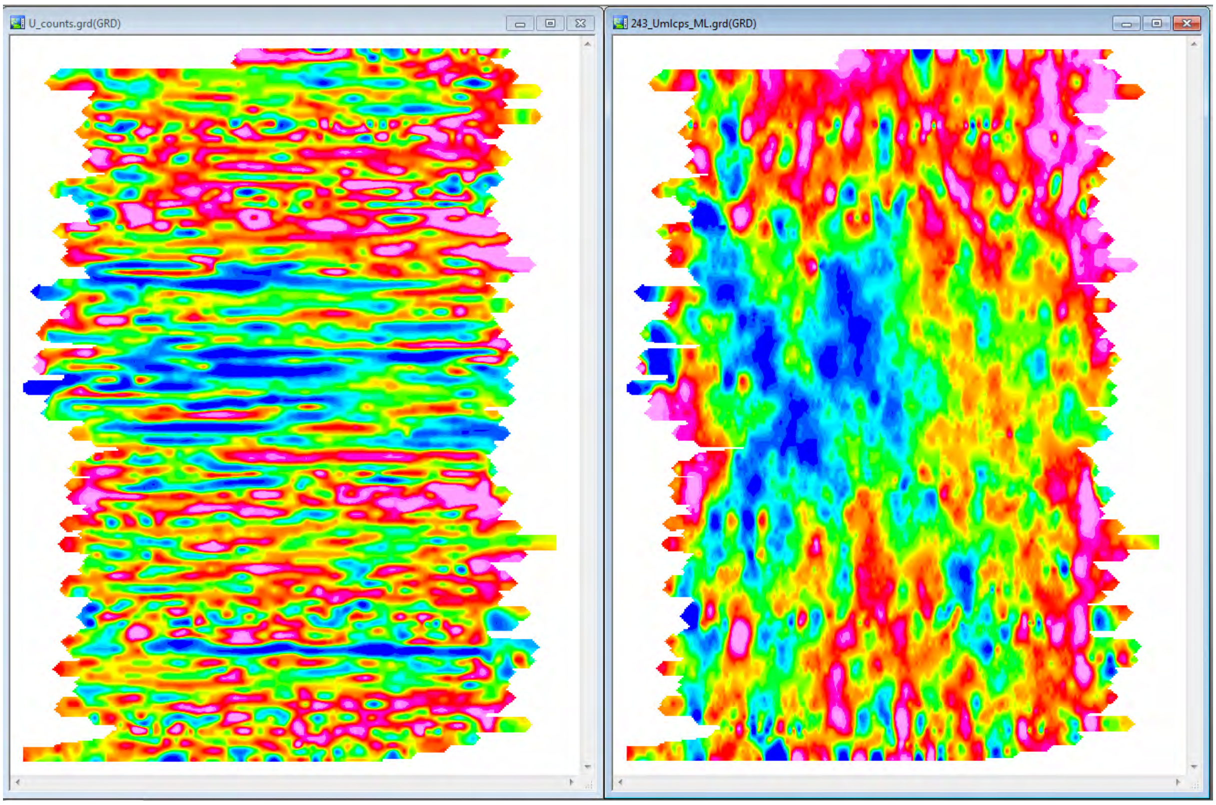

Figure 5 : 243 - Uranium Count

3.2 249 - Lavvoaivi, Siebe - 1980

Thorium and total count grids have been manually adjusted to level the data and remove major stripes shown in the original data (Håbrekke 1980). The adjusted correction value for each line is shown in the table below.

Line	Thorium adjustment	Total count adjustment
74	15.35	79.56
87	3.175	44.835
88	1.09	-
99	7.38	42.93
100	5.985	-
109	9.195	49.88
110	6.76	-
119	8.315	41.54
120	6.48	-
121	4.43	-
129	8.59	37.175
130	6.31	-
139	8.835	35.41
140	6.245	-
151	7.935	33.755
152	6.79	-
153	7.275	-

Table 3. 249 - Thorium and total count adjustments

After this manual adjustment, a micro-leveling using Geosoft tools was easier to apply. A decorrugation cutoff wavelength of 4000 m and a Naudy filter of 1000 m was used to smooth both total count and thorium datasets.

Uranium and potassium count data did not require any leveling adjustments.

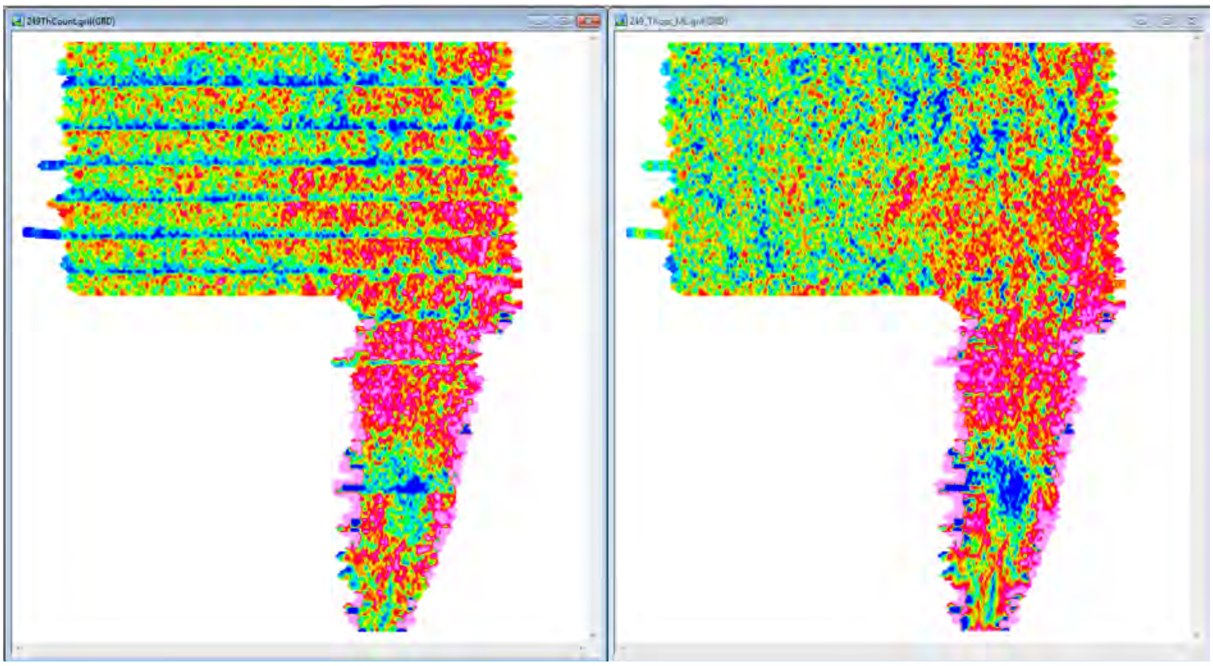

Figure 6 : 249 - Thorium Count

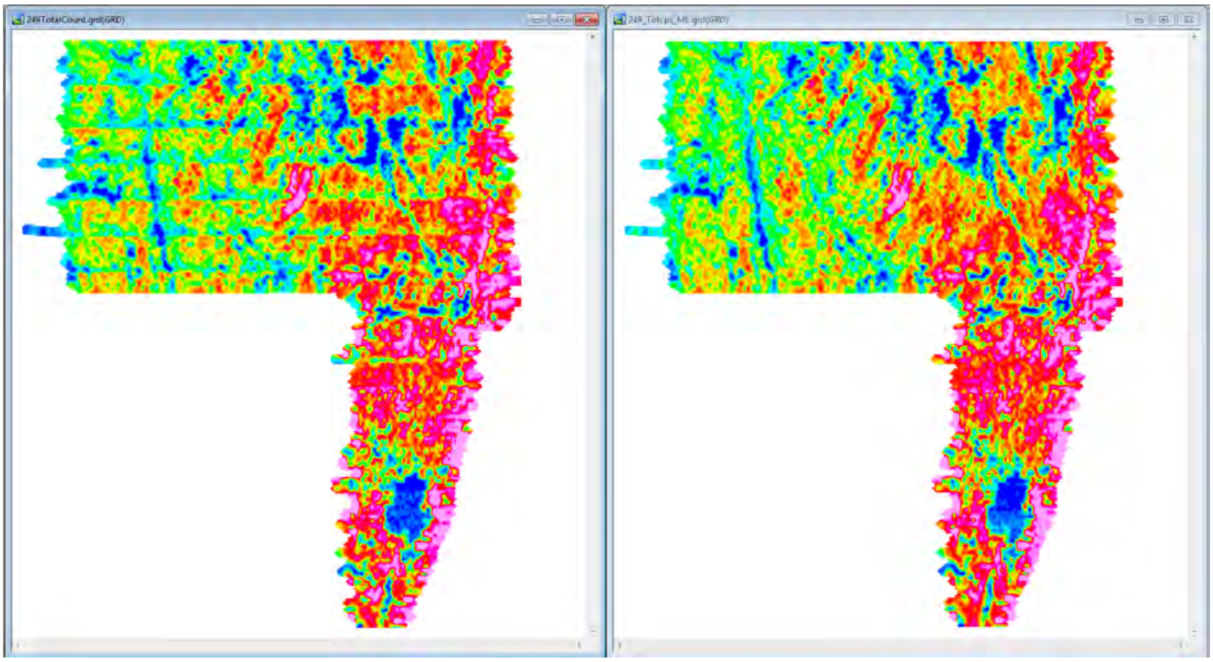

Figure 7 : 249 - Total Count

3.3 250 - Mållejus, Raisjavri - 1980

Thorium and total count grids have been manually adjusted to level the data and remove major stripes from the original datasets (Håbrekke 1980).

Line	Thorium adjustment	Total Count adjustment
20	7.35	-
21	4.865	30.46
40	3.33	-
41	5.565	-
57	5.09	-
58	7.18	-
62	5.635	-
63	8.095	42.815
80	6.92	-
81	6.92	29.79
96	7.175	-
97	8.79	-
115	8.045	-

Table 4. 250 - Thorium and total count adjustments

Following this manual adjustment, a micro-leveling was used to reduce the remaining noise. A decorrugation cutoff wavelength of 4000 m and a Naudy filter of 1000 m were used to smooth both total counts and thorium datasets.

Uranium and potassium count data did not require any leveling adjustments.

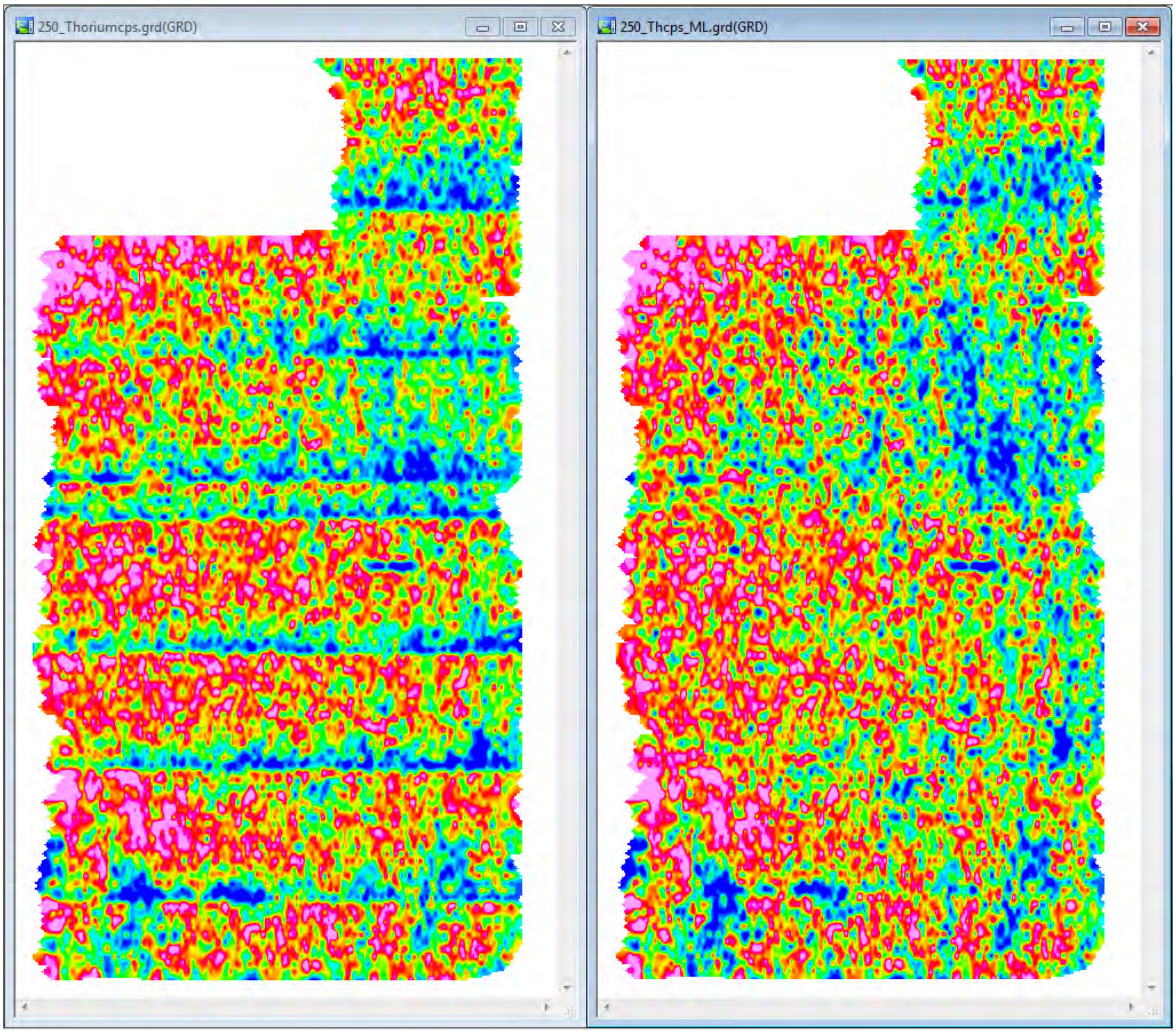

Figure 8 : 250 - Thorium Count

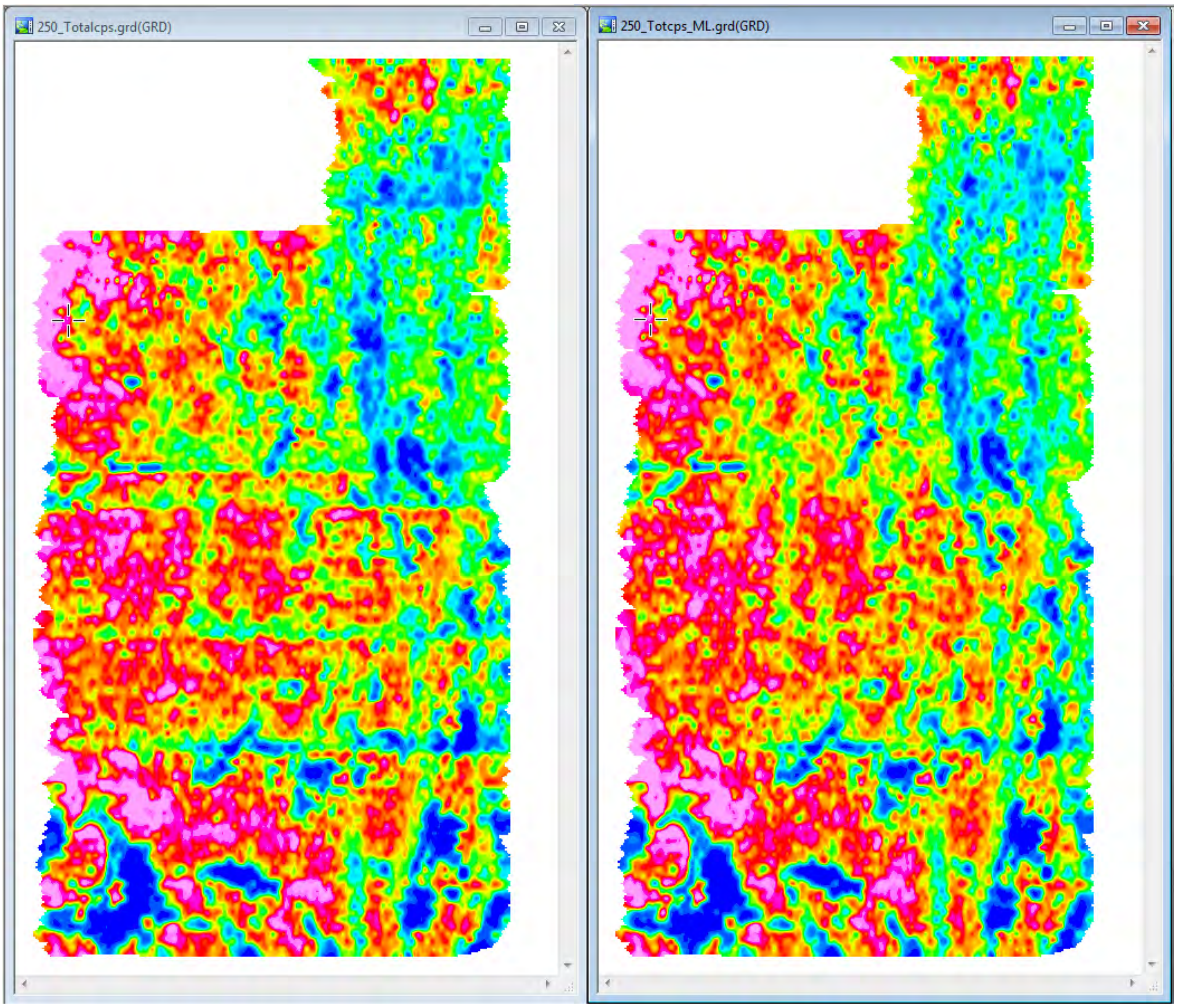

Figure 9 : 250 - Total Count

3.4 254 - Raisjavri - 1981

Thorium original count grid has large stripes across the whole grid in the flight direction (Håbrekke 1981). Only a micro-leveling step was required to remove these artifacts. A decorrugation cutoff wavelength of 16,000 m and a Naudy filter of 1000 m were used to smooth both thorium and uranium datasets. Potassium and total count grids did not need further leveling adjustments.

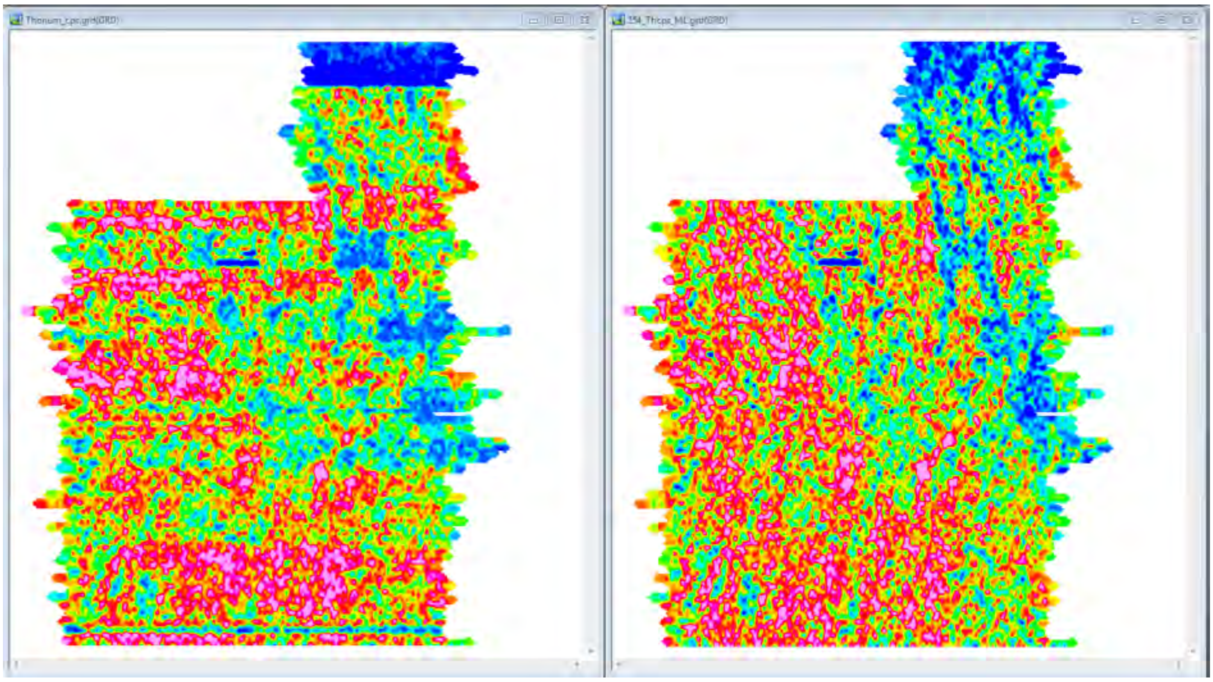

Figure 10 : 254 - Thorium Count

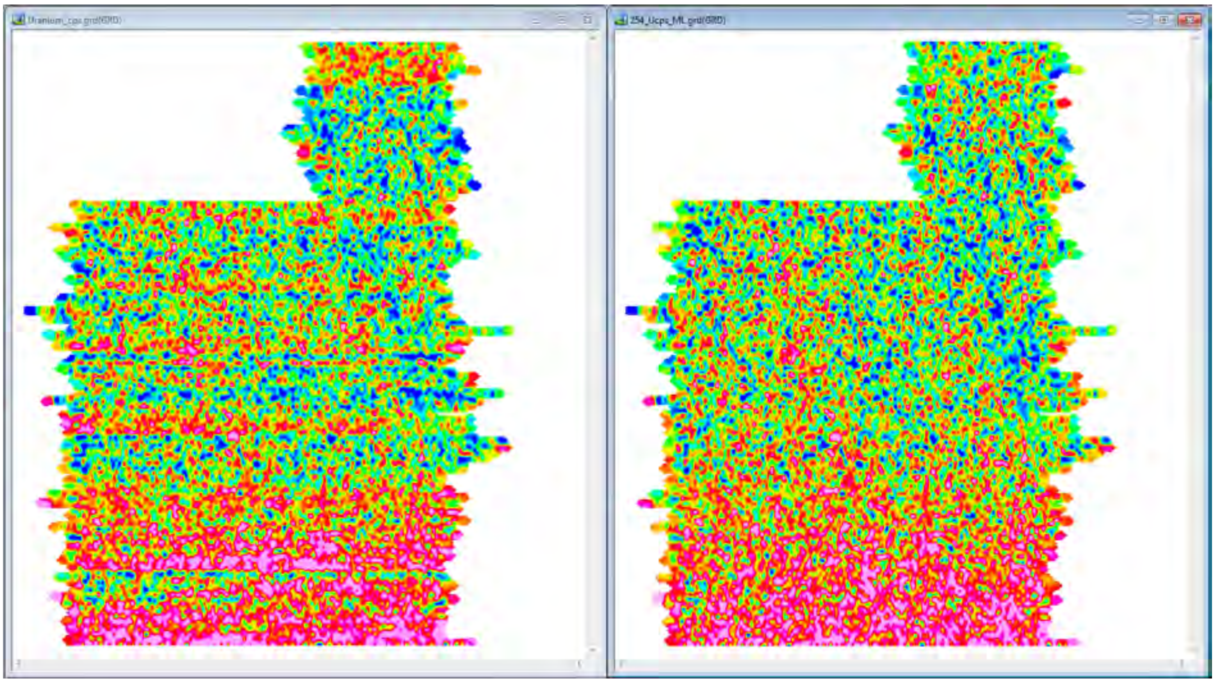

Figure 11 : 254 - Uranium Count

3.5 264 - Suoluvuobmi, Carajavri - 1982

Thorium and uranium original count grids are difficult to level due to a low signal-to-noise ratio (Håbrekke 1983). Where the data were already at their minimum, it was impossible to recover the signal. Several iterations of micro-leveling were applied to both uranium and thorium count grids using the parameters shown in the table below:

Element	Iteration #	Line angle	Butterworth Filter (m)	Naudy Filter (m)
Thorium	1	135	16000	1250
	2	135	1000	50
	3	45	1000	250
Uranium	1	135	16000	1250
	2	135	1000	50

Table 5. 264 - Micro-leveling iterations and parameters for thorium and uranium

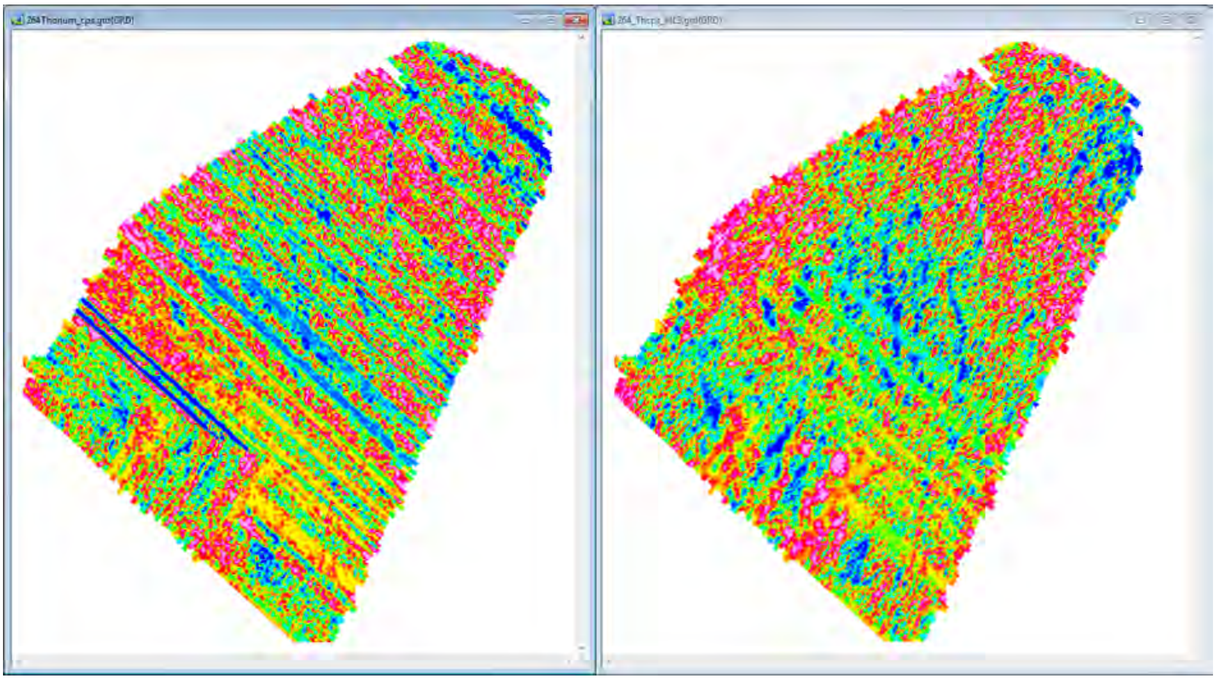

Figure 12 : 264 - Thorium Count

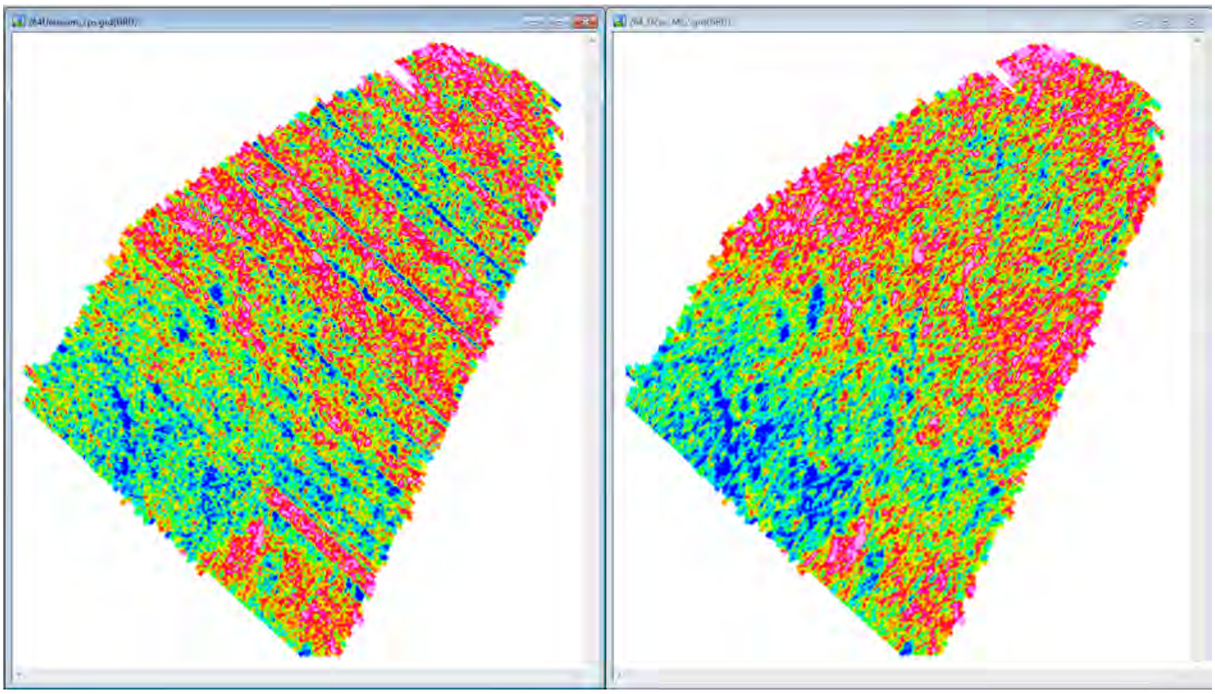

Figure 13 : 264 - Uranium Count

3.6 268 - Carajavri - 1983

Thorium original count grid has large and broad stripes across the whole grid in the flight direction (Håbrekke 1984). Since it is difficult to isolate the impact of each line, Geosoft micro-leveling tool was used. This technique is proven efficient as the noise is parallel to the flight lines. A decorrugation cutoff wavelength of 4000 m and a Naudy filter of 1250 m were used to smooth both uranium and thorium datasets. Potassium and total count grids did not need further leveling adjustment.

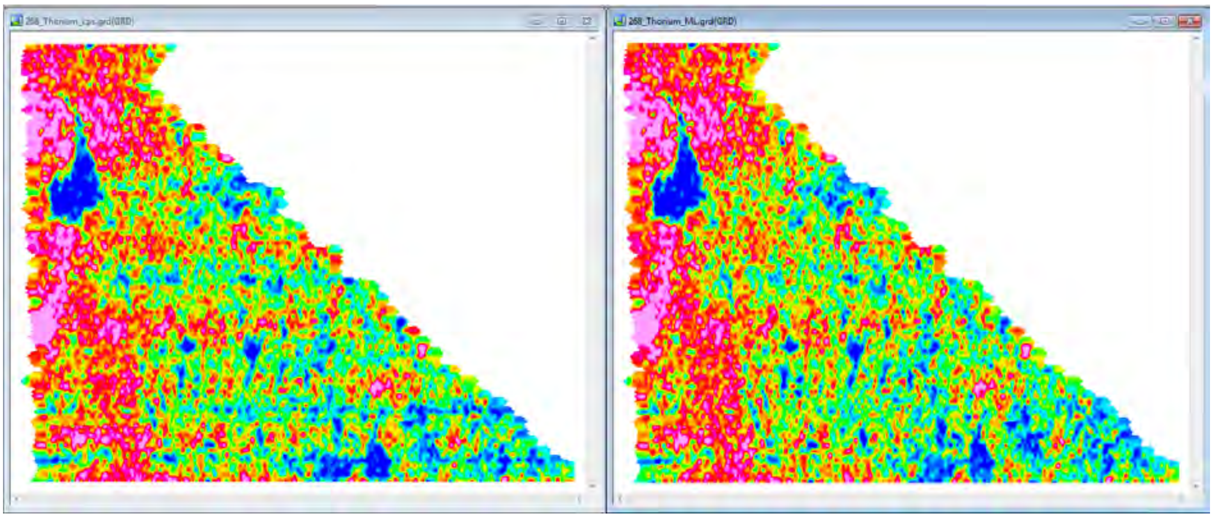

Figure 14 : 268 - Thorium Count

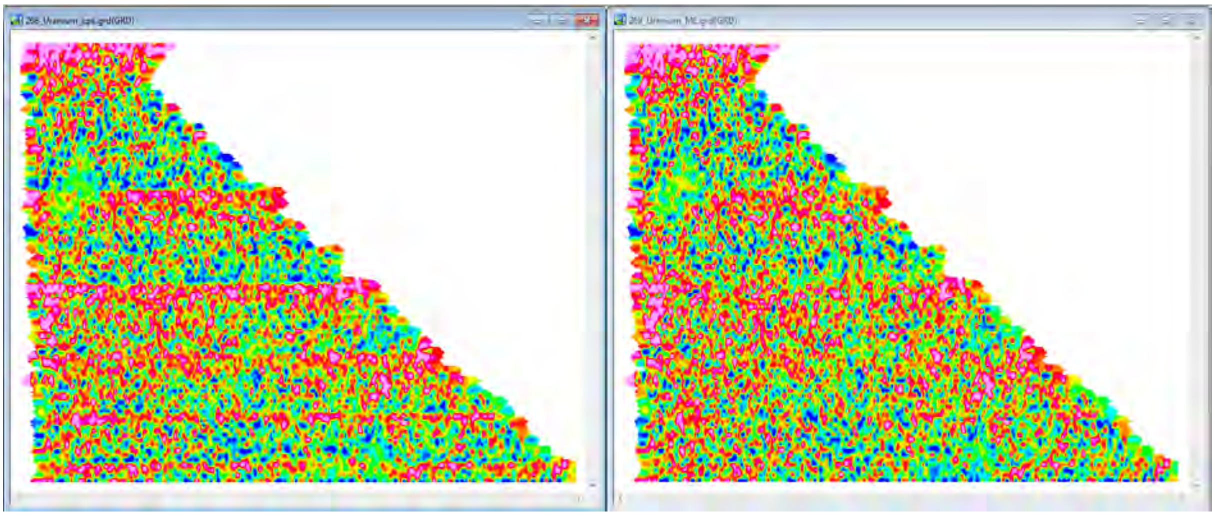

Figure 15 : 268 - Uranium Count

3.7 269 - Iesjavri - 1983

Thorium original count grid has large stripes across the whole grid in the flight direction (Håbrekke 1984). Geosoft micro-leveling tool was used to correct thorium and uranium data. A decorrugation cutoff wavelength of 4000 m and a Naudy filter of 1250 m were used to smooth both datasets. Most of the geological features are not oriented parallel to the flight lines.

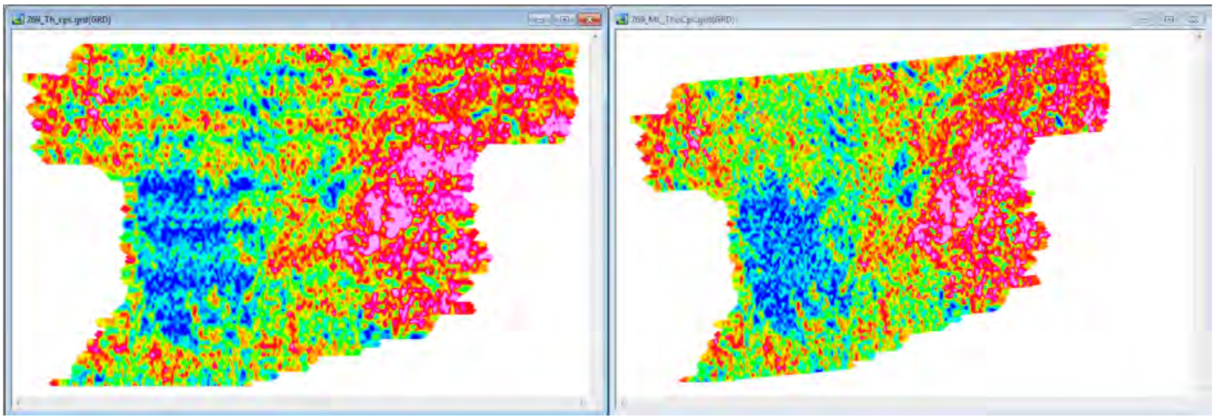

Figure 16 : 269 - Thorium Count

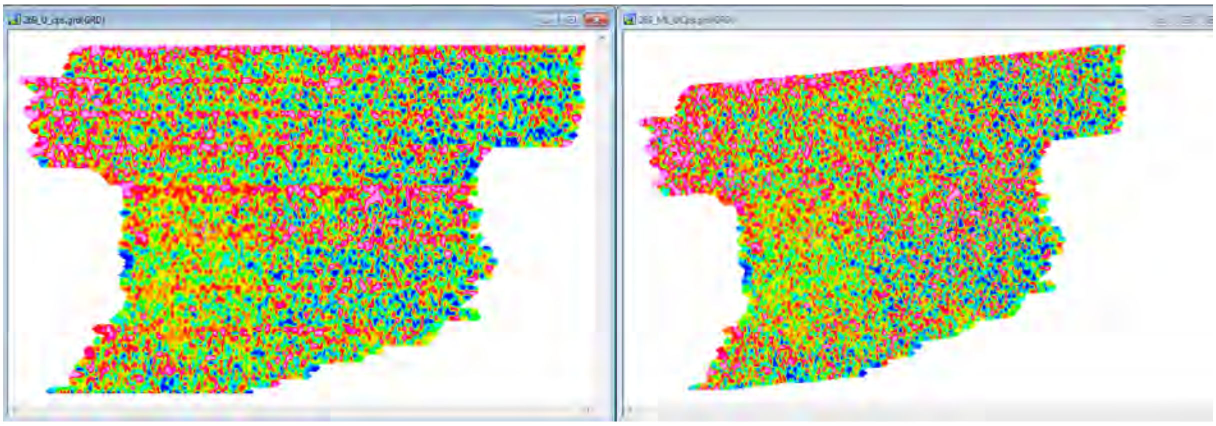

Figure 17 : 269 - Uranium Count

3.8 271 - Iesjavri - 1984

This area has been mainly re-flown during the FRAS-W campaign. Only the concentrations have been calculated.

3.9 273 - Kautokeino - 1985

The thorium grid showed several stripes due to the position of the crystal pack in the helicopter, adjacent to the fuel tank (Mogaard & Skilbrei 1986). The counts varied with the level of fuel in the tank through the flight. A line spacing of 250 m was used for the acquisition.

To help correcting the thorium counts, we first compared it to the raw thorium count acquired during the FRAS-W (area 645) project (*Figure 1*). The raw FRAS-W grid was sampled into the 273 database. The difference between the count channels of 645 (FRAS-W) and 273 was calculated. For each line, the mean difference of the overlap was calculated. The mean difference of each line was subtracted from the original thorium line channel. As each line is shifted accordingly to the count level of FRAS-W, all lines are leveled relative to each other. The overall average of the shift applied to the lines is -9.13 cps. Few lines with little overlap with FRAS-W were still standing out and a manual adjustment was made instead.

Line	Thorium adjustment
131-132 137-140 142 195 217-222 226-233 239-244 441 833	-9.4
133-136 211-216 223-225 234-238 833	-13.4

Table 6. 273 - Thorium manual corrections

To fix the remaining stripes, a micro-leveling correction from Geosoft module was applied to the data. A decorrugation cutoff wavelength of 4000 m and a Naudy filter of 1250 m were used to smooth the data.

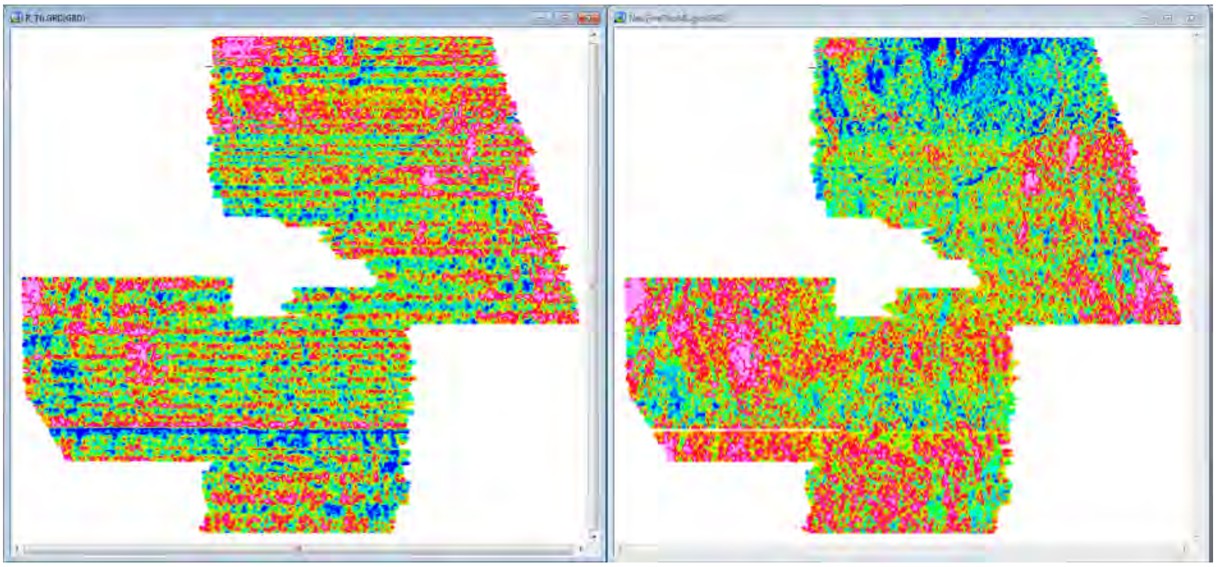

Figure 18 : 273 - Thorium Count

Only few lines required correction for the potassium count. The average difference between FRAS-W and Kautokeino is 70 cps. This shift was applied to the entire Kautokeino area in order to level the data set with FRAS-W data. To remove the large stripes a semi-automatic adjustment was made on a few lines using the line average difference between the overlapping area of Kautokeino and FRAS-W.

Line	Potassium adjustment
34 to 48 449 541 13 66 72 65 73 69 70 71	Line average of the difference between FRAS-W and Kautokeino overlapping area

Table 7. 273 - Potassium semi-automated corrections

In a second step, manual adjustments were performed based on line average comparison with the adjacent lines and the visual look of the grid.

Line	Potassium additional adjustment
13 34	20
35 to 48	10
65 71	15
449	5

Table 8. 273 - Potassium manual corrections

The final step is to apply the same micro-leveling correction to the potassium count as applied to thorium using the same parameters.

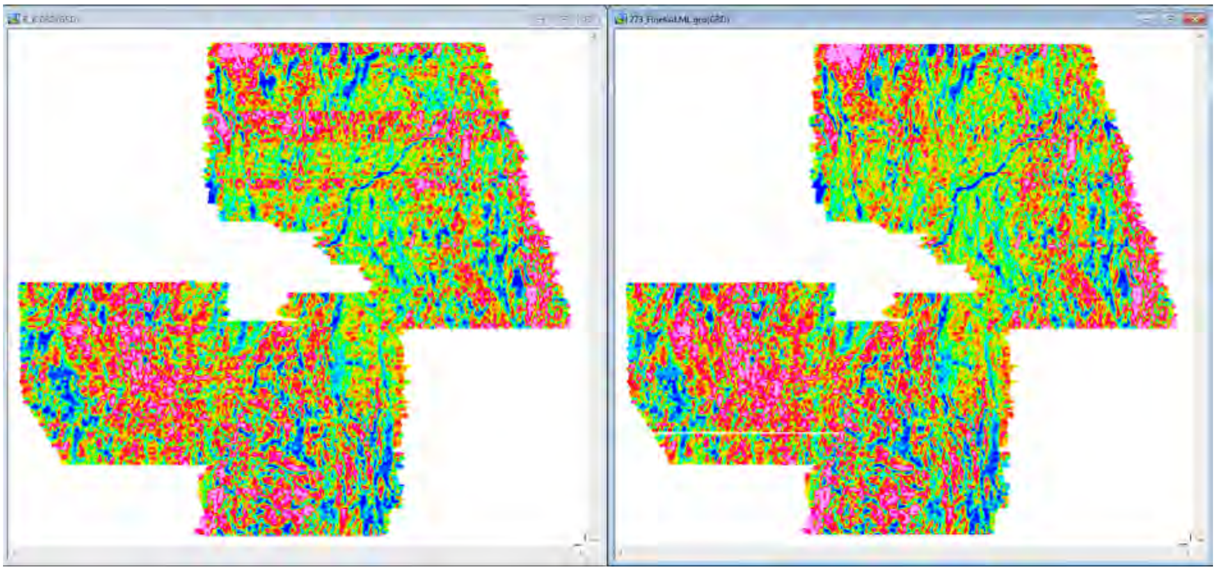

Figure 19 : 273 - Potassium Count

The very low uranium count level made the grid corrections challenging. In areas where the spectrometer was shielded by the full fuel tank, the count is almost null. A simple micro-leveling using the same parameters as thorium and potassium had a small improving effect.

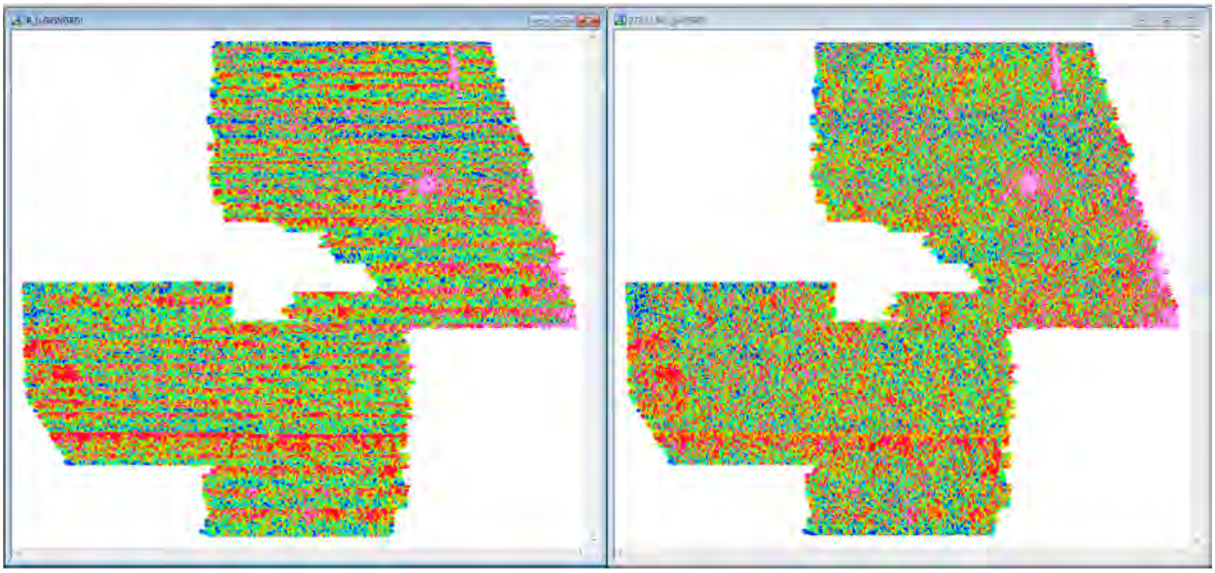

Figure 20 : 273 - Uranium Count

The total count channel was corrected using the same method as the potassium window channel. The shift used to level the total count level of Kautokeino to FRAS-W is 340 cps. Then a semi-automated correction followed by a fine manual correction helped to pre-level the data.

Line	Total count adjustment
34 to 48 449 541 13 66 72 65 73 69 70 71	Line average of the difference between FRAS-W and Kautokeino overlapping area

Table 9. 273 - Total count semi-automated correction

Line	Total count additional adjustment
13 34	200
35 to 48 449	38
65 71	100

Table 10. 273 - Total count manual correction

The final step is to apply the same micro-leveling correction as applied to thorium and potassium with the same parameters.

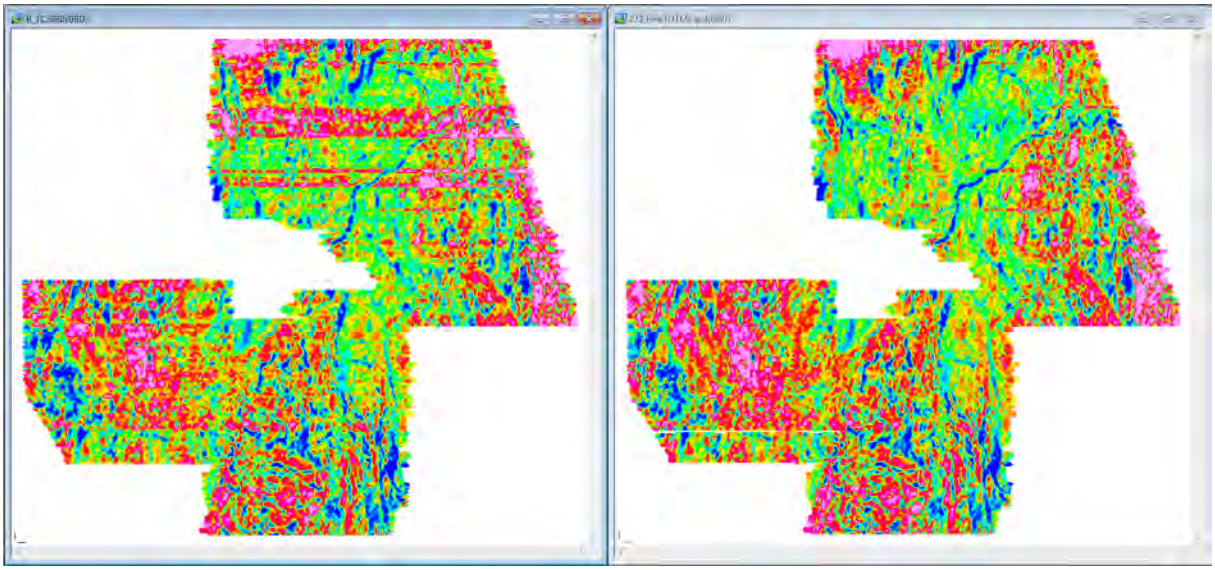

Figure 21 : 273 - Total Count

3.10 279 - Addjit, Siebe - 1989

Project 279 includes three small areas all embedded in the Kautokeino-273 project flown at a smaller line spacing (Håbrekke 1990). For 279-1, only the uranium grid required to be adjusted. The Geosoft micro-leveling tool was used to correct it. A decorrugation cutoff wavelength of 2000 m and a Naudy filter of 500 m were used to smooth both datasets. Given the line spacing of 100 m, a cell size of 25 m was used for gridding.

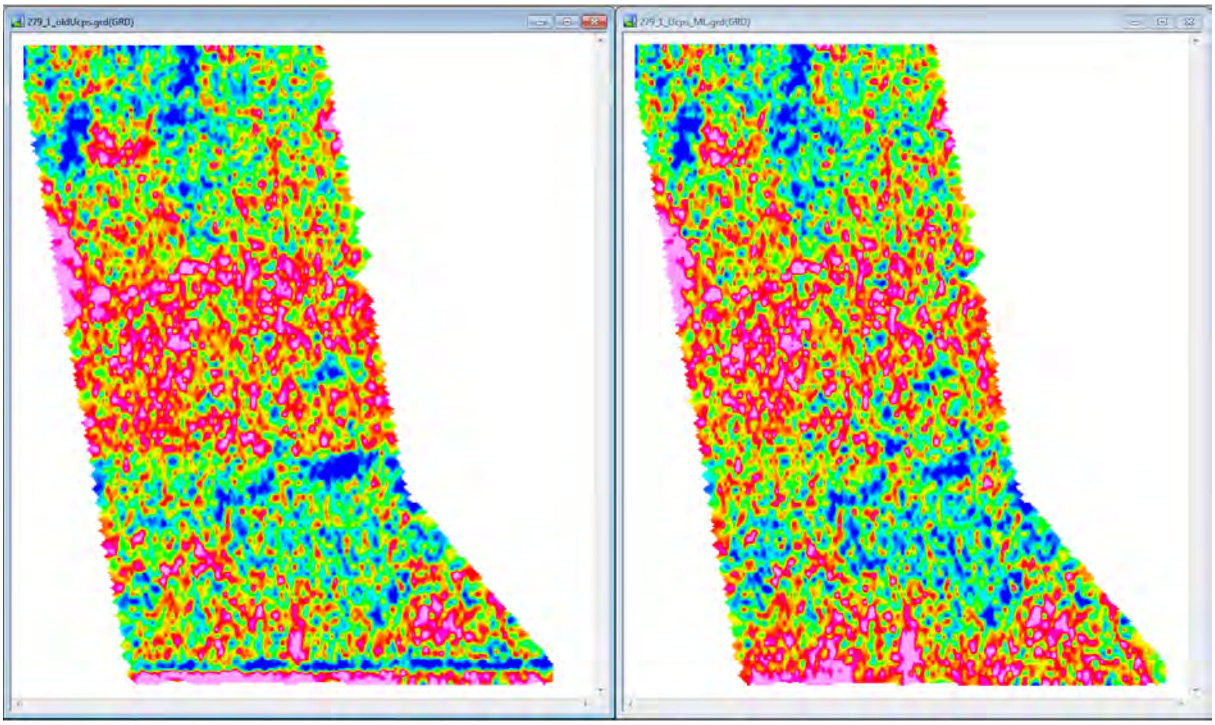

Figure 22 : 279-1 - Uranium Count

For 279-2 uranium grid, a decorrugation cutoff wavelength of 200 m and a Naudy filter of 250 m were used to smooth both datasets. Given the line spacing of 50 m, a cell size of 15 m was used for gridding.

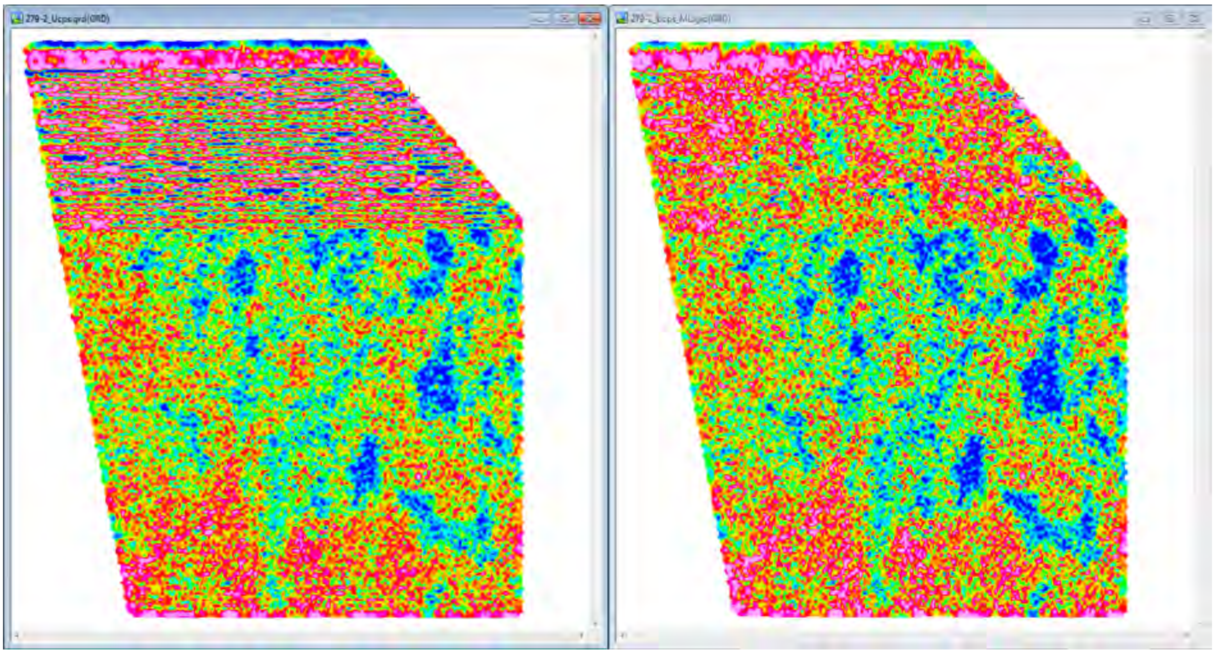

Figure 23 : 279-2 - Uranium Count

For 279-2 total count grid, a decorrugation cutoff wavelength of 500 m and a Naudy filter of 250 m were used to smooth both datasets.

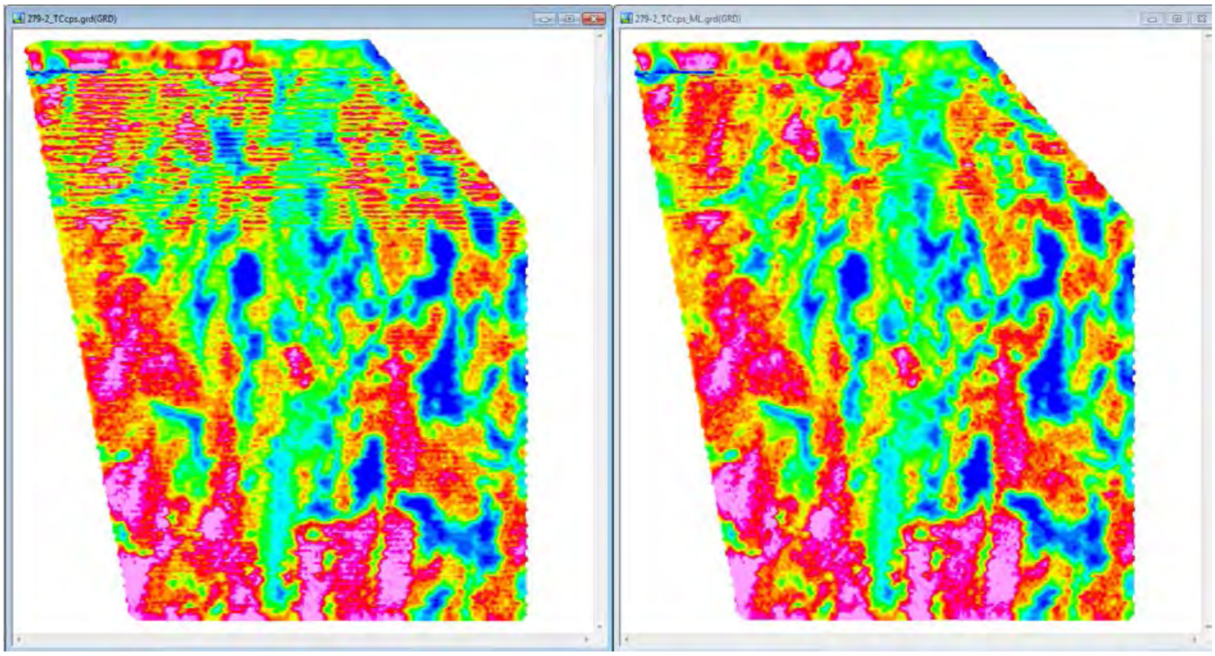

Figure 24 : 279-2 - Total Count

The third area (279-3) did not require further processing. Grid cell size used was 25 m.

3.11 286 - Siebe, Roavvoaivi - 1991

Project 286 includes two small area (Walker 1991). Both have small stripes in all grids (for K, Th, U and total count). A decorrugation cutoff wavelength of 250 m for potassium, thorium and total count and 200 m for uranium in area 2 and 500 m for uranium in area 3. A Naudy filter of 10 m were used to smooth both datasets. Given the line spacing of 50 m, a cell size of 15 m was used for gridding.

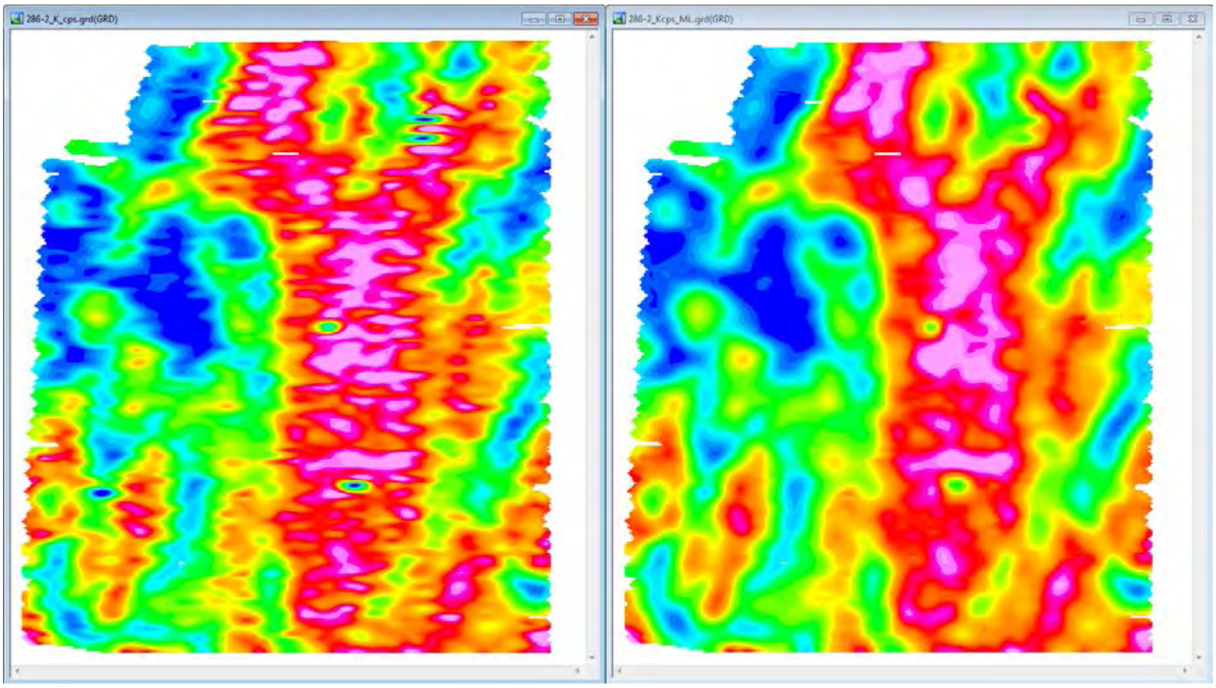

Figure 25 : 286-2 - Potassium Count

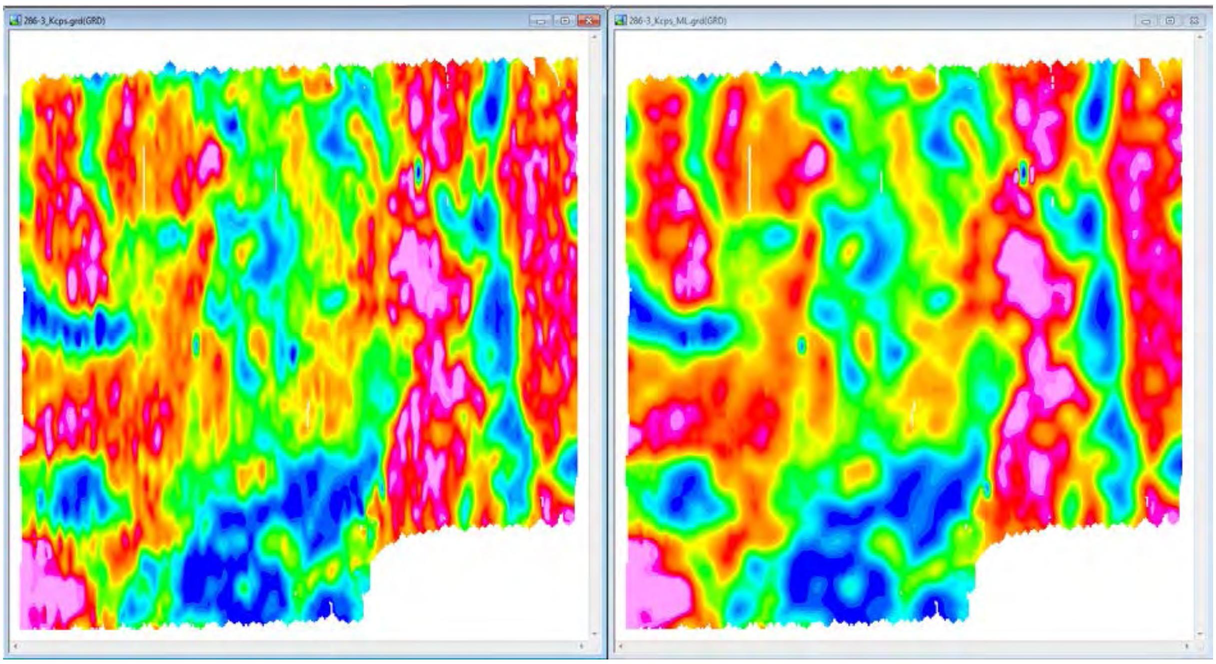

Figure 26 : 286-3 - Potassium Count

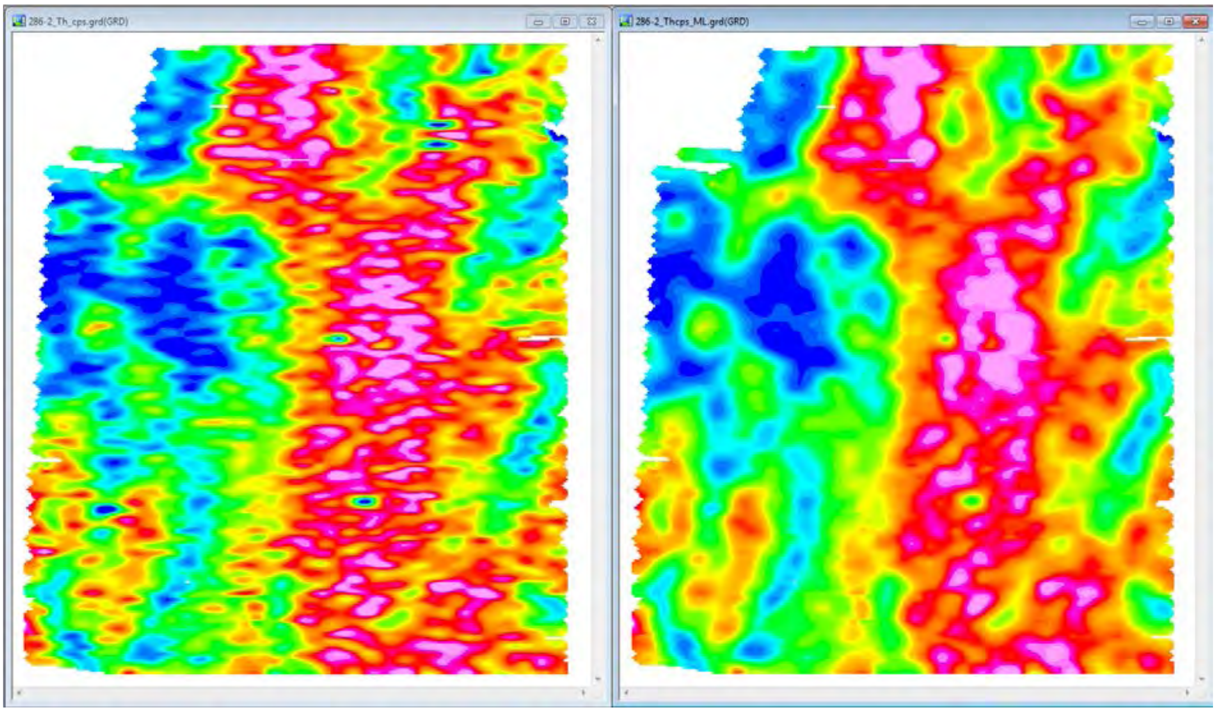

Figure 27 : 286-2 - Thorium Count

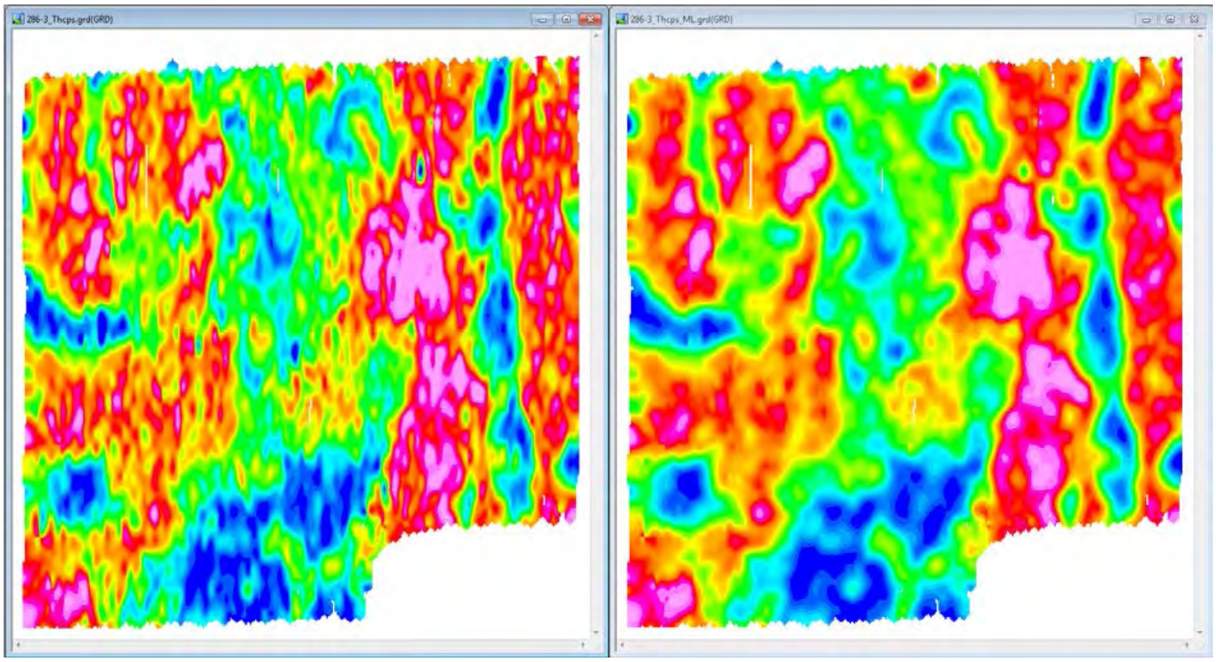

Figure 28 : 286-3 - Thorium Count

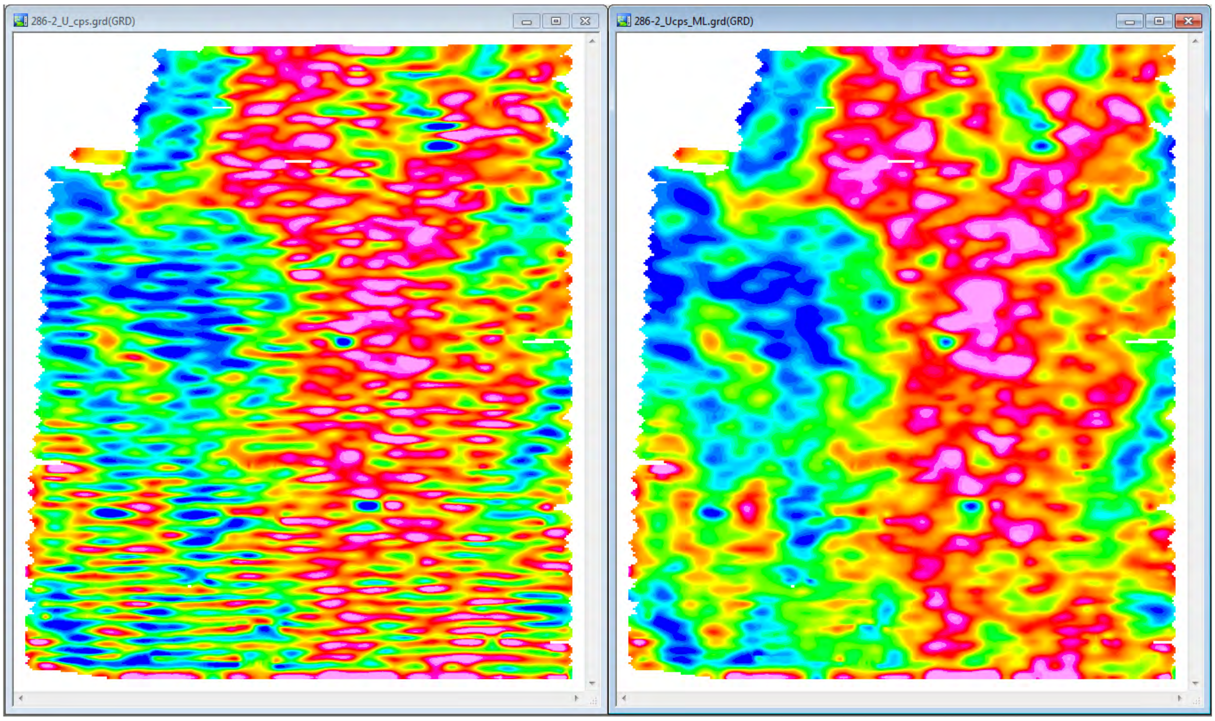

Figure 29 : 286-2 - Uranium Count

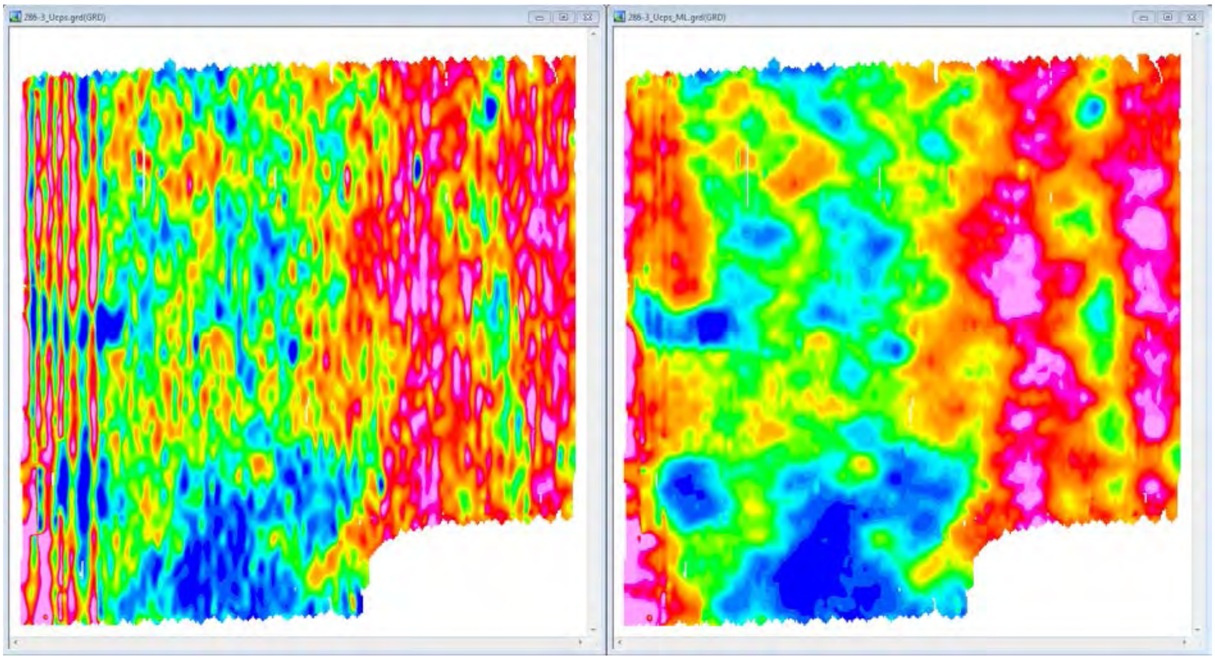

Figure 30 : 286-3 - Uranium Count

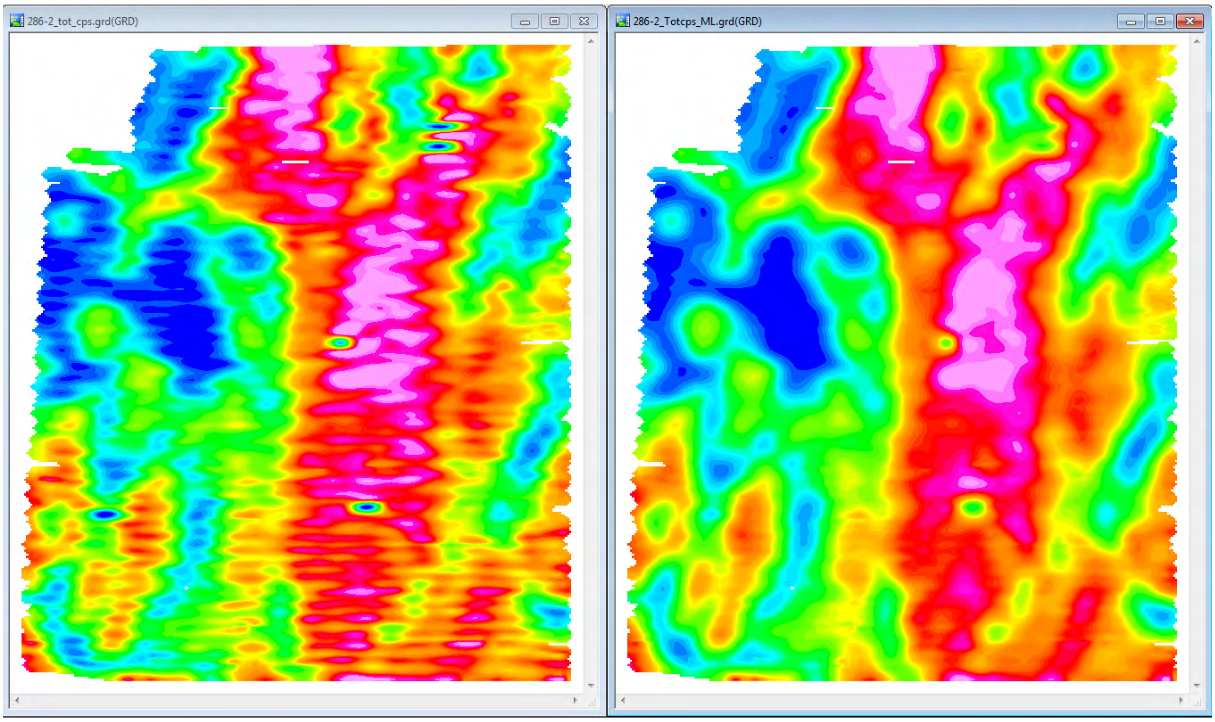

Figure 31 : 286-2 - Total Count

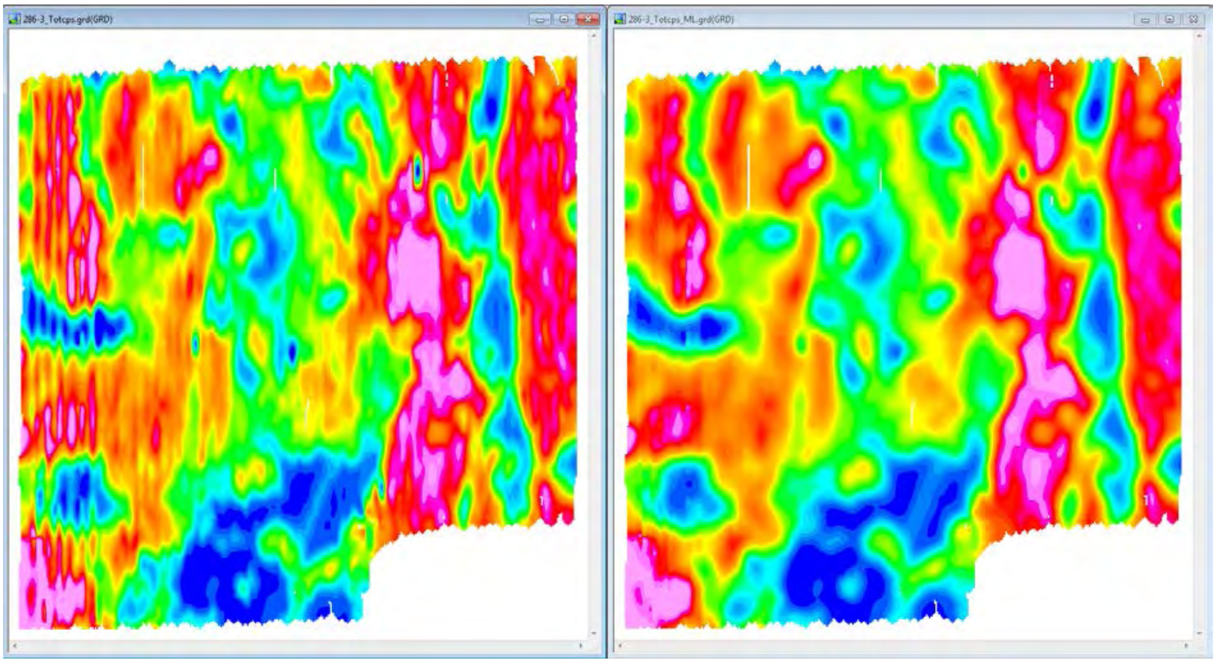

Figure 32 : 286-3 - Total Count

Processed and leveled count grids were initially presented in NGU Report 92.314 (Walker 1992). These grids no longer exist at the time of the presemt processing. However the maps can be found in Appendix A for comparison. The final grids presented above look similar to those initially processed in 1992.

3.12 287 - Kautokeino - 1991

This area has small stripes in all original grids (for K, Th, U and Total Count) (Walker 1991). A series of filters has been run on the data to remove these artifacts.

A decorrugation cutoff wavelength of 300 m for potassium, thorium and total count and a Naudy filter of 10 m were used to smooth both datasets. Given the line spacing of 50 m, a cell size of 15 m was used for gridding. Portion of lines L1691 and L1650 were removed.

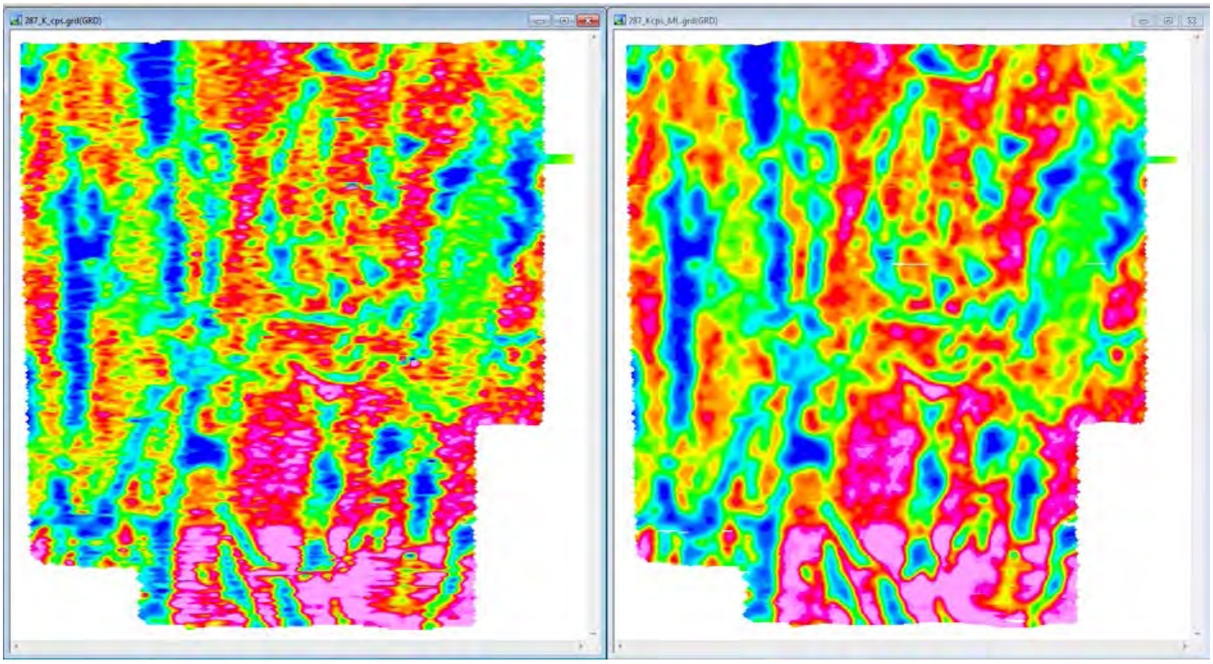

Figure 33 : 287 - Potassium Count

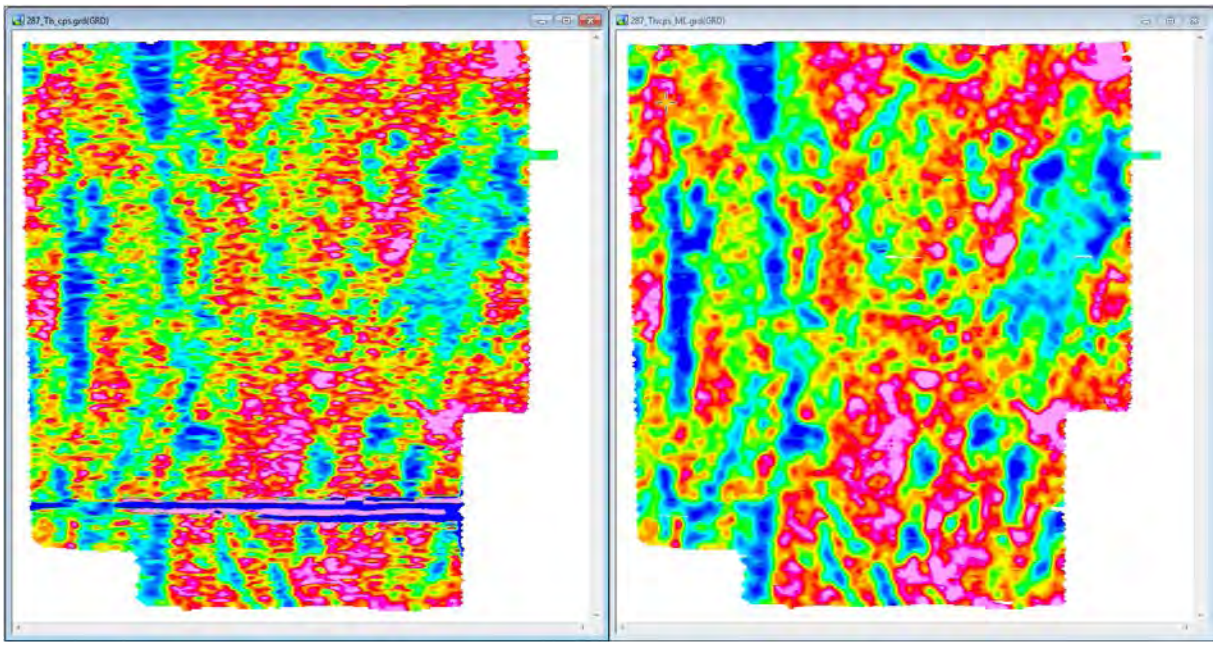

Figure 34 : 287 - Thorium Count

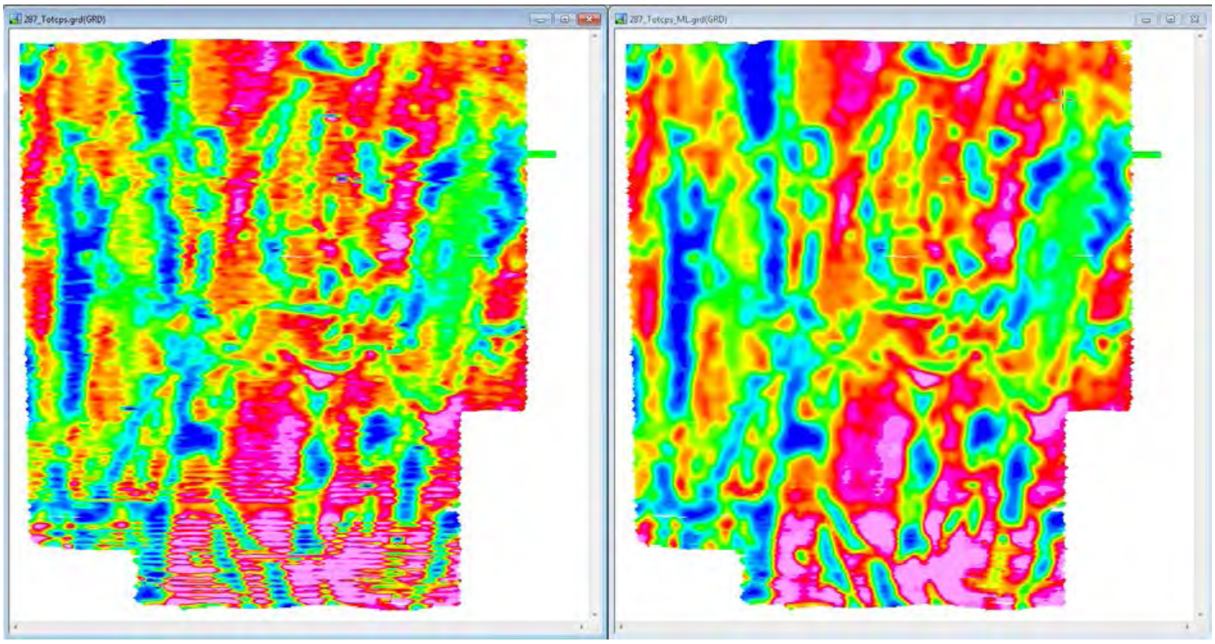

Figure 35 : 287 - Total Count

Due to the high unexpected uranium counts of several lines in the southern area of the grid, a manual adjustment was first made on the data.

Lines	Uranium manual correction (cps)
1691, 1710, 1730, 1750, 1771, 1790, 1810, 1830.1, 1850, 1870, 1890, 1910, 1930, 1950, 1970, 1990	-17
1680, 1700, 1721, 1741, 1760, 1780, 1800, 1820, 1841, 1860, 1881, 1900, 1920, 1941, 1960, 1980, 2000	-5

Table 11. 287 - Uranium manual correction

A decorrugation cutoff wavelength of 8000 m for potassium and thorium and a Naudy filter of 250 m were used to smooth both datasets. A second micro-leveling procedure was applied to the data using a decorrugation cutoff wavelength of 300 m and a Naudy filter of 10 m. Given the line spacing of 50 m, a cell size of 15 m was used for gridding.

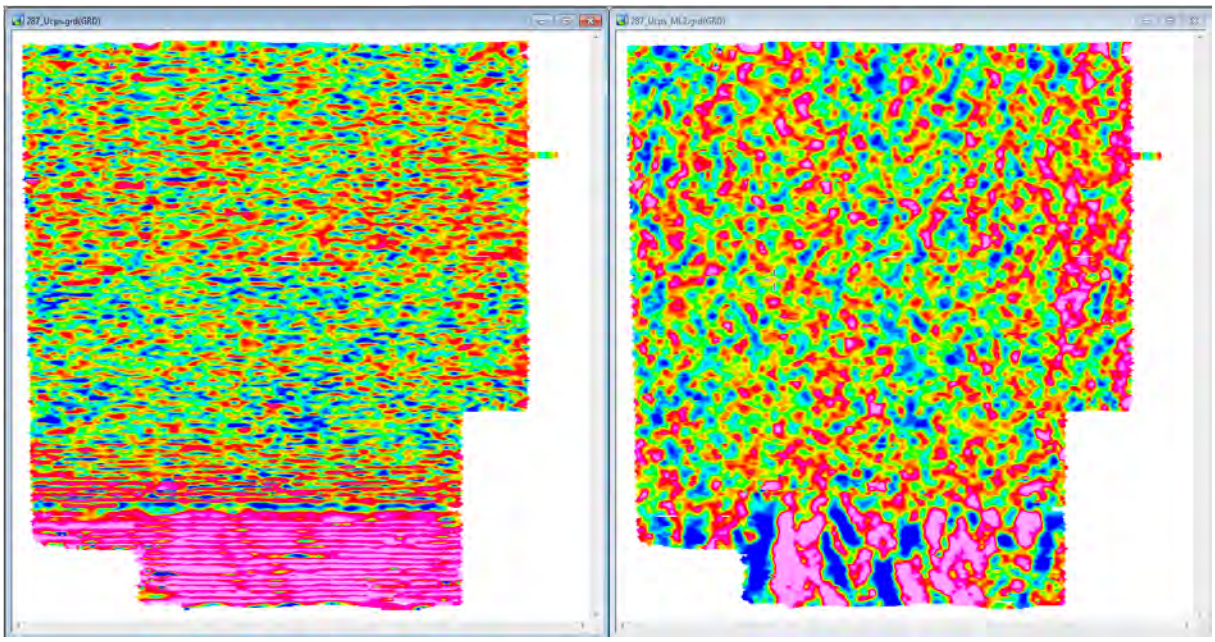

Figure 36 : 287 - Uranium Count

Processed and leveled count grids were also presented in NGU Report 92.314 (Walker 1992). These gridded data no longer exist at the time of the present compilation. These maps can be found in Appendix A for comparison. Potassium and thorium grids processed here (shown above) have major trends in commun with the potassium and thorium products presented by Walker (1991). However, the uranium grid presented above does not correlate completely with Walker's work and shows sharper features on the southern and eastern part of the area. Given the similarities between thorium and uranium data in this current reprocessing, it is possible that the anomalies in the uranium grids shown above are real. On the other hand, the trend in the southern area differs from the rest of the uranium grid. It is impossible to determine which map is the most accurate as both uranium processed grids can contain real anomalies.

3.13 Karasjok (GTK) - 2007-2009

Project flown by GTK (Geological Survey of Finland) from 2007-2009 (Leväniemi 2007, Leväniemi & Kurimo 2007, Kurimo 2008, 2009). Data were used for comparison and leveling.

3.14 640 - Kvænangen - 2012

Project flown by NGU (Geological Survey of Norway) in 2012 (Rodionov 2012). Data were used for comparison and leveling.

3.15 645 - FRAS - 2012 (FRASW and FRASE)

Project flown by Novatem from 2011 to 2012 (Novatem 2013a, Novatem 2013b). Data were used for comparison, leveling and calibration.

3.16 646 - Repparfjord - 2011

Project flown by NGU (Geological Survey of Norway) in 2011 (Ofstad 2013). Data were used for comparison and leveling.

3.17 Øksfjord - 2013

Project flown by NGU (Geological Survey of Norway) in 2013 (Rodionov 2013). Data were simply integrated in the compilation.

4. Calculation of concentrations

For data analysis and comparison, the count rates were adjusted to the relevant ground concentrations. Normally, the ground concentrations of the radio-elements are calculated using the so-called sensitivity coefficients obtained from a calibration test (IAEA 1991). By using a calibrated portable spectrometer and recording airborne data of few passes of a same line, the sensitivity coefficients are measured.

$$C_e = \frac{n_e}{S_e}$$

The *concentration C* of a given *element e* (Th, K or U) is proportional to the *sensitivity coefficient S* and to the *count rate n* corrected for dead-time, stripping ratio, background and attenuation.

In this case, data are sometimes more than 30 years old with very little information on their acquisition. To obtain the concentrations from these data, a concentration reference must be used. As most dataset overlapped with FRAS-W radiometric grids, they were used as a reference to calculate the concentration. As seen above, a linear correlation exists between the count values and the concentration values. For the overlap area, all points are plotted in a graph from which the linear regression is calculated.

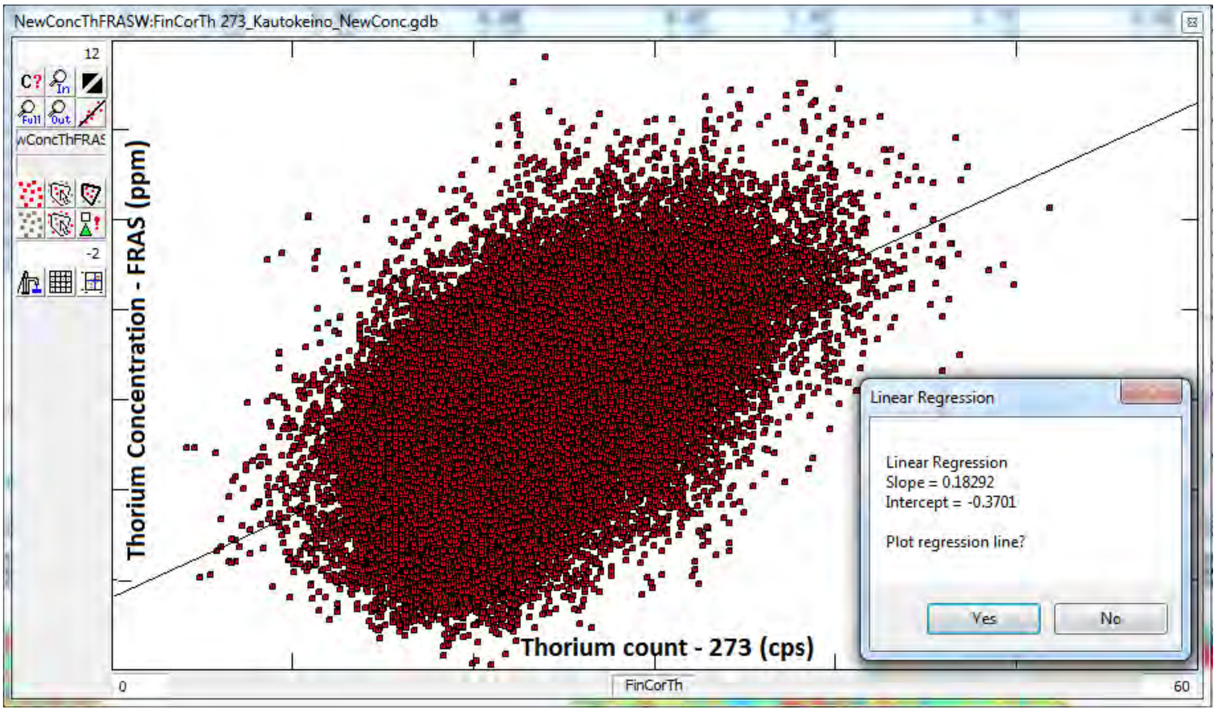

Figure 37 : Linear regression used for concentration calculation

The picture above shows an example of a linear regression in an overlapped area between projects FRAS-W (Concentration) and 273 (Counts per second). In this case, the thorium linear regression is calculated. The slope and intercept calculated by the Geosoft module is later used for the concentration estimation of 273:

$$C_{273} = an_{273} + b$$

C is the concentration for the thorium data of project 273, n is the counts rate for the thorium data of project 273 and a and b are the slope and intercept respectively as calculated from the linear regression.

Slope and intercept are shown in Table 12 below for each grid:

Project	Element	Slope	Intercept
243	**K**	0.017501	-0.66208
	Th	0.097507	-1.6484
	U	0.0061617	0.42191
	Total	0.11381	-31.716
249	**K**	0.01728	0.22318
	Th	0.12437	-1.2815
	U	0.047966	0.2676
	Total	0.11619	-26.538
250	**K**	0.013567	0.27065
	Th	0.089699	-1.0824
	U	0.016624	0.36484
	Total	0.098903	-29.185
254	**K**	0.013809	-0.10186
	Th	0.10068	-3.961
	U	0.011503	0.64862
	Total	0.039212	-18.237

264	**K**	0.012556	0.26306
	Th	0.12109	-3.9805
	U	0.027837	0.32545
	Total	0.038292	-8.0723
268	**K**	0.0096565	0.8221
	Th	0.11067	2.6779
	U	-0.011896	1.4791
	Total	0.049033	3.8164
269	**K**	0.013764	0.30328
	Th	0.13945	0.80581
	U	0.010652	0.82888
	Total	0.048541	0.76166
271	**K**	0.014075	0.2261
	Th	0.11161	0.55108
	U	0.044491	0.49869
	Total	0.050689	-3.1462
273	**K**	0.019817	-1.0846
	Th	0.19175	-0.58835
	U	0.058867	0.80817
	Total	0.068966	-32.711
279-1	**K**	0.01169	0.13527
	Th	0.11525	2.2819
	U	0.01627	0.57597
	Total	0.042589	8.1106
279-2	**K**	0.015592	-0.28567
	Th	0.11306	2.3585
	U	0.0074191	0.66279
	Total	0.049238	4.2491
279-3*	**K**	0.013392	-0.12857
	Th	0.072195	3.1007
	U	0.0035533	0.73525
	Total	0.045171	5.4436
286-2	**K**	0.017086	-0.16157
	Th	0.22158	0.14425
	U	0.053541	-0.011032
	Total	0.045757	5.9517
286-3*	**K**	0.015535	-0.084237
	Th	0.2022	0.43598
	U	0.034589	0.19623
	Total	0.041024	7.2774
287**	**K**	0.010607	0.54717
	Th	0.081551	2.642
	U	0.0062776	1.0103
	Total	0.040346	11.543

Table 12. Linear regression results

*279-3 and 286-3 used overlapped grids 279-2 and 286-2 respectively for concentration calculation
**287 used grid 273 for its concentration calculation

5. Grid knitting

Grids are merged together using the Geosoft Oasis Montaj tool called "Grid Knitting". In the process, a slight shift is introduced to match the grids. Shifts have been calculated as:

$Shift = E_{comp} - E_{XXX}$, E is the element grid, comp the compilation and XXX the project number

The average shift within a grid has been recorded in Table 13.

Project Code	Project Name	Year	Shift Potassium (%K)	Shift Thorium (ppm)	Shift Uranium (ppm)
243	Siebe, Lavvoaivi	1979	0.1106	0.8204	0.5411
249	Lavvoaivi, Siebe	1980	-0.2167	-1.3141	-0.5527
250	Mållejus, Raisjavri	1980	0.0164	0.0647	0.0221
254	Raisjavri	1981	-0.0079	0.0117	0.0134
264	Suoluvuobmi, Carajavri	1982	0.0095	-0.0558	-0.0354
268	Carajavri	1983	-0.1560	-1.0988	-0.3250
269	Iesjavri	1983	0.0107	0.0070	0.0093
271	Iesjavri	1984	0.1597	0.2115	0.1834
273	Kautokeino	1985	-0.0009	0.0008	0.0202
279	Addjit, Siebe	1989	-0.0882	-0.1708	0.0145
286	Siebe, Roavvoaivi	1991	0.2798	1.2821	-0.0241
287	Kautokeino	1991	-0.0053	0.0285	0.0114
	Karasjok	2009	0.0148	0.4632	0.1892
640	Kvænangen	2012	0.3502	1.0525	0.7875
645	FRAS-W	2012	0.0003	0.0000	0.0004
645	FRAS-E	2012	0.1318	0.1386	0.3408
646	Repparfjord	2011	0.3076	1.200	0.3074
	Øksfjord	2013	0	0	0

Table 13. Grid knitting shifts

No shift is induced to Øksfjord grids as it has no overlap with the rest of the compilation. As the concentration grids have been calculated using FRAS-W, the shift between the original grid and the compilation is small. The oldest project 243, 249 and 250 have a bigger shift than the average. These areas have been flown with seven litres crystal volume. 268 is also standing out. The very small overlap with FRAS-W might have affected the quality of the concentration calculation.

6. Maps

Potassium, thorium and uranium maps have been compiled using the concentration grids. The re-reprocessed grids are consistent from one to another and there are no major artifacts standing out from the merging process.

All the grids are consistent for potassium and thorium given the geology. Therefore, lower concentrations are expected for the Karasjok Greenstone Belt area flown from 2007 to 2009 as well as for the Kautokeino Greenstone Belt area flown from 1979 to 1991. The content of uranium and thorium is generally low in the data compilation. The western Jergul Gneiss Complex, the Neiden Granite and some Caledonian units have however relatively increased uranium concentrations.

Uranium grids are usually consistent from one to another. The concentration grid are very low and still contain a certain amount of noise. However, the sharpest anomalies stands out from the compilation grid.

All the maps are in WGS-84, UTM zone 34N, 1:500000 scale. The cesium grid of the FRAS-12 survey bears resemblance to the potassium grid and needs reprocessing. It is therefore not included in the present report.

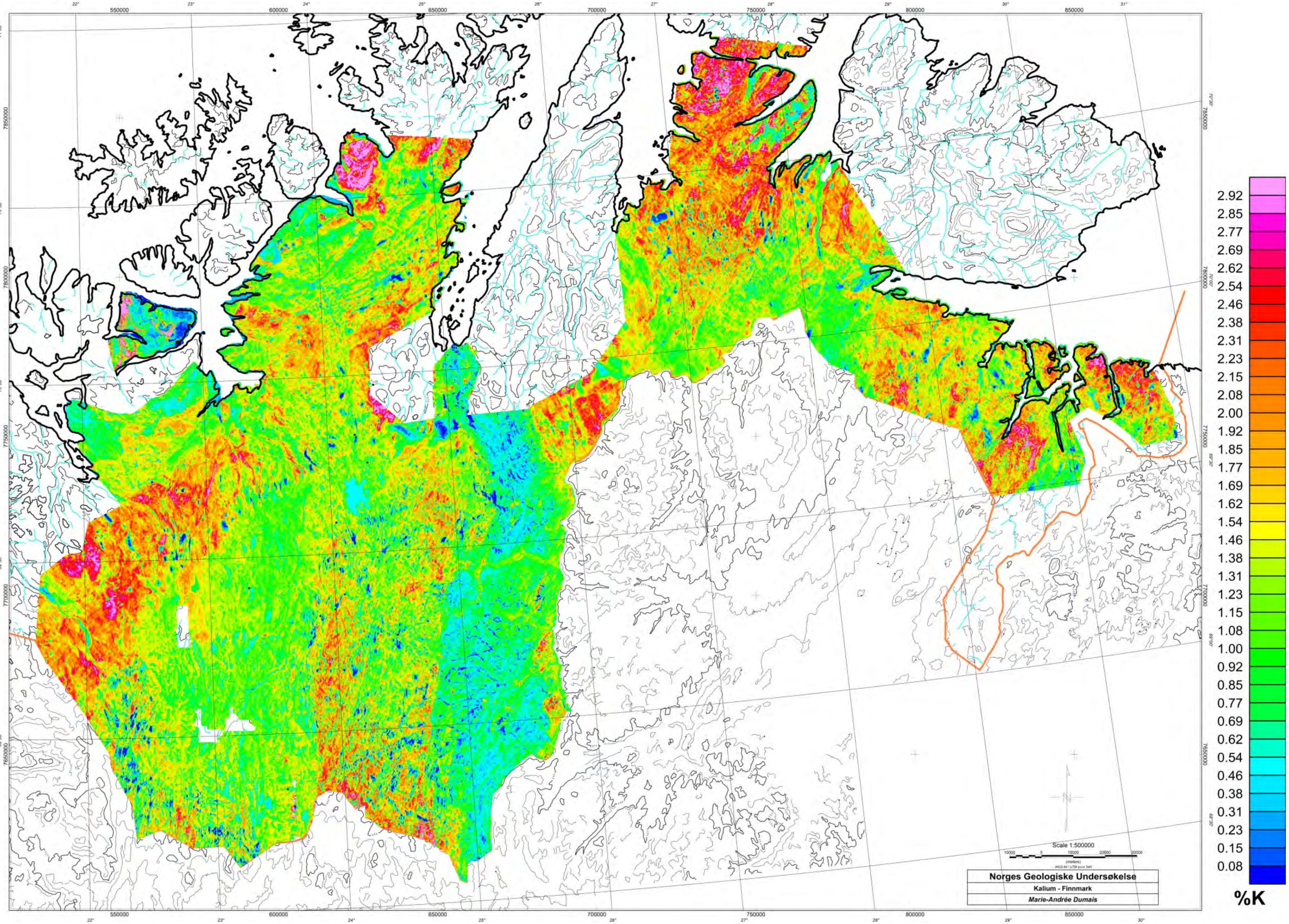

Figure 38 : Potassium concentration in Finnmark

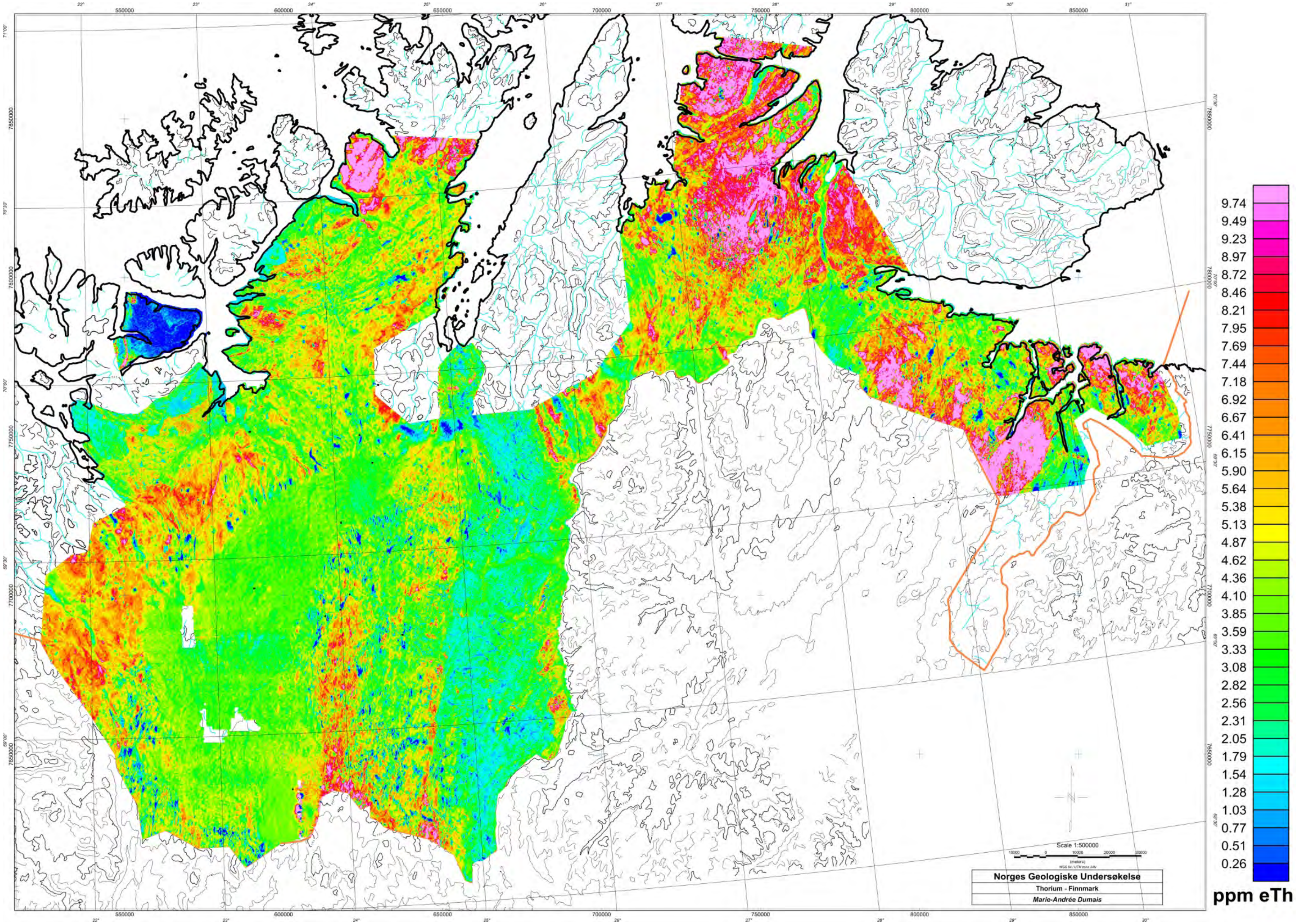

Figure 39 : Thorium concentration in Finnmark

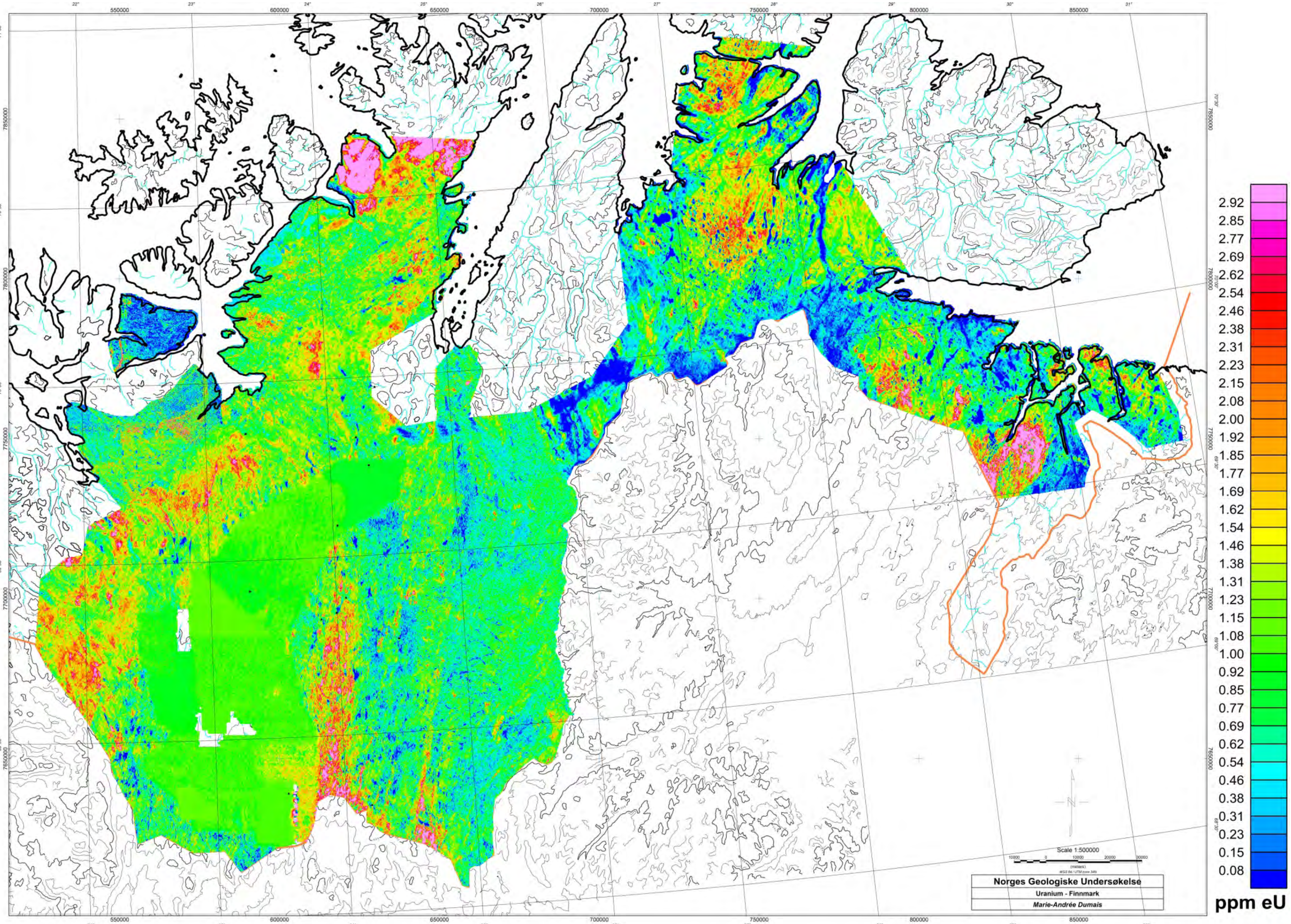

Figure 40 : Uranium concentration in Finnmark

7. CONCLUSIONS

We were able to improve the quality of all radiometrics dataset flown from 1979 to 1991 by manual adjustments and micro-leveling techniques. On a few of them remains very few artifacts or faint stripes. The main difficulty was the very low counts per second acquired especially for the uranium data. The reprocessed grids were very consistent from one to another and the merging step did not create major artifacts. The resulting maps (%K, eTh and eU) are available in UTM zone 34N projection at WGS-84 datum at 1:500,000 scale.

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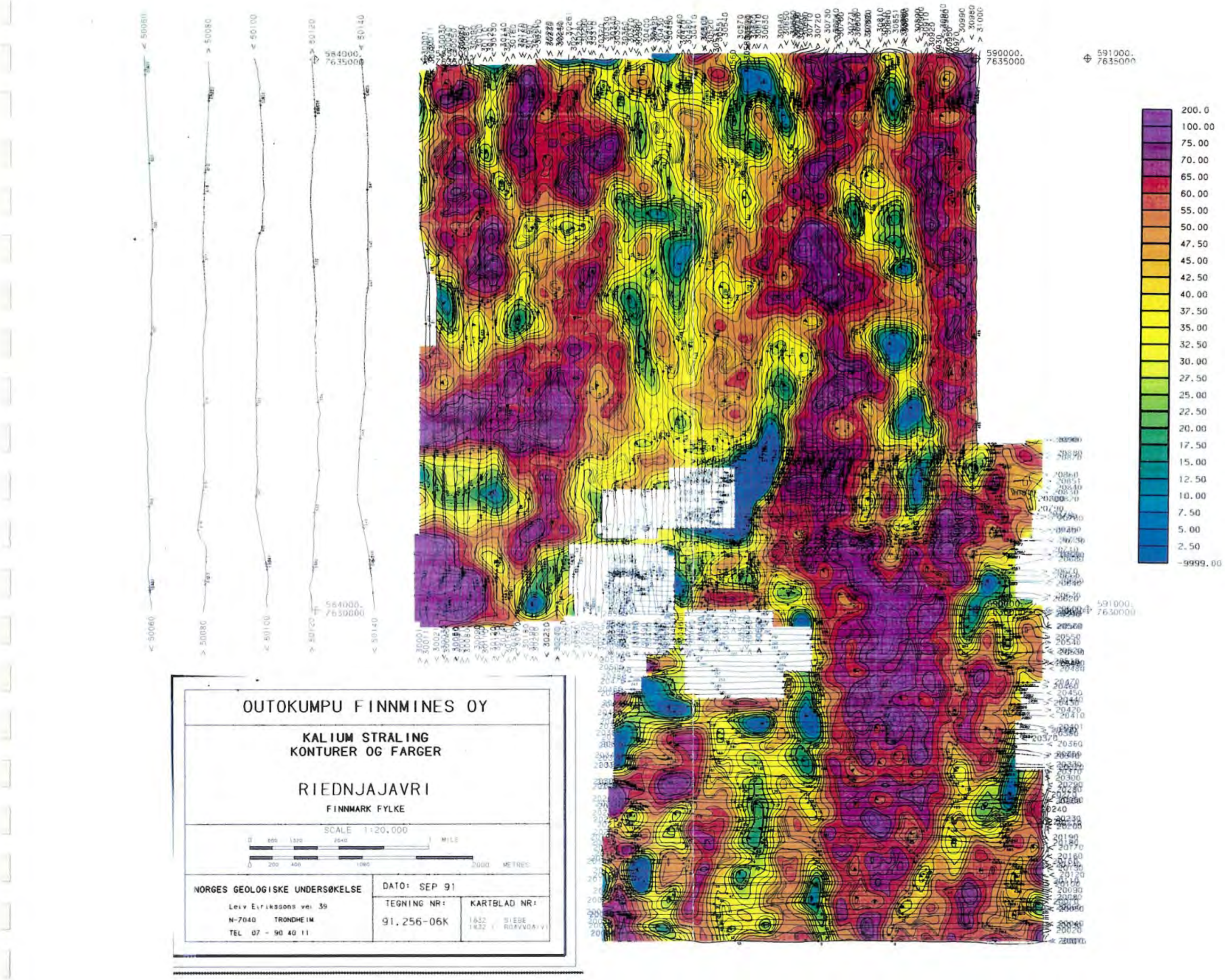
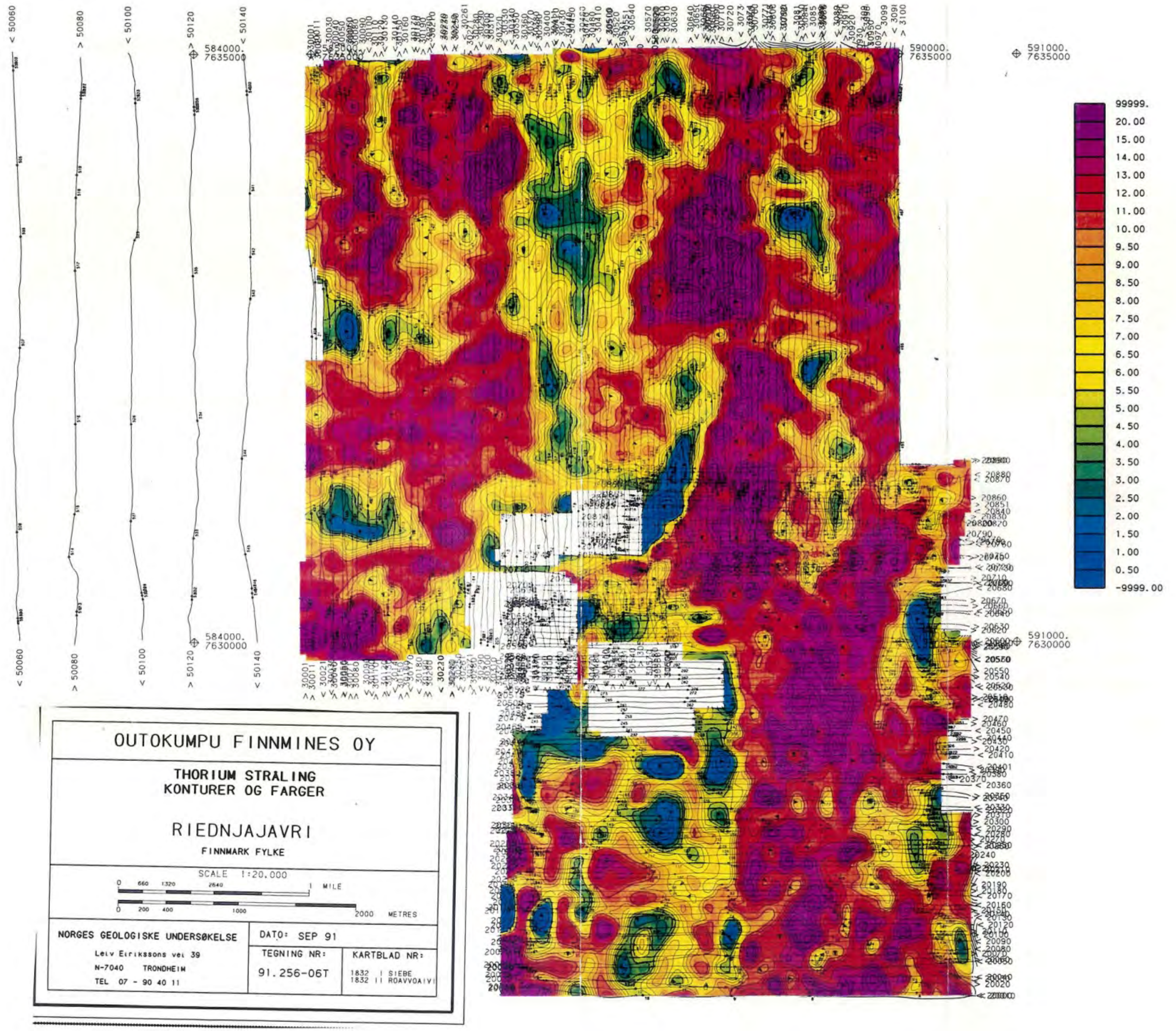
Appendix A - 1992 Previous reprocessing of Siebe, Roavvoaivi (286) and Kautokeino (287) surveys

Siebe, Roavvaoaivi - 286 (Walker 1992)

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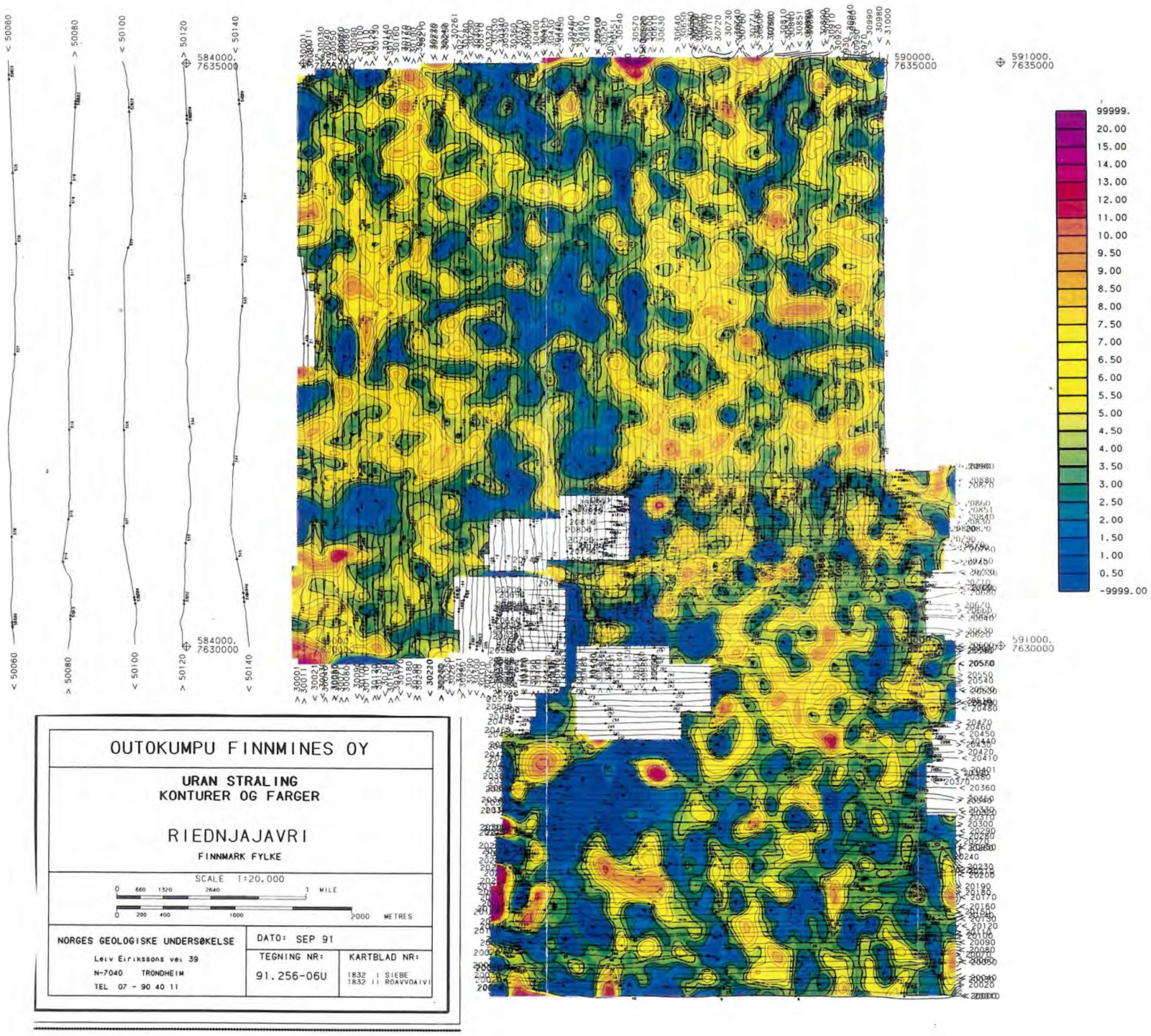
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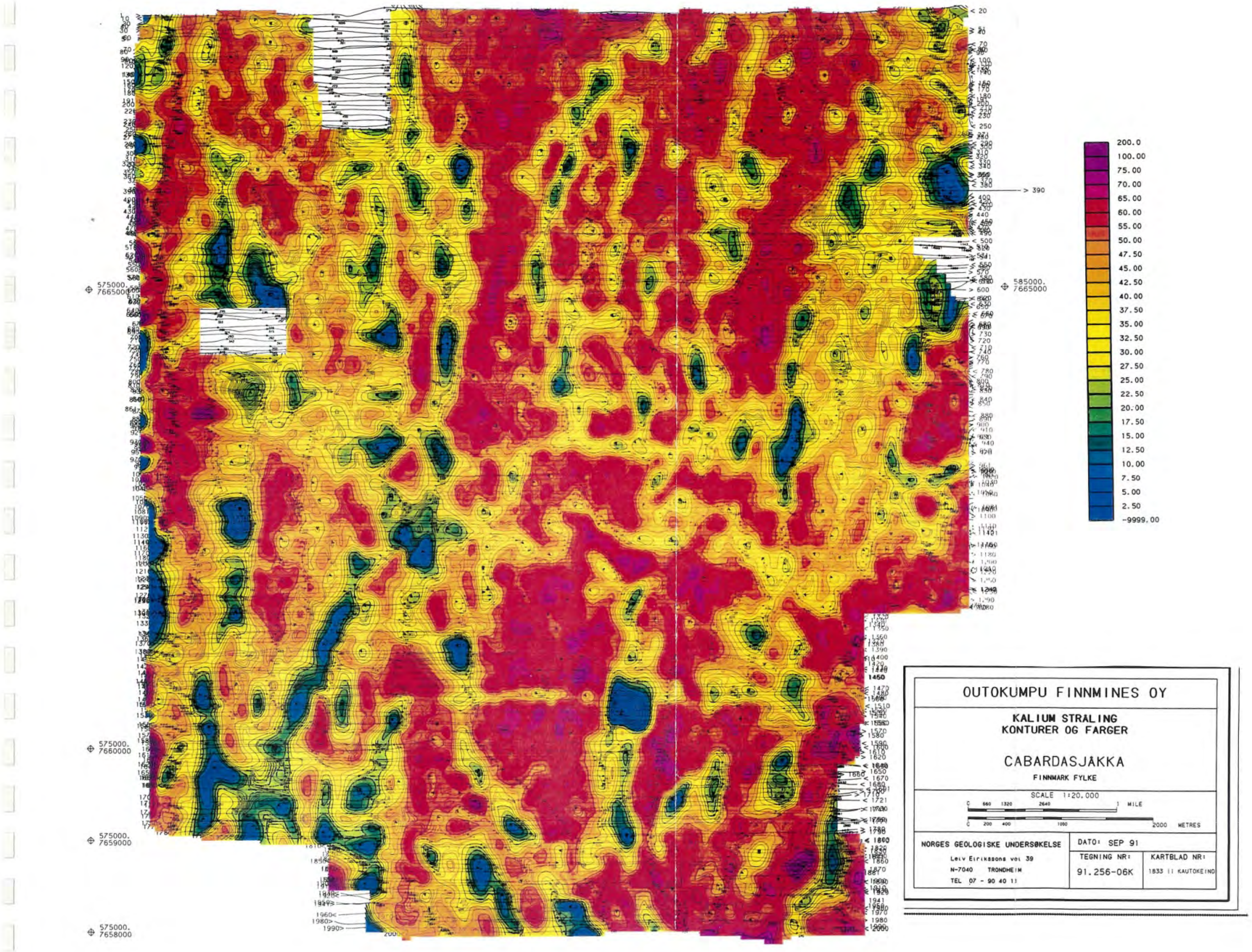
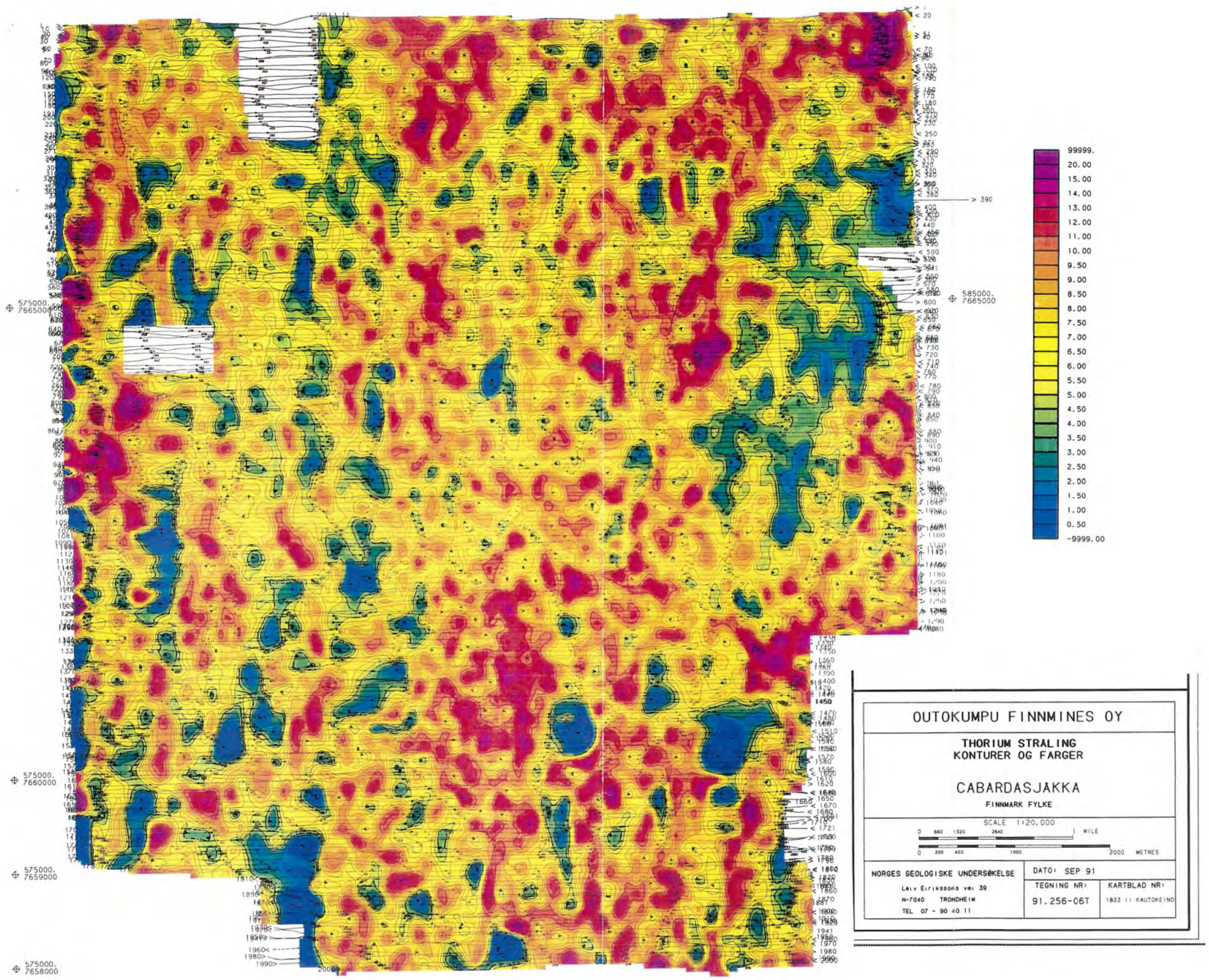
Kautokeino - 287 (Walker 1992)





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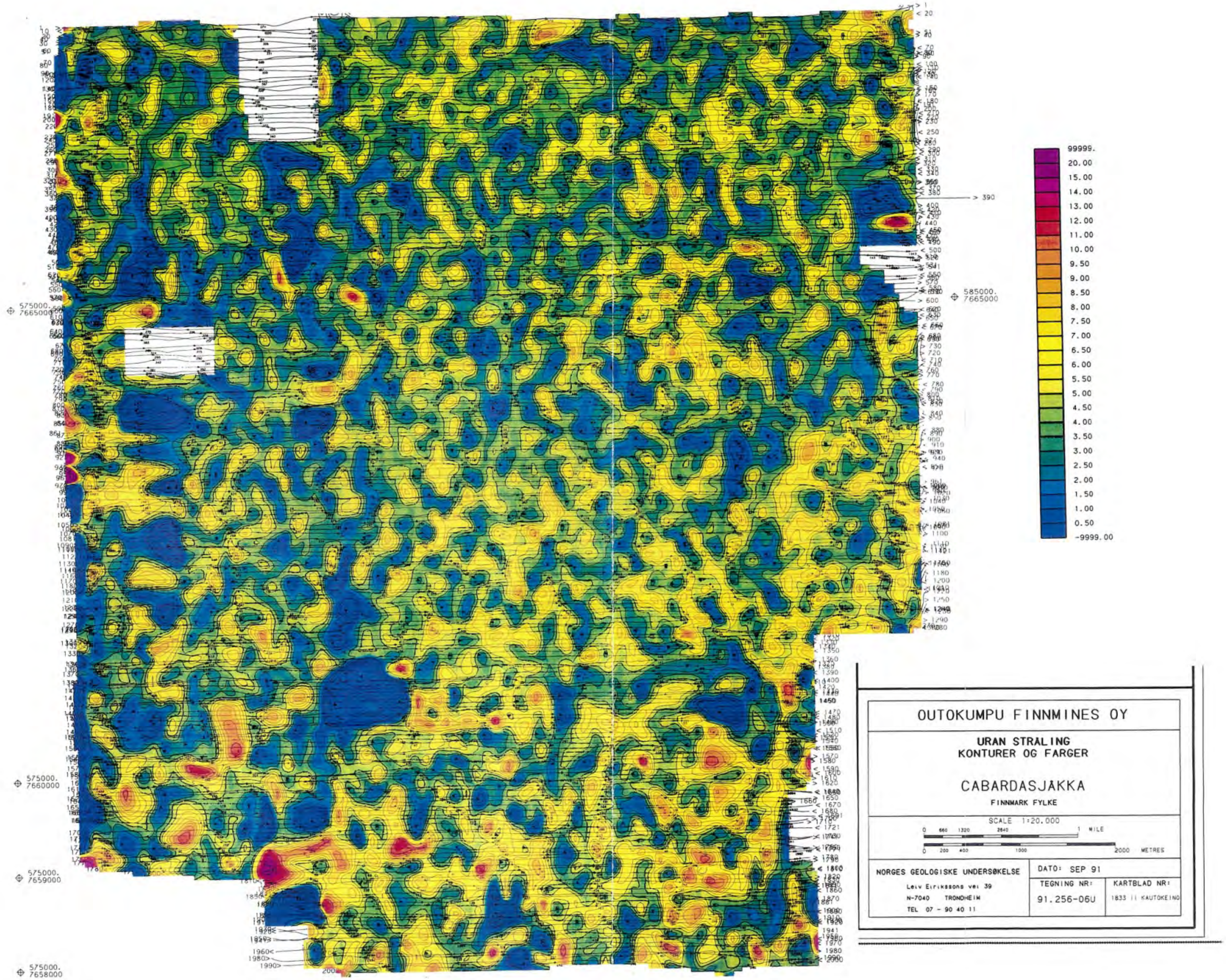
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