

GEOLOGICAL SURVEY OF CANADA



COMMISSION GÉOLOGIQUE DU CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES

AIRBORNE GEOPHYSICAL SURVEY
1986

WINNIPEG RIVER AREA
MANITOBA
NTS 52L5,6 (parts of)

Gamma Ray Spectrometric Colour
Maps
and VLF-EM Profile Maps

Geological Survey of Canada Open File
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GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA
1987

AIRBORNE GAMMA RAY SPECTROMETRIC AND VLF ELECTROMAGNETIC MAPS

In the summer of 1986 a multi-parameter geophysical survey was flown in the Winnipeg River area of Manitoba. The area surveyed is shown on the index map. The main purpose of the survey was to produce quantitative gamma ray spectrometric information to assist with the identification of various phases of a composite suite of intrusive rocks, and using radioelements as indicator or pathfinder elements, to aid exploration for granophile element mineralization. VLF electromagnetic data were also recorded and compiled as profile maps.

Data are presented as a set of eight radioelement colour maps (total count, potassium, equivalent uranium and equivalent thorium concentrations, the eU/eTh, eU/K and eTh/K ratios, and the ternary radioelement map (J. Broome, J.M. Carson, J.A. Grant and K.L. Ford, 1987, A Modified Ternary Radioelement Mapping Technique and its Application to the South Coast of Newfoundland, GSC Paper 87-14)).

Two 1:100,000 scale VLF profile maps with flight lines are also included along with a 1:100,000 scale transparent geological overlay (P. Cerny, D.L. Trueman, D.V. Ziehlke, B.E. Goal, and B.J. Paul, 1981, The Cat Lake-Winnipeg River and The Wekusko Lake Pegmatite Field, Manitoba, Manitoba Department of Energy and Mines, Economic Geology Report ER80-1).

The airborne VLF measurements were obtained using a Herz Totem 1A airborne VLF system. The primary electromagnetic field is generated by VLF station NAA at Cutler, Maine, which transmits at 24.0 kHz. The secondary field is generated by eddy currents flowing in near-surface conductors. The profiles presented are the total field value (vector sum of the horizontal and vertical components) and the quadrature (out-of-phase) component of the vertical field. The total field is expressed in percent of the local primary field and the quadrature in percent of the along-track component. The mean values of the total field and quadrature component were removed along each flight line. The quadrature which depends on the flight line directions, was inverted for lines flown from north to south. A 5 point filter was applied to both total field and quadrature data for final presentation. Anomalies over conductors produce positive peaks on the total field trace and are of the cross-over type (negative to positive) on the quadrature trace. All VLF profiles are plotted on the true flight path.

All data were sampled at 1 second intervals. The airborne radiometric measurements were made using a 256 channel spectrometer, with twelve 102x102x406 mm NaI (Tl) detectors, flown at a mean terrain clearance of 125 m at 190 km/h. North-south flight lines were at 500 metre line spacing.

Potassium is measured directly from the 1.46 MeV gamma ray photons emitted by ⁴⁰K, whereas uranium and thorium are measured indirectly from gamma ray photons emitted by daughter products in their decay chains. Uranium is monitored by means of gamma ray photons at approximately 1.76 MeV from ²¹⁴Bi, and thorium, from 2.62 MeV photons emitted by ²⁰⁸Tl. The energy windows used are as follows: Potassium is measured directly from the 1.46 MeV gamma ray photons emitted by ⁴⁰K, whereas uranium and thorium are measured indirectly from gamma ray photons emitted by daughter products in their decay chains. Uranium is monitored by means of gamma ray photons at approximately 1.76 MeV from ²¹⁴Bi, and thorium, from 2.62 MeV photons emitted by ²⁰⁸Tl. The energy windows used are as follows:

Total Count		0.41-2.81 MeV
Potassium	⁴⁰ K	1.36-1.56 MeV
Uranium	²¹⁴ Bi	1.66-1.86 MeV
Thorium	²⁰⁸ Tl	2.41-2.81 MeV

Total count, uranium, thorium and potassium counts have been corrected for dead time, ambient temperature changes, background radiation, spectral scattering and deviations of terrain clearance from the planned survey altitude. The computer programs used to produce the contour maps and profiles are modified from Geological Survey of Canada Open File 109 "Airborne Gamma Spectrometry Data Processing Manual".

The values for the radioelement concentrations shown on the contour maps are "average surface concentrations", that is, an average for the area on the ground viewed by the spectrometer, an area which may contain varying amounts of outcrop, overburden and surface waters. As a result the concentrations as shown on the contoured maps are usually considerably lower than the concentrations in the bedrock. However, the radioelement distribution shown by the contour maps reflects the relative distribution of the elements in the bedrock.

Factors for converting airborne measurements to element concentration were determined by relating the corrected airborne count rates over a test strip in the Ottawa area to the known ground radioelement concentrations (R.L. Grasty and B.W. Charbonneau, 1974, Gamma-Ray Spectrometry Calibration Facilities, G.S.C. Paper 74-1B, pp. 69-71).

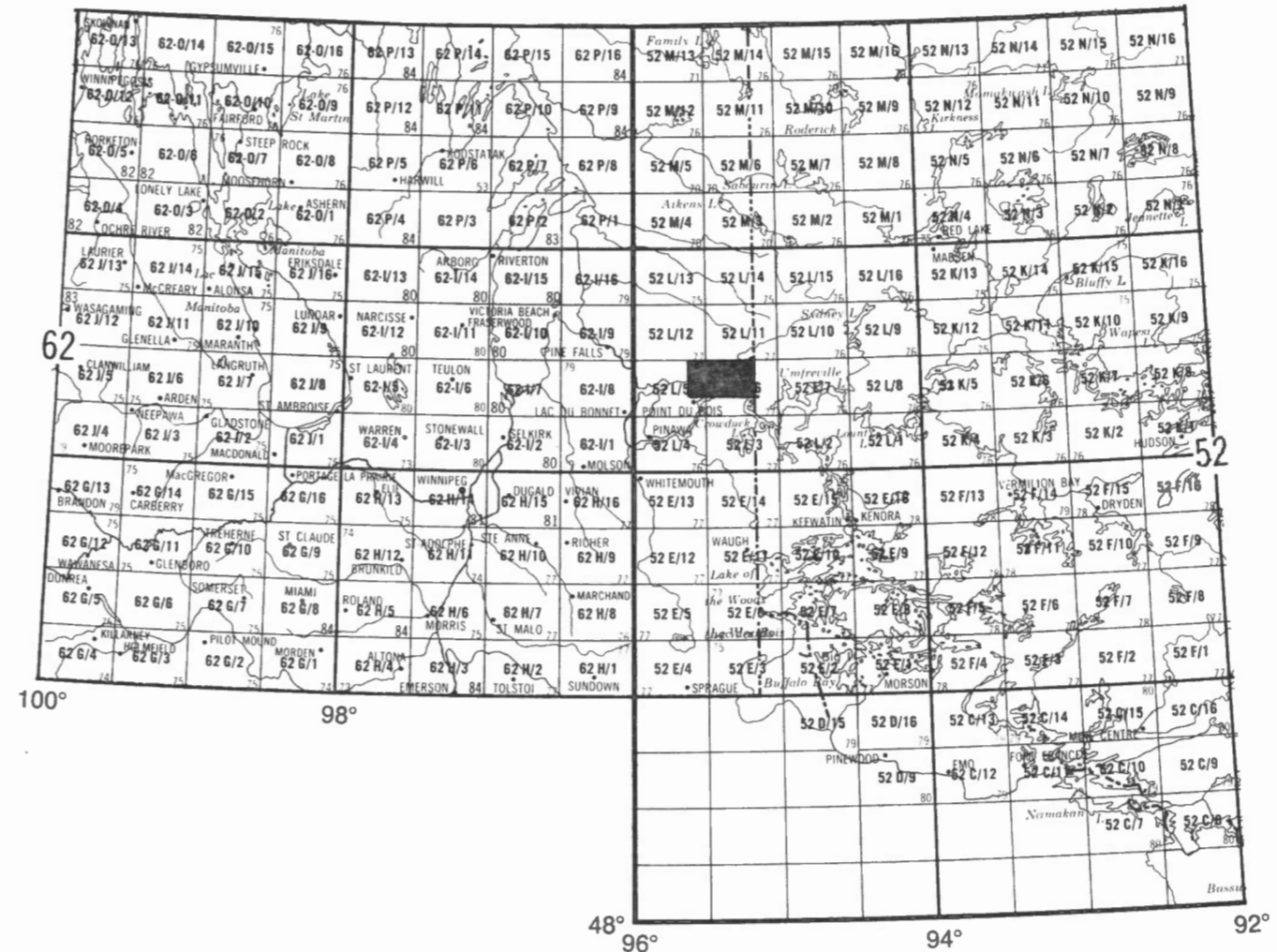
The conversion factors used are those listed below:

1 Ur	161	cps (Total Count)
1% K	91.0	cps
1 ppm eU	9.1	cps
1 ppm eTh	7.0	cps

Total count measurements are presented as units of radioelement concentration (Ur), as defined in International Atomic Energy Agency Technical Report Series No. 174, 1976.

Information regarding the availability of this Open File release may be obtained from: Geological Survey of Canada, 601 Booth St., Ottawa, Ontario, K1A 0E8. Telephone (613) 995-4342.

Airborne gamma ray spectrometric and VLF-EM survey flown and compiled by Geological Survey of Canada

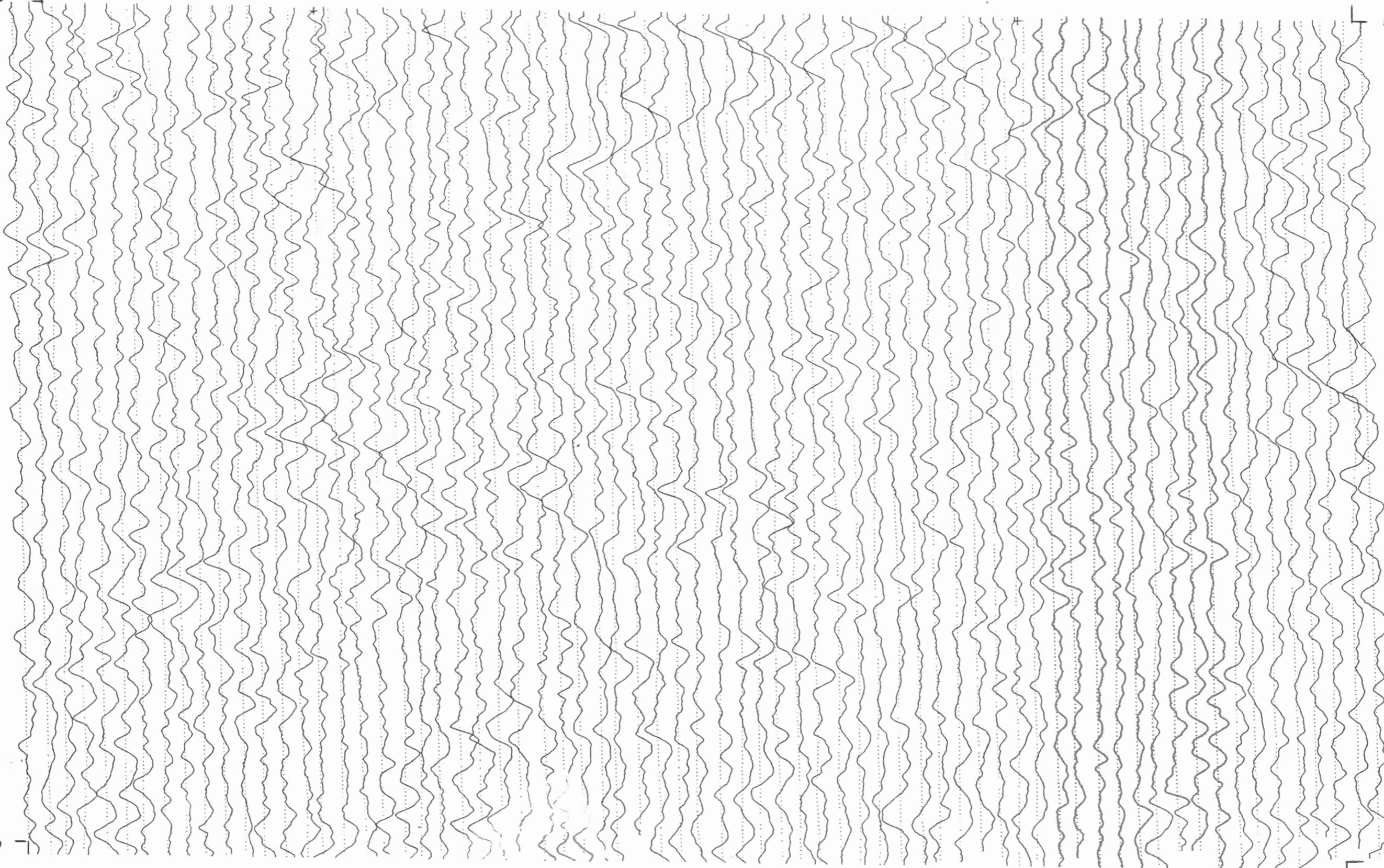


95 36 00

95 08 00

50 30 00

50 30 00



VLF-TOTAL FIELD

VERTICAL SCALE

40%/cm

**WINNIPEG RIVER
AREA**

Manitoba

52L5,6 (parts of)

50 18 30

50 18 30

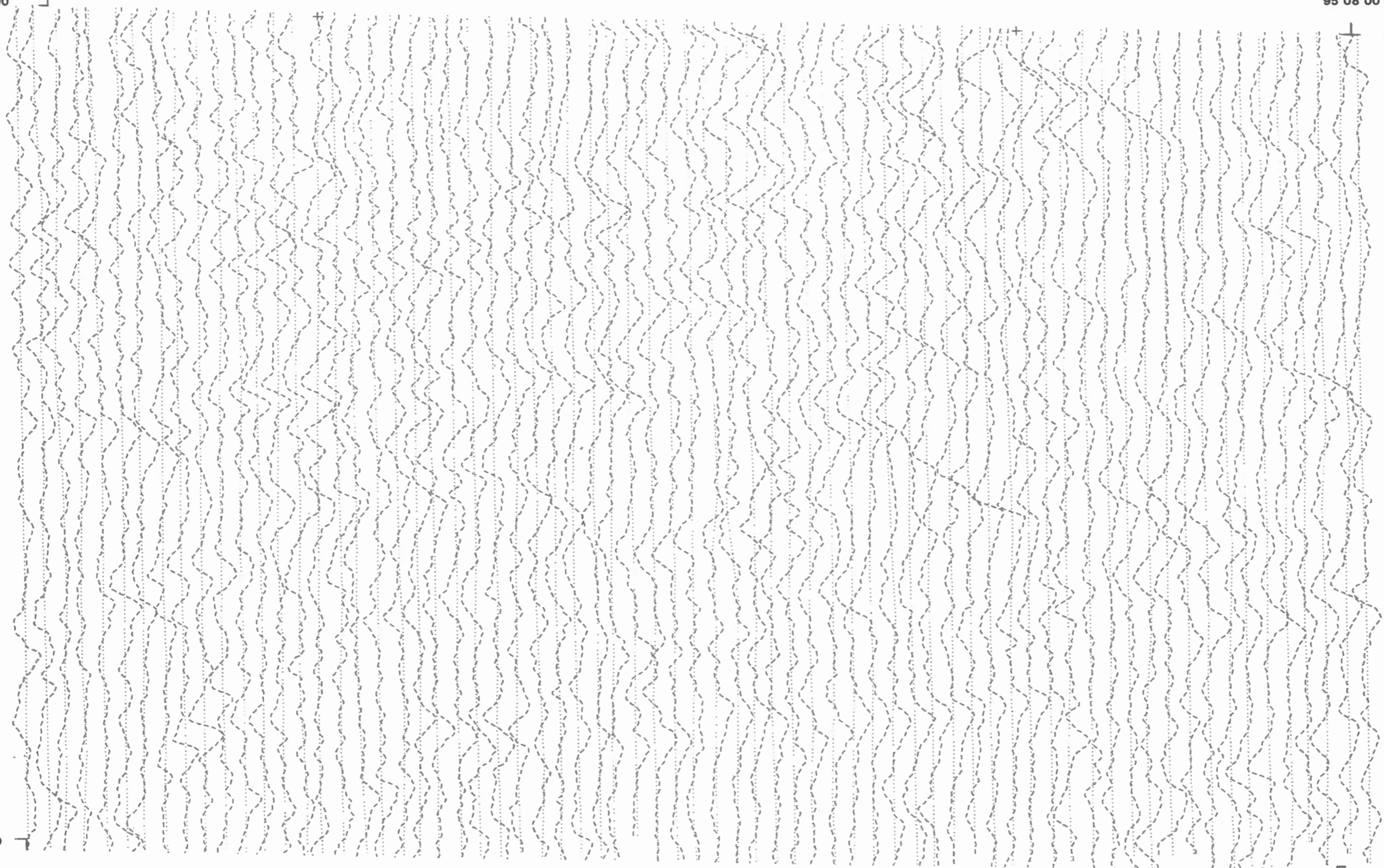


95 36 00

50 00

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VLF-QUADRATURE

VERTICAL SCALE

40%/CM

WINNIPEG RIVER

AREA

Manitoba

52L5,6 (parts of)

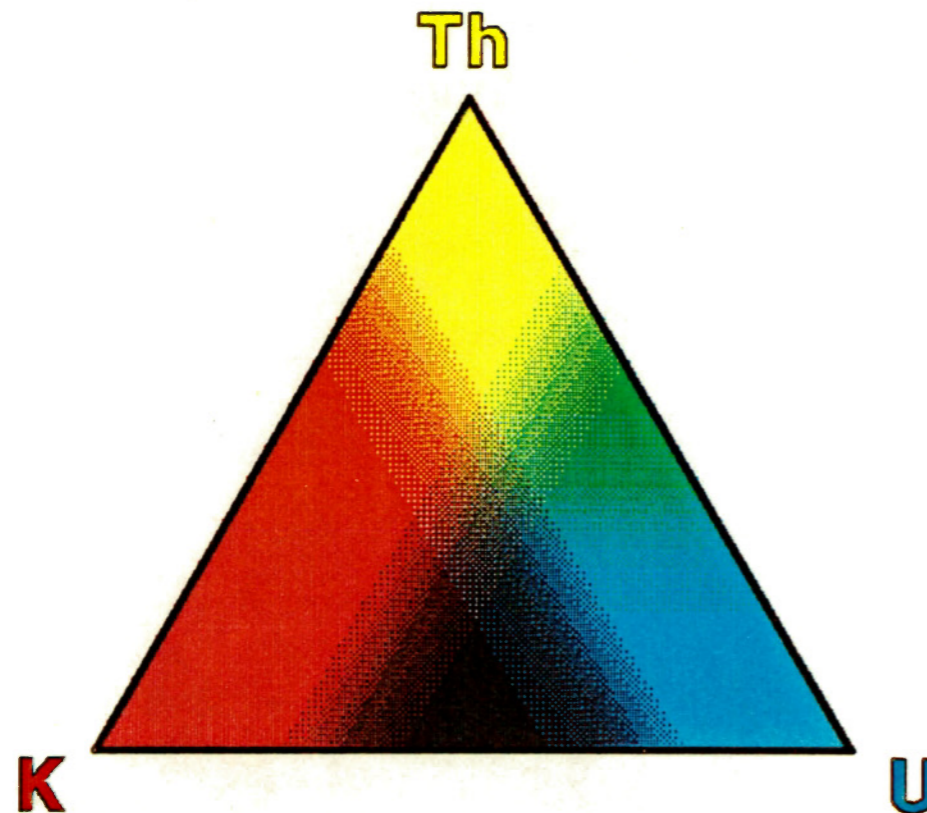
50 18 30

50 18 30

Kilomètres 2 0 2 4 6 8 Kilometres

TERNARY LEGEND FOR THREE-COMPONENT RADIOMETRIC MAPS

The marked vertices represent 100% relative concentrations of the elements indicated. Intermediate locations represent different ratios of the three elements.



WINNIPEG RIVER AREA, MANITOBA
Ternary Radio-element Map
SCALE - 1:100 000
(LINE SPACING 500m)

Software developed by : J. Broome
Lithospheric Geophysics Section
Lithosphere and Canadian Shield Div.
Data compiled by: Peter B. Holman
Airborne Geophysics Section
Mineral Resources Division
Geological Survey of Canada

Legend

SYN-TO LATE TECTONIC INTRUSIVE AND METASOMATIC ROCKS

- Pegmatitic granite, pegmatite
- Lac du Bonnet granite
- Monzogranite, microgranite, pegmatite
- Inconnu granite
- Black River suite
- Granodiorite

EARLY TO SYN-TECTONIC INTRUSIVE AND METAMORPHIC ROCKS

- Tonalite, schollen zone
- Migmatite complex
- Great Falls quartz diorite; 10a Maskwa Lake batholith; 10b Marijane Lake batholith
- 10b
- Paragneiss: 9a upper amphibolite facies; 9b lower amphibolite facies. In part equivalent to map unit 7

METAVOLCANIC, METASEDIMENTARY AND SYNVOLCANIC INTRUSIVE ROCKS

- Booster Lake Formation; 8a greywacke mudstone; 8b conglomerate/metamorphosed equivalents

UNCONFORMITY

- Flanders Lake Formation; 7a lithic arenite; 7b polymict conglomerate/metamorphosed equivalents



- Composite synvolcanic intrusive rocks; 6a gabbro; 6b diorite; 6c quartz-feldspar porphyry; 6d granodiorite/metamorphosed equivalents

UNCONFORMITY

- Bernic Lake Formation; 5a basalt; 5b andesite; 5c dacite; 5d rhyolite; 5e polymict conglomerate; 5f oligomict conglomerate; 5g cordierite-anthophyllite schist; 5h garnet-biotite schist; 5i quartz porphyry



UNCONFORMITY

- Peterson Creek Formation; 4a rhyolite; 4b breccia; 4c lapillstone; 4d lapill/tuff; 4e tuff; 4f volcanic sandstone/metamorphosed equivalents

- Bird River sill; serpentized dunite, peridotite, picrite and related anorthositic and gabbroic rocks/metamorphosed equivalents

- Gabbro; synvolcanic stocks and sills, in part hypabyssal/metamorphosed equivalents

- Lemprey Falls Formation; 2a pillow basalt; 2b porphyritic basalt; 2c amygdaloidal basalt; 2d megacrystic basalt; 2e hyaloclastite, equigranular breccia/metamorphosed equivalents

- Englehart Lake Formation; volcanic wacks, pebbly wacks, volcanic sandstone/metamorphosed equivalents

TERNARY RADIO-ELEMENT MAP

95 36 00

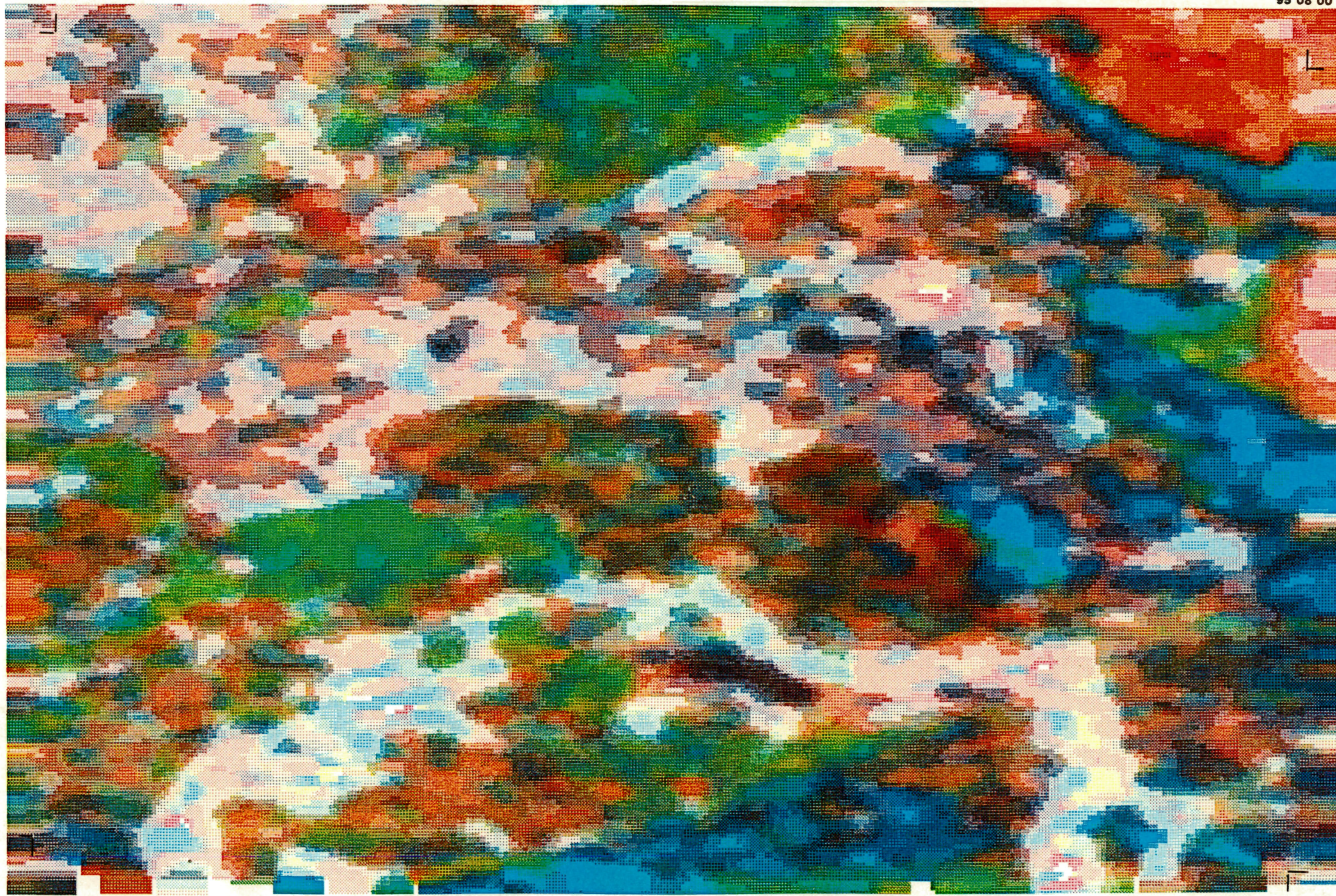
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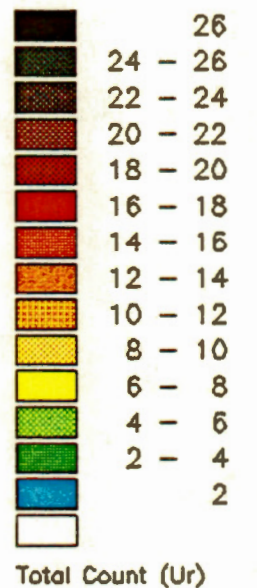
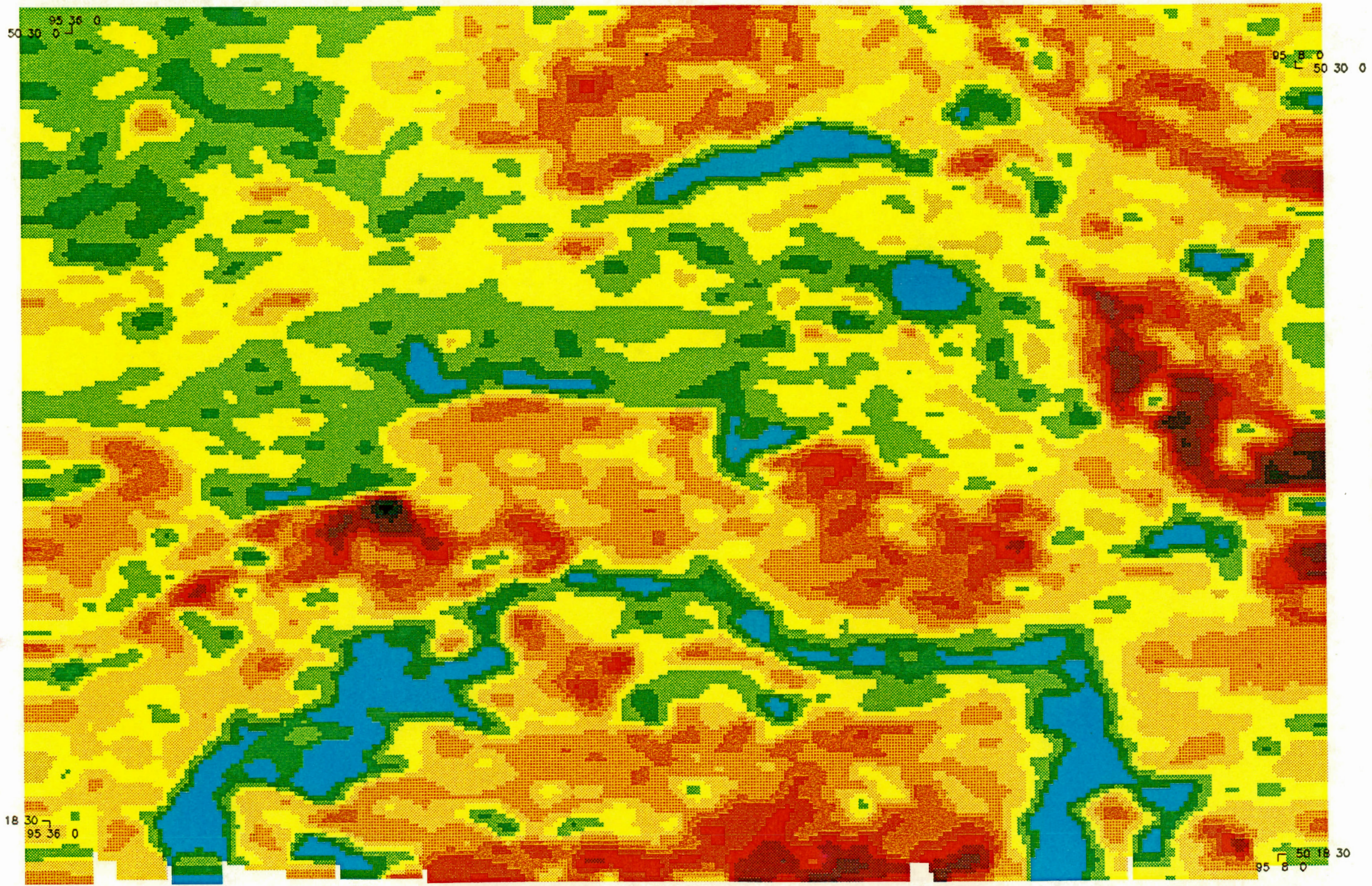
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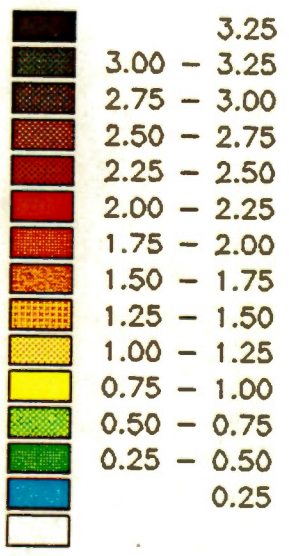
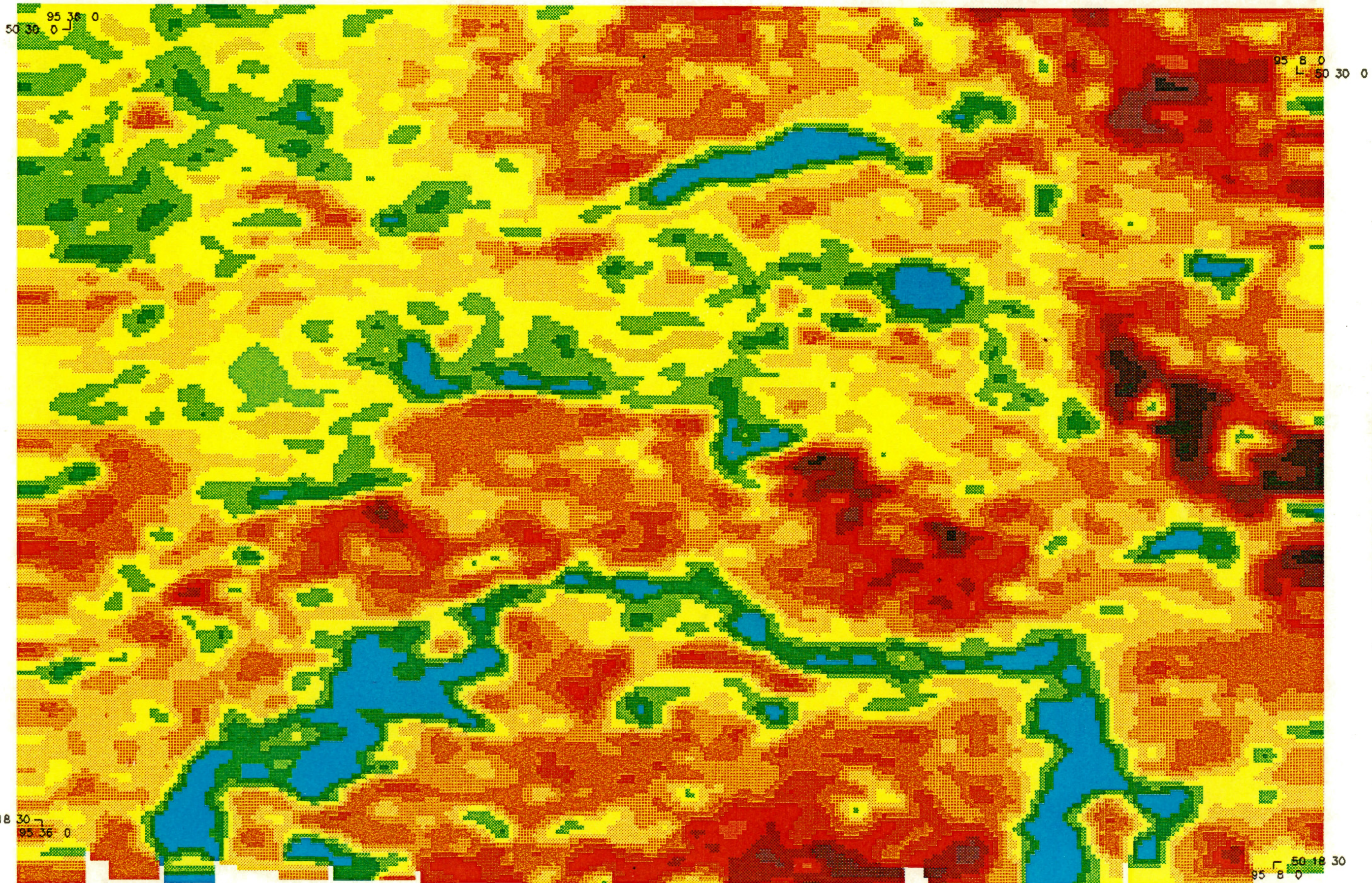
Kilometres 2 0 2 4 6 8 Kilomètres



**WINNIPEG RIVER
AREA**

**Manitoba
52L5,6 (parts of)**





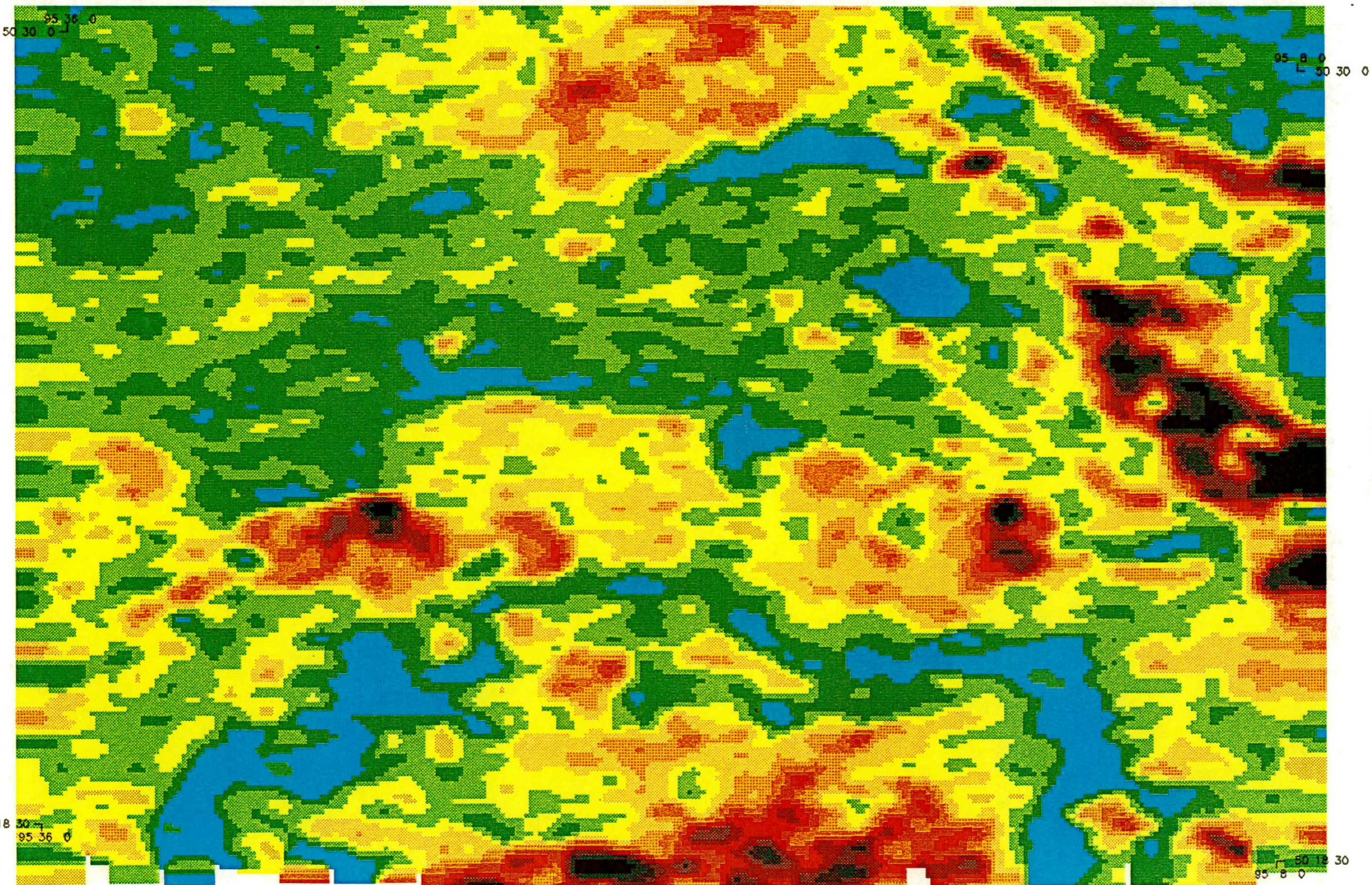
Potassium (percent)

**WINNIPEG RIVER
AREA**

Manitoba

52L5,6 (parts of)





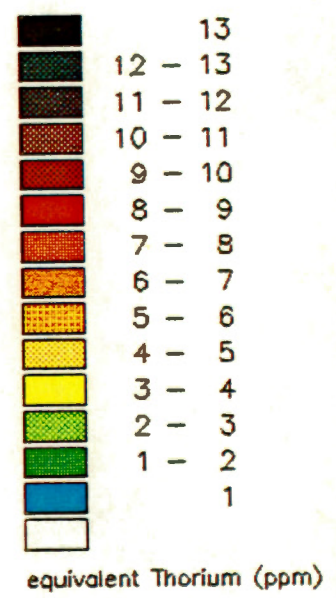
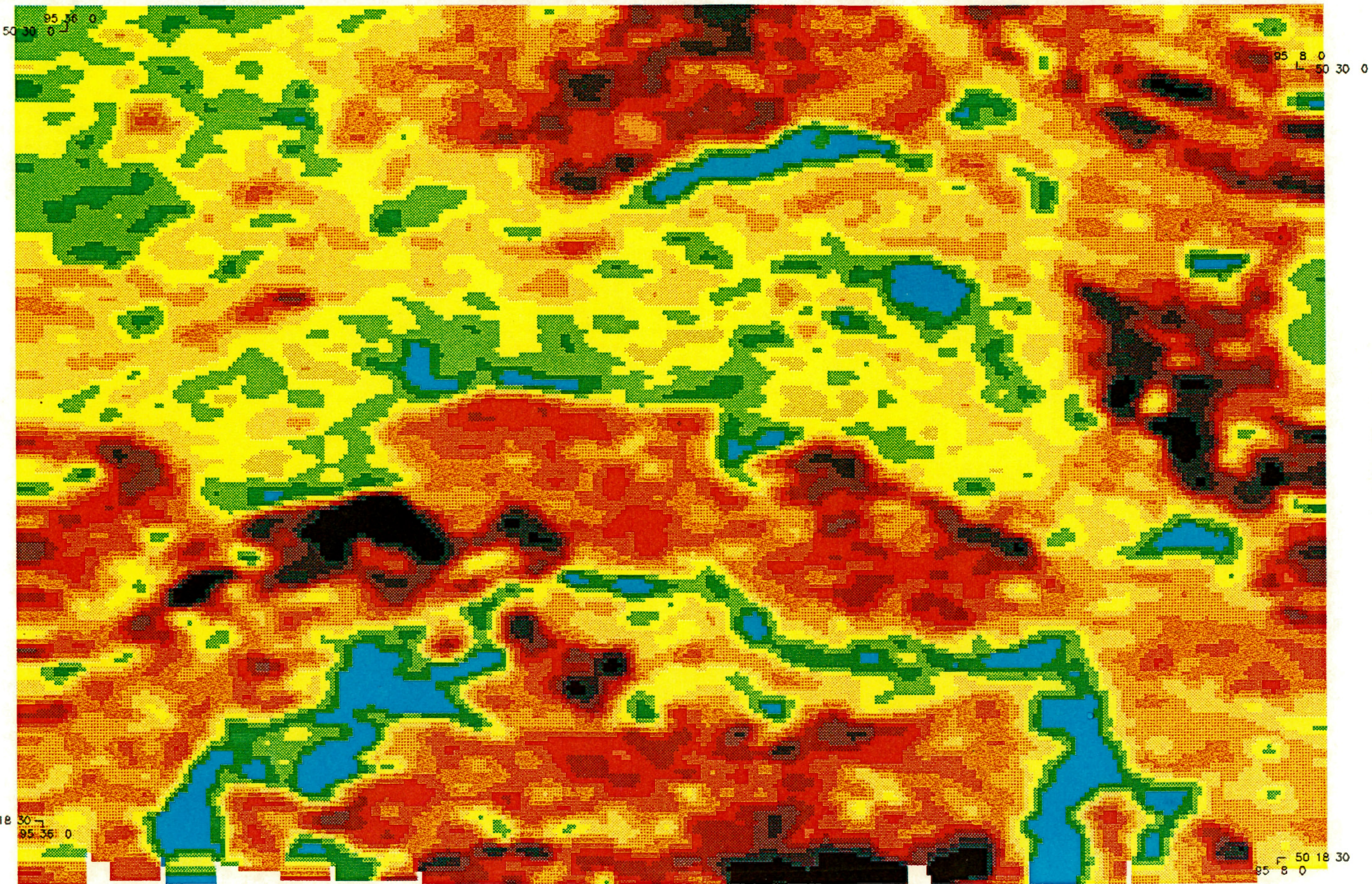
Black	6.5
Dark Grey	6.0 - 6.5
Dark Brown	5.5 - 6.0
Red-Brown	5.0 - 5.5
Red	4.5 - 5.0
Orange-Red	4.0 - 4.5
Orange	3.5 - 4.0
Light Orange	3.0 - 3.5
Yellow-Orange	2.5 - 3.0
Yellow	2.0 - 2.5
Light Yellow	1.5 - 2.0
Light Green	1.0 - 1.5
Green	0.5 - 1.0
Blue	0.5
White	

equivalent Uranium (ppm)

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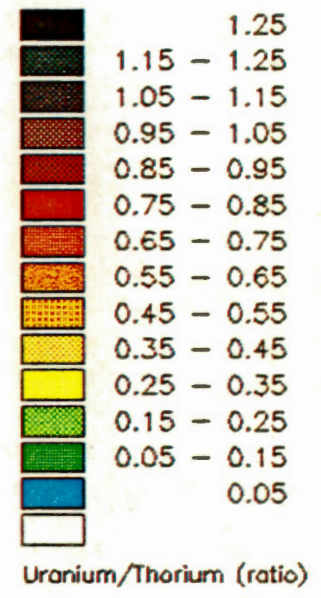
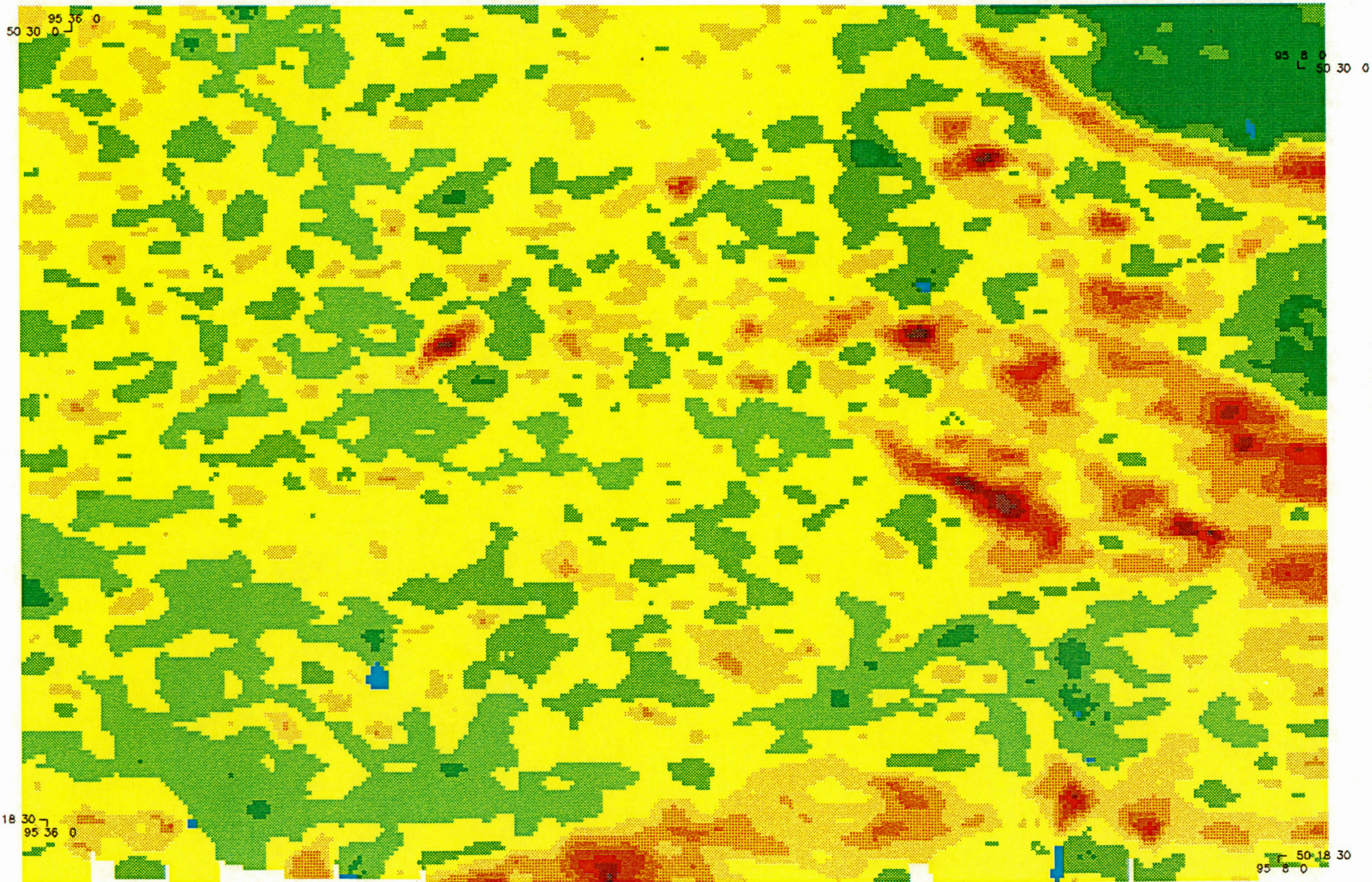




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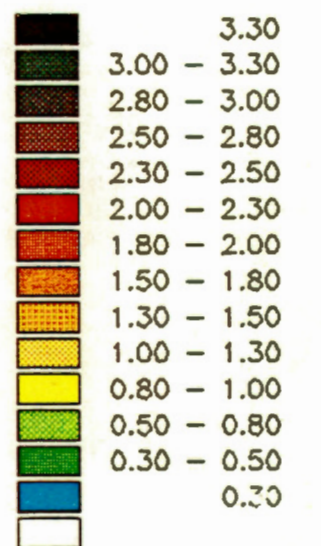
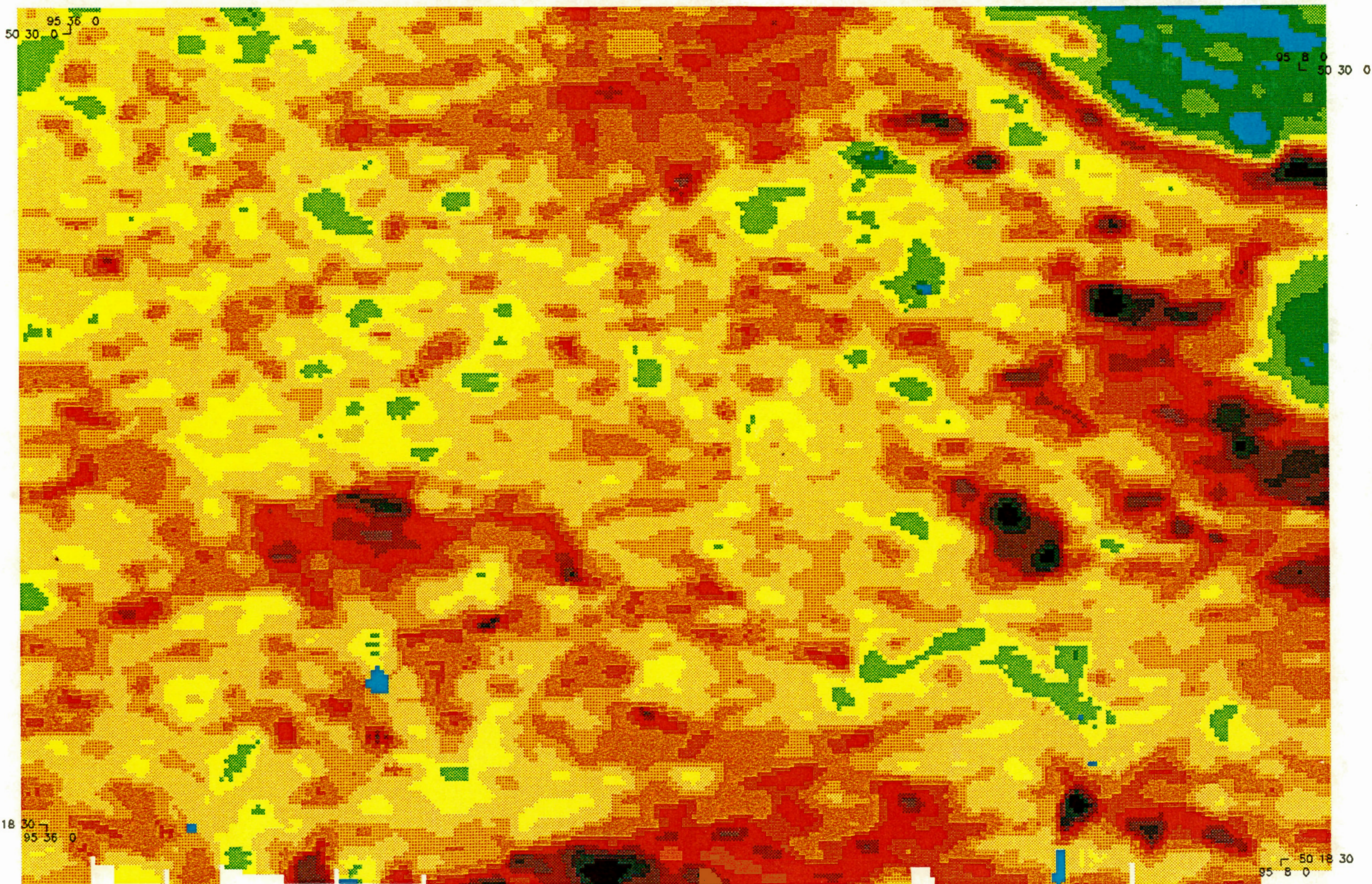




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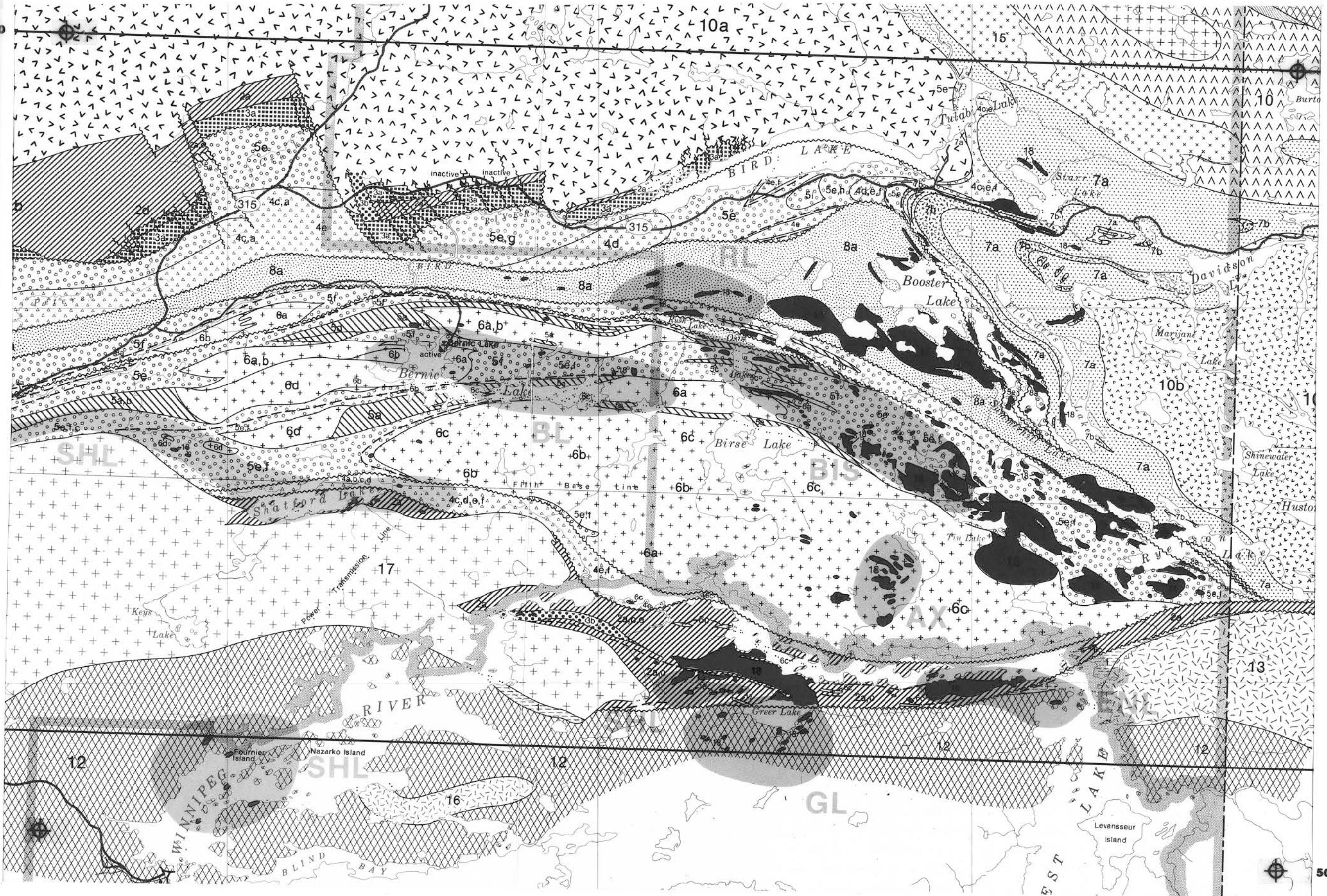
Uranium/Potassium (ratio)

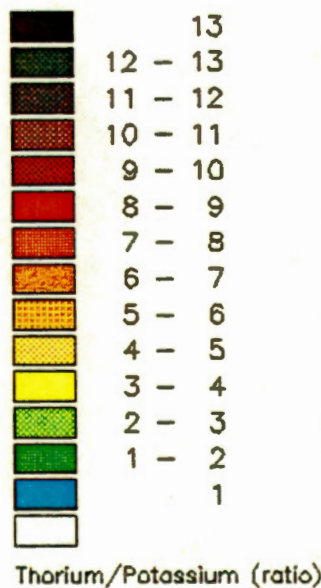
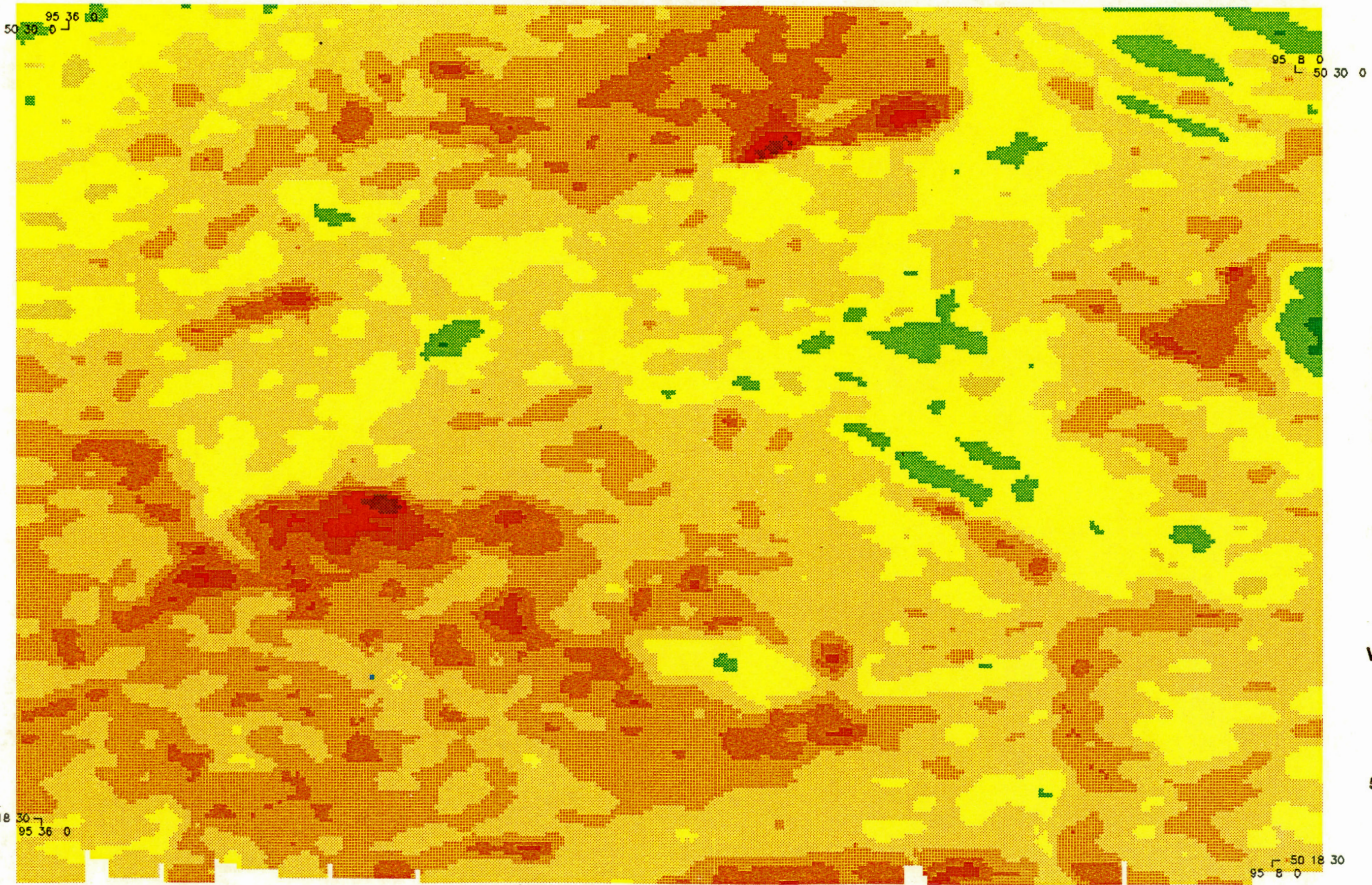
**WINNIPEG RIVER
AREA**

Manitoba

52L5,6 (parts of)







**WINNIPEG RIVER
AREA**

**Manitoba
52L5,6 (parts of)**

