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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  
Levé géophysique Aéroporté  
Baddeck  
Nova Scotia

NTS/SNRC 11 K/2 (SE)

Contents include gamma ray spectrometric and magnetic  
colour maps, flight path map, VLF profilemaps and  
accompanying stacked profiles  
Contient des cartes en couleur de rayons gamma spectrométrique  
et magnétique, une carte de lignes de vol, VLF sous forme des  
cartes de profils et profils multi-paramétriques

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COOPERATION

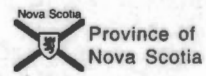
COOPERATION  
AGREEMENT ON  
MINERAL DEVELOPMENT

ENTENTE DE  
COOPÉRATION SUR  
L'EXPLOITATION MINÉRALE

Contribution to Canada-Nova Scotia Cooperation Agreement on  
Mineral Development (1990-1992) a subsidiary agreement under the  
Economic and Regional Development Agreement.

Contribution à l'Entente de coopération Canada-Nouvelle-Écosse  
sur l'exploitation minérale (1990-1992), entente auxiliaire négociée  
en vertu de l'Entente Canada/Nouvelle-Écosse de développement  
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Colour - Geophysical Series  
Couleur - Séries géophysiques

36111(02)G-SE

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OTTAWA



## Airborne Geophysical Survey

In 1990, a multi-parameter airborne geophysical survey of southeastern Cape Breton Island, Nova Scotia was flown by the Geological Survey of Canada (GSC). This survey was flown as a contribution to the Canada-Nova Scotia Cooperation Agreement on Mineral Development (1990-1992), a subsidiary agreement under the Canada-Nova Scotia Economic and Regional Development Agreement. The area was surveyed using the GSC Skyvan aircraft. Gamma-ray spectrometric, VLF electromagnetic and total field magnetic data were recorded digitally and sampled at one second intervals. The aircraft was flown at a mean terrain clearance of 125 meters and at an average ground speed of 190 km/h. The flight lines were flown in an east-west direction with a line spacing of 1000 meters.

For this survey the data are released as eight (8) G-Series booklets. This booklet for the **Baddeck area, G-Series 36111(02)G-SE** includes a set of colour maps with the flight path of the aircraft superimposed, two black and white profile maps and stacked profiles for each flight line, all at 1:150,000 scale. The following maps are enclosed:

- 1) An exposure rate map,
- 2) 3 maps of the ground concentration of Potassium (K), Uranium (eU) and Thorium (eTh),
- 3) 3 ratio maps - eU/eTh, eU/K and eTh/K,
- 4) A three component or Ternary Radioelement map combining the potassium, uranium and thorium data,
- 5) A Magnetic Total Field map,
- 6) Two VLF profile maps, one with Total Field VLF profile data and the other with Quadrature VLF profile data,
- 7) A matte positive of the corresponding 1:50,000 NTS map sheet reduced to 1:150,000 scale.

The stacked profiles in the booklet have a five point weighted average filter applied to each parameter. Each profile shows the aircraft radar altimeter, the three radioelement ratios, the ground concentrations of potassium, uranium and thorium, the exposure rate, the magnetic total field and the VLF total field and quadrature components. The picked fiducials along the horizontal axis of each profile relates the data to the flight lines shown on the colour maps.

### **Gamma-ray Spectrometric Data**

The airborne gamma-ray measurements were made using a 256 channel gamma-ray spectrometer with fourteen 102 x 102 x 406 mm NaI(Tl) crystals. The main detector array consisted of twelve crystals (total volume 50 litres). Two crystals, shielded by the main array, were used to detect variations in background radiation. The system constantly monitored the natural potassium peak and adjusted the gain for the system.

Potassium is measured directly from the 1460 keV gamma-ray photons emitted by  $^{40}\text{K}$ , whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products ( $^{214}\text{Bi}$  for uranium and  $^{208}\text{Tl}$  for thorium). Although these daughters are far down their respective decay chains they are assumed to be in equilibrium with their parents; thus gamma-ray spectrometric measurements of uranium and thorium are referred to as equivalent uranium and equivalent thorium i.e. eU and eTh. The energy windows used to measure potassium, uranium and thorium are:

Potassium ( $^{40}\text{K}$ )	1360 - 1560 keV
Uranium ( $^{214}\text{Bi}$ )	1660 - 1860 keV
Thorium ( $^{208}\text{Tl}$ )	2410 - 2810 keV

During processing, the spectra were energy calibrated, and counts were accumulated into the windows described above. The window counts were corrected for deadtime and for background activity due to cosmic radiation, the radioactivity of the aircraft and atmospheric radon decay products. The window data were then corrected for spectral scattering in the ground, air and detectors. Corrections for deviations, of altitude from the planned terrain clearance, and of temperature and pressure were made prior to conversion to ground concentrations of potassium, uranium and thorium, using factors determined from flights over a calibration range near Ottawa. In areas of extreme topographic variations accurate terrain corrections are difficult. Thus, estimates of radioelement concentrations may be inaccurate in these areas. The stacked profiles should be inspected in areas of extreme topographic relief.

Potassium	91.0 cps/%
Uranium	9.1 cps/ppm
Thorium	7.0 cps/ppm

Corrected data were interpolated to yield 100 m grids using an inverse distance weighted average technique. The results of an airborne gamma-ray spectrometer survey represent average surface concentrations which are influenced by varying amounts of outcrop, overburden, vegetation cover, soil moisture and surface water. As a result the measured concentrations are usually lower than the actual bedrock concentration.

The exposure rate in micro Roentgens per hour was computed from the measured ground concentration of potassium, uranium and thorium. To compare this exposure rate with older total count maps contoured in Ur (units of radioelement concentration) the conversion factor is  $1\mu\text{R/h} = 1.67 \text{ Ur}$ .

### **VLF Data**

The VLF electromagnetic data were recorded using a Hertz Totem 1A system. The system was tuned to a primary electromagnetic field generated by one of several VLF communication stations. For this survey, the receiving coils were tuned to station NSS in Annapolis, Maryland which transmits at a frequency of 21.4 kHz.

Anomalies reflect distortions in the primary field cause by a secondary electromagnetic field generated by eddy currents flowing in geological and man-made conductors. Anomalies produce positive peaks on the total field trace and are of the cross-over type (negative to positive) on the quadrature trace. Both parameters are plotted with positive deflections toward north. The profiles presented are the total field value (vector sum of the horizontal and vertical components) and the quadrature value (out-of-phase component). For the stacked profiles, the mean value or line average of the total field and quadrature component were removed along each flight line. The quadrature, which depends on the flight line direction, was inverted for lines flown from east to west. All the VLF data are plotted with a two second lag.

### **Magnetic Data**

The aeromagnetic data were acquired using a Geometrics model G-803 proton precession magnetometer with a sensitivity of one nanotesla (1 nT). The magnetic data were corrected to remove spikes, heading effects and diurnal variations.

**Information regarding these G-Series Maps may be obtained from: Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, K1A 0E8; Telephone (613) 995-4342 or 992-4279.**

**Base map material supplied by Surveys and Mapping Branch.**

**Airborne gamma-ray spectrometer, VLF and magnetic survey carried out by the Mineral Resources Division of the Geological Survey of Canada as a contribution to the Canada-Nova Scotia Cooperation Agreement of Mineral Development (1990-1992), a subsidiary agreement under the Canada-Nova Scotia Economic and Regional Development Agreement.**

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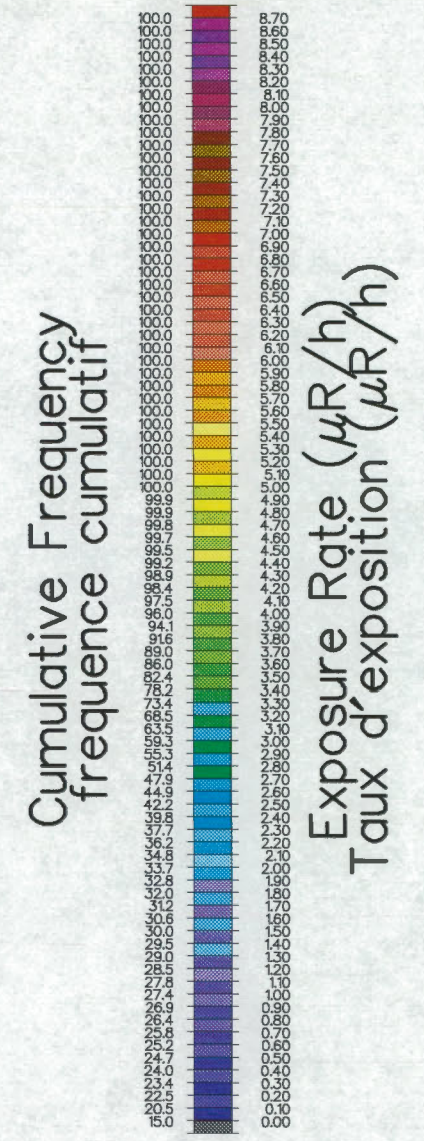
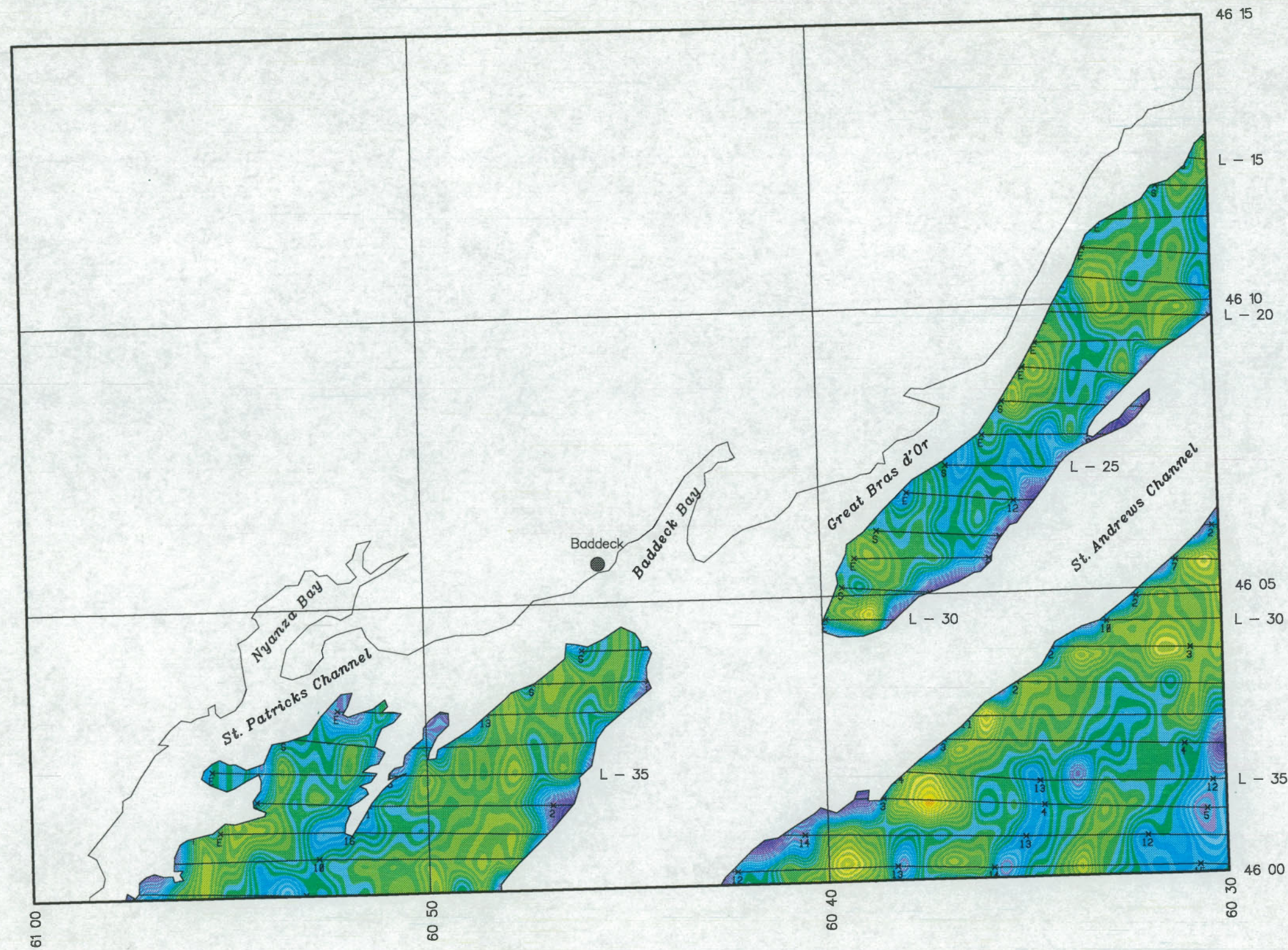




BADDECK  
NOVA SCOTIA

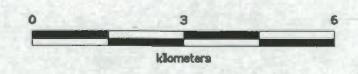






MAP 36111(02)G-SE CARTE

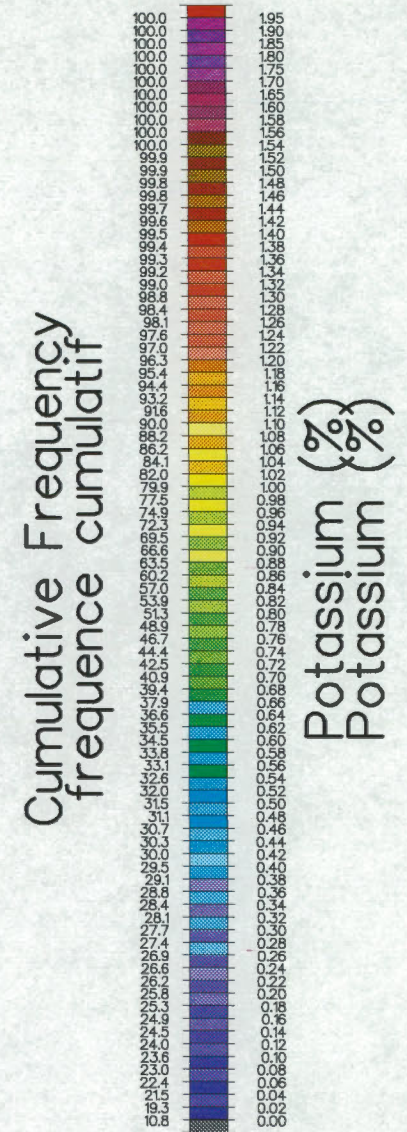
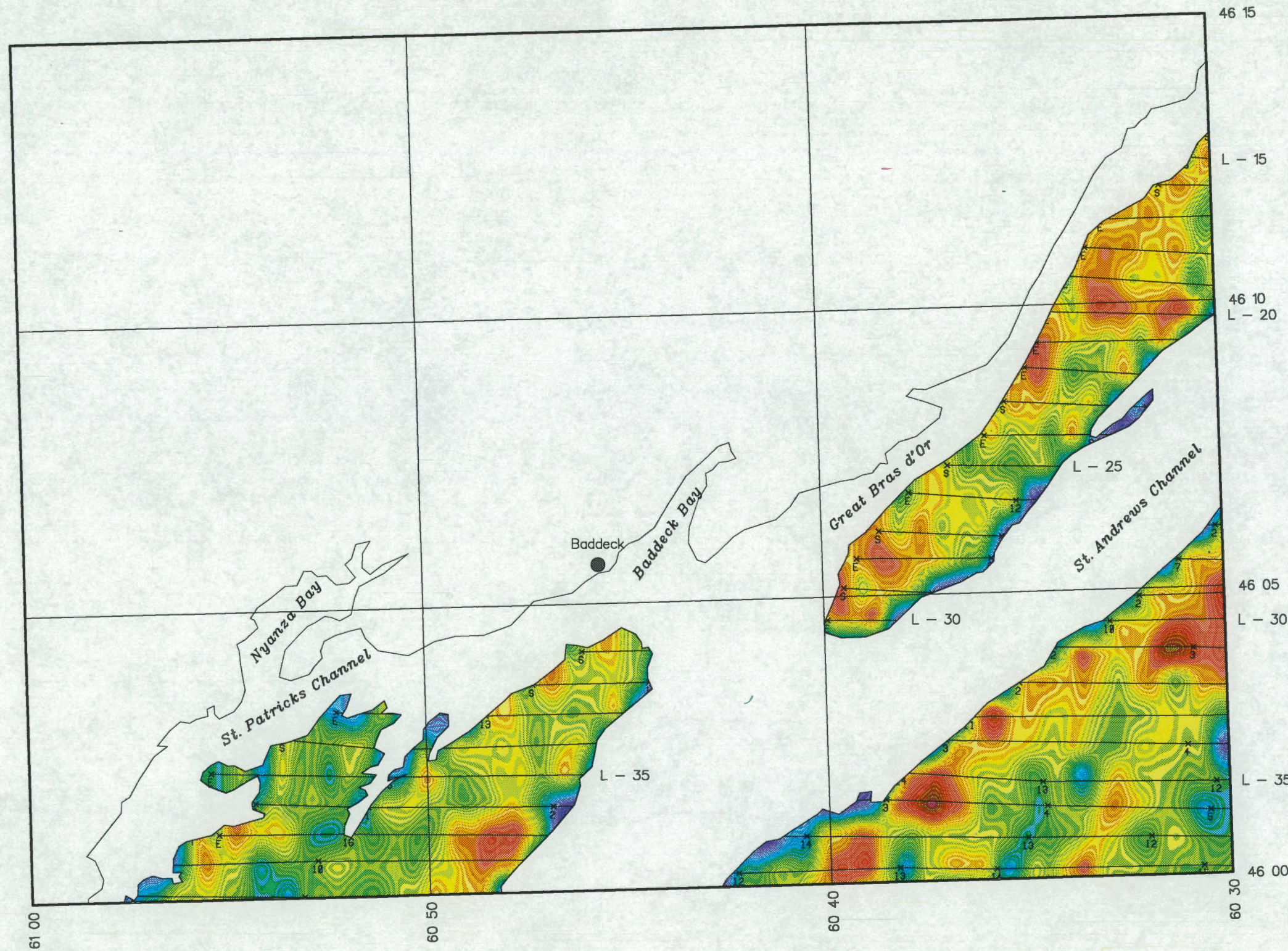
**Baddeck**  
 Nova Scotia  
 NTS 11K/2 (SE)



Scale/Échelle = 1:150 000  
 Line spacing/Espacement des lignes = 1000 metres

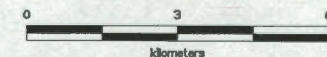
Exposure Rate ( $\mu\text{R}/\text{h}$ )  
 Taux d'exposition ( $\mu\text{R}/\text{h}$ )





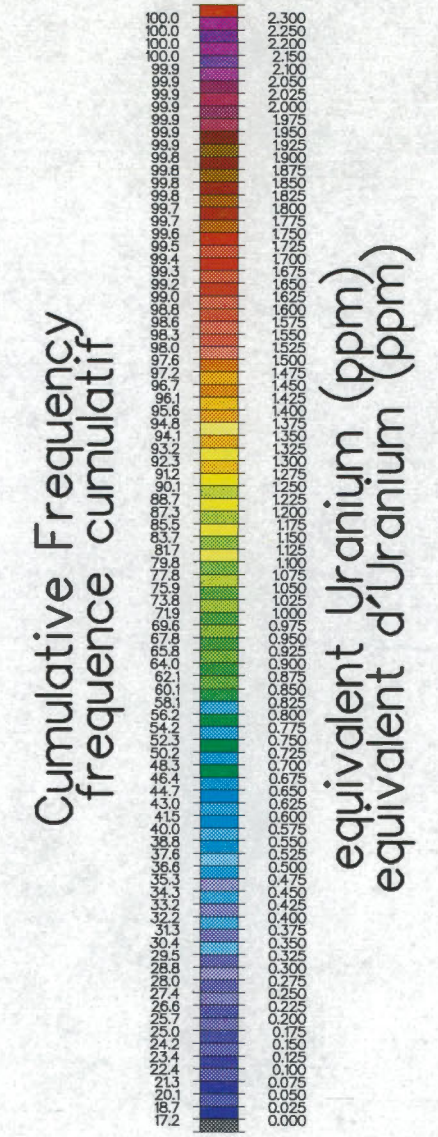
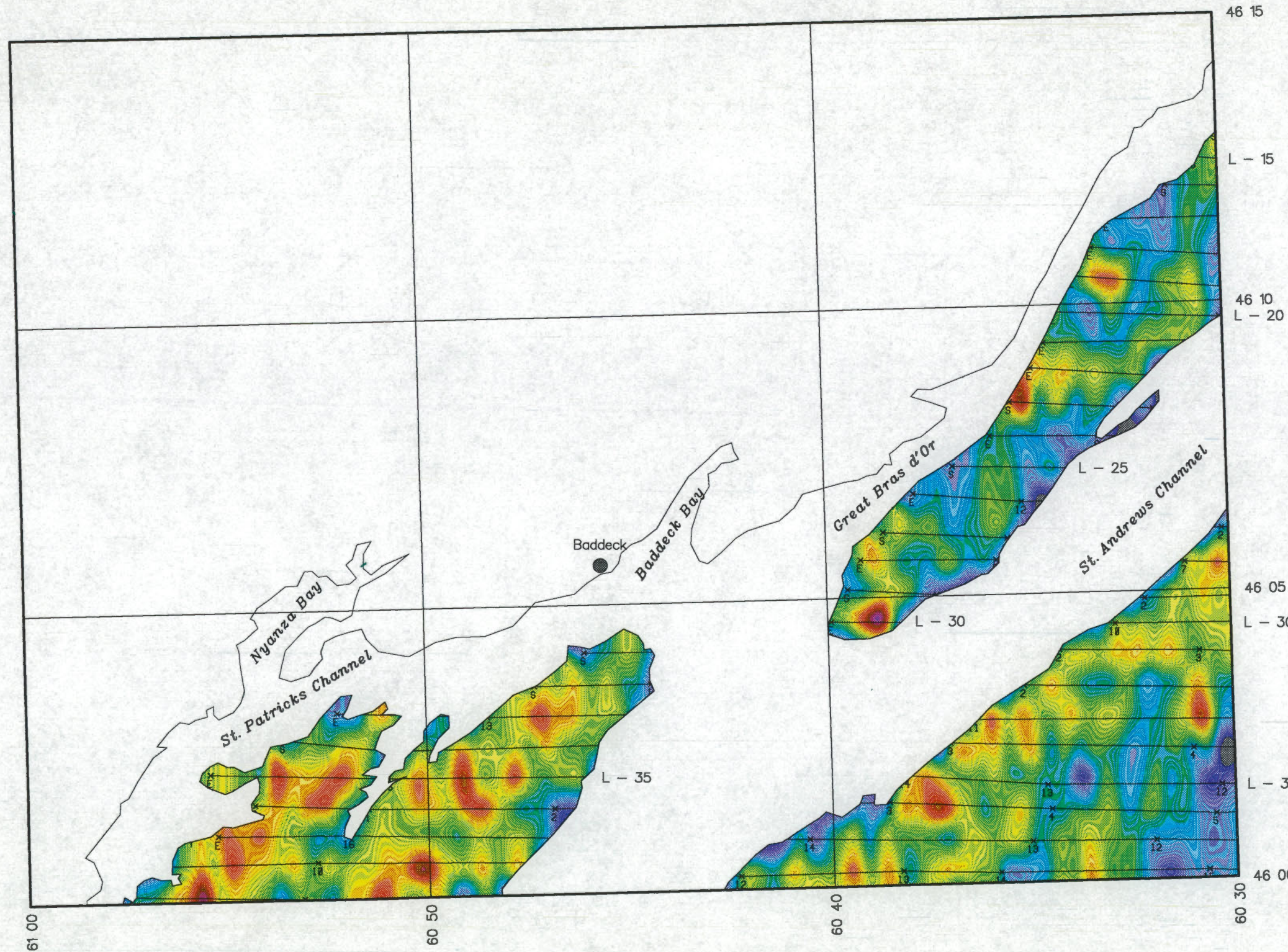
MAP 36111(02)G-SE CARTE

Baddeck  
 Nova Scotia  
 NTS 11K/2 (SE)



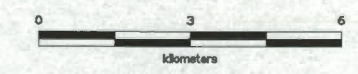
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MAP 36111(02)G-SE CARTE

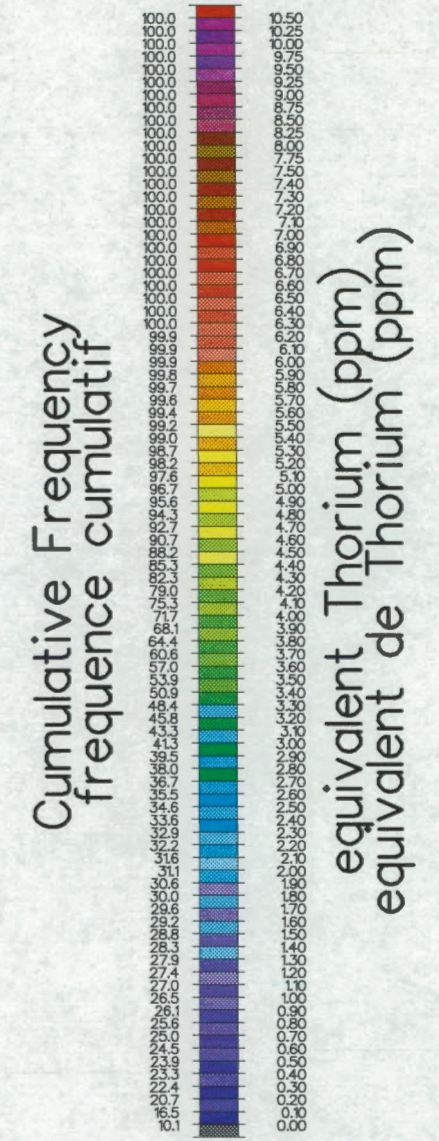
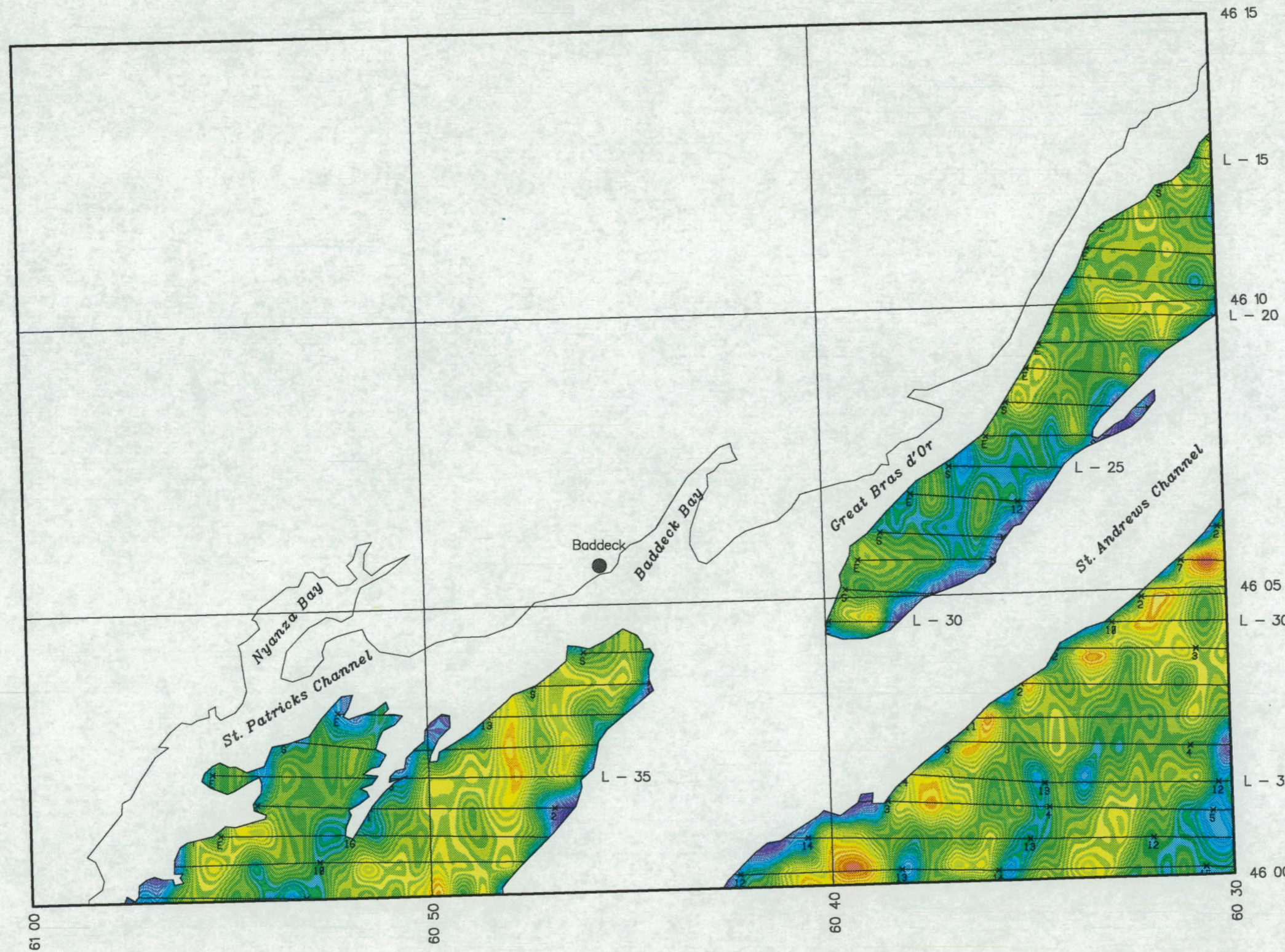
Baddeck  
 Nova Scotia  
 NTS 1K/2 (SE)



Scale/Échelle = 1:150 000  
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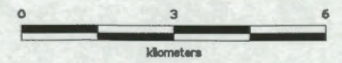
equivalent Uranium (ppm)  
 equivalent d'Uranium (ppm)





MAP 36111(02)G-SE CARTE

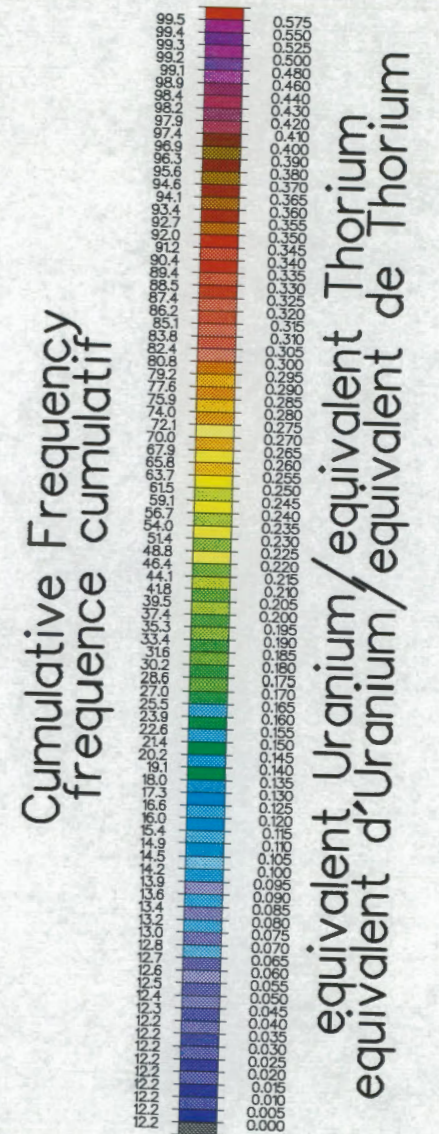
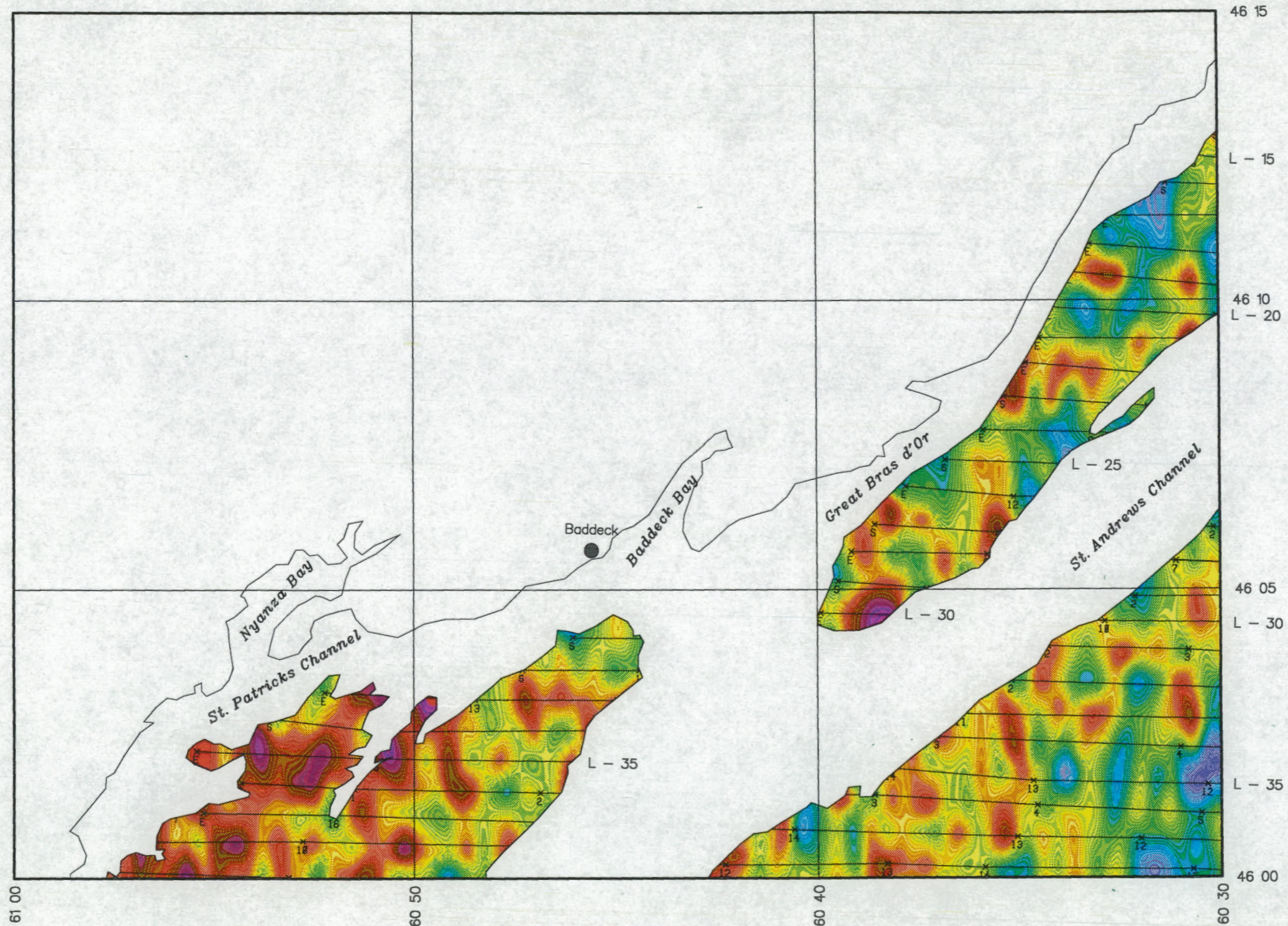
Baddeck  
 Nova Scotia  
 NTS 11K/2 (SE)



Scale/Échelle = 1:150 000  
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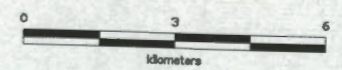
equivalent Thorium (ppm)  
 équivalent de Thorium (ppm)





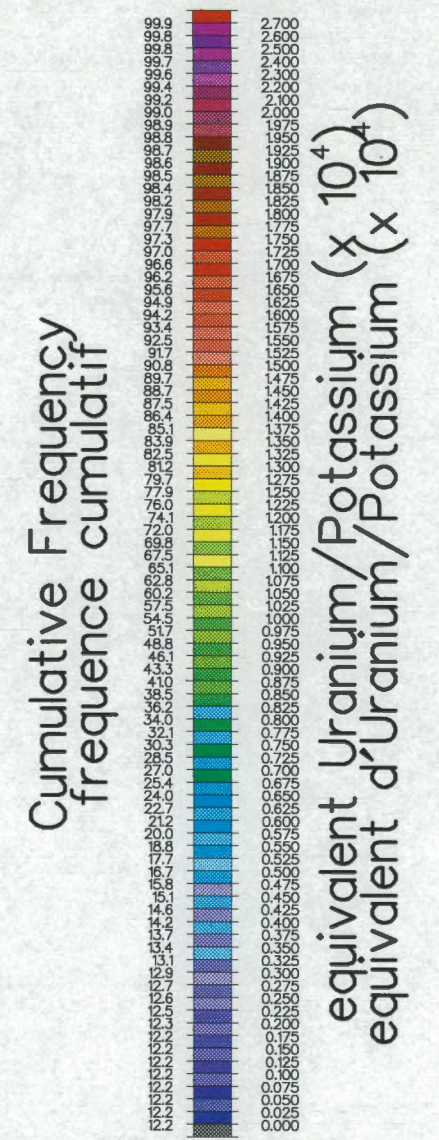
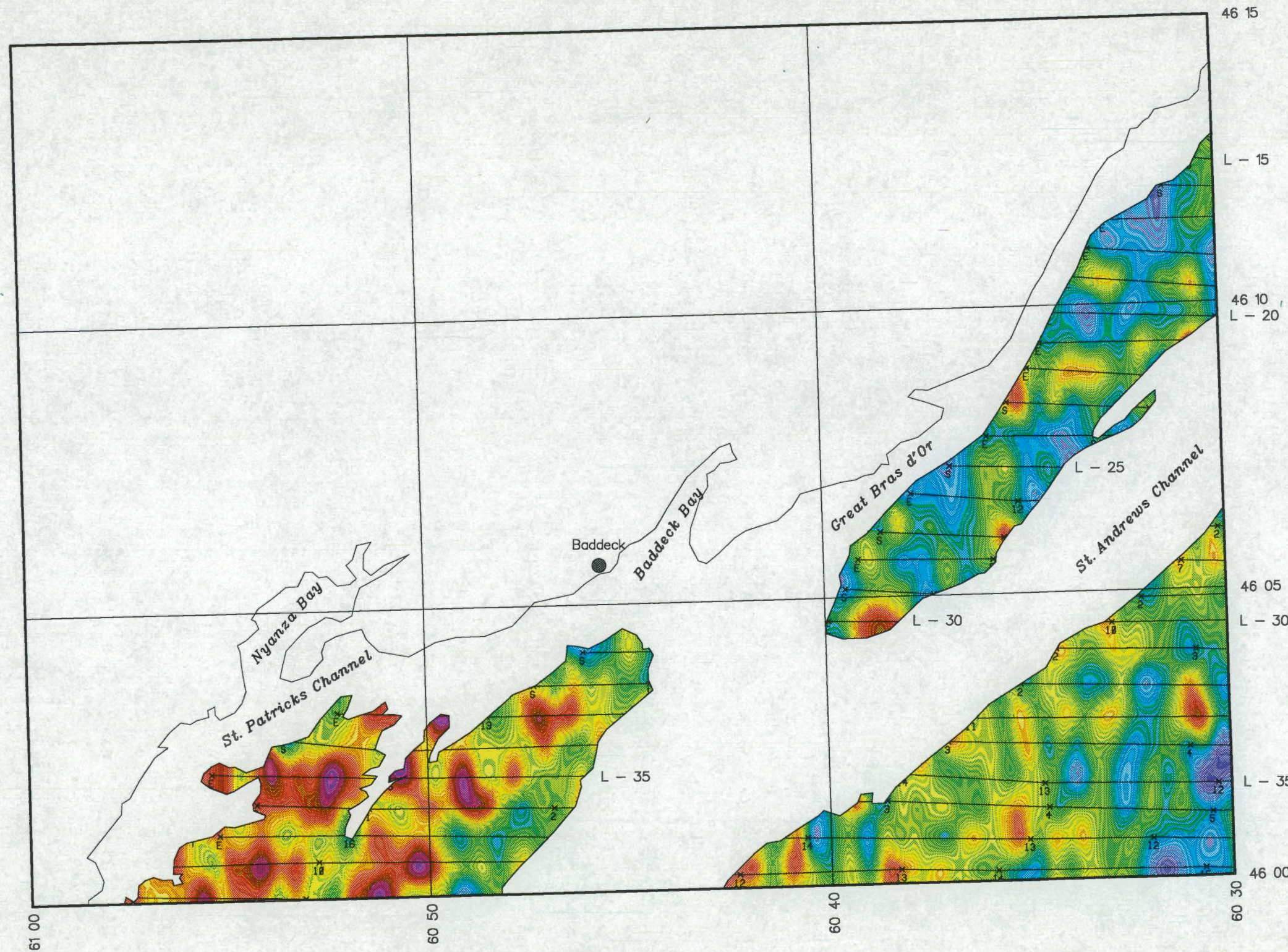
MAP 36111(02)G-SE CARTE

**Baddeck**  
 Nova Scotia  
 NTS 11K/2 (SE)



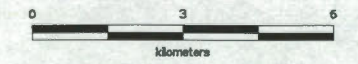
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MAP 36111(02)G-SE CARTE

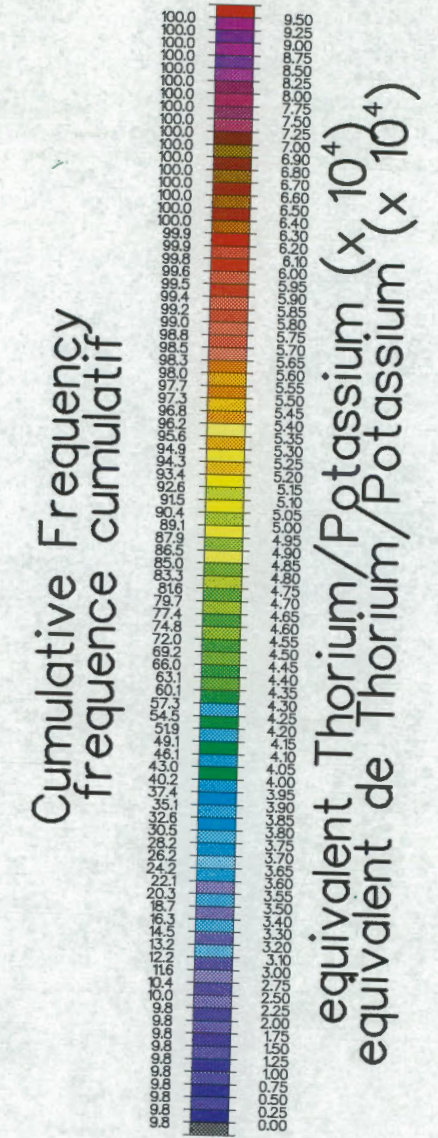
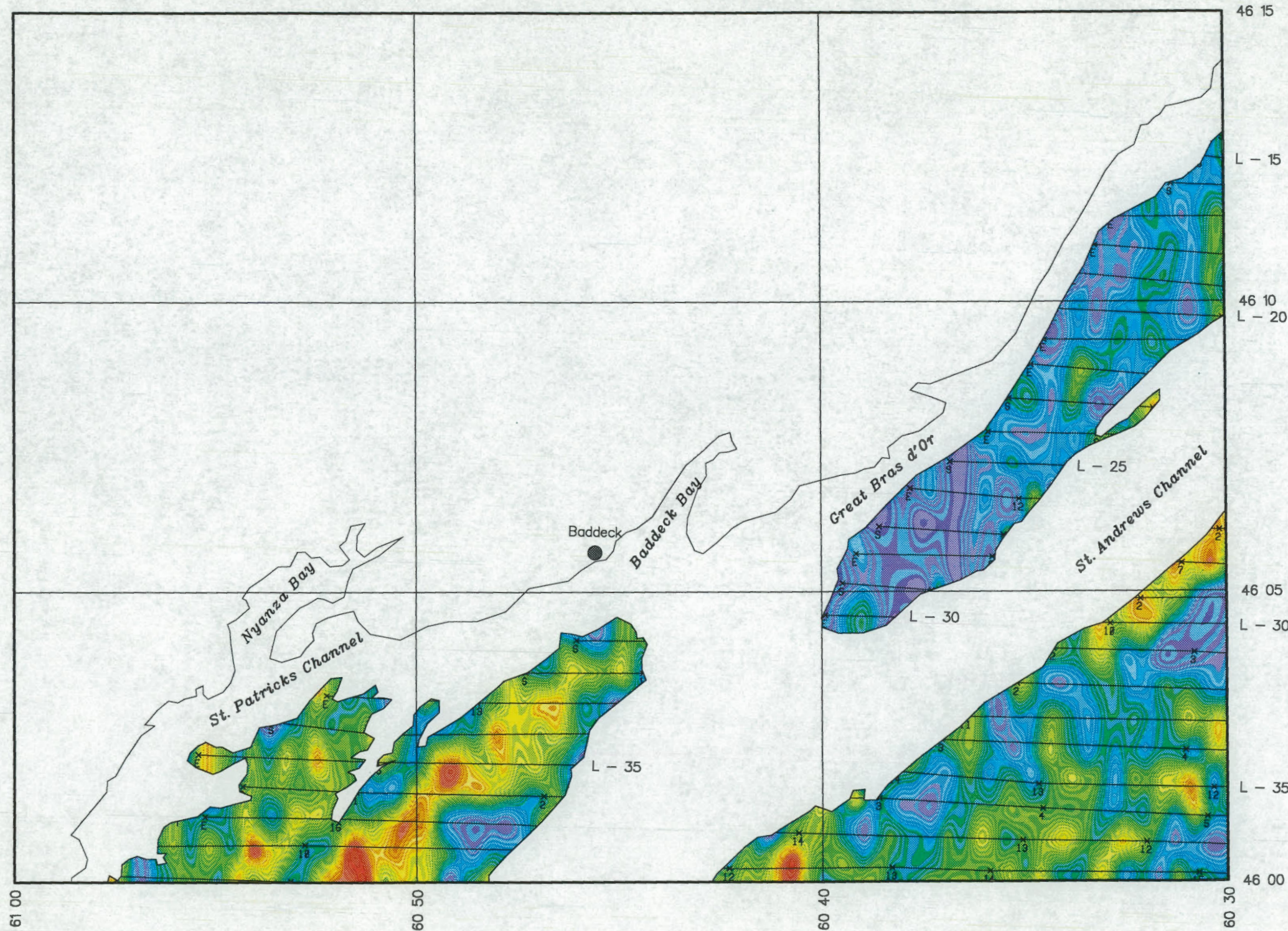
Baddeck  
 Nova Scotia  
 NTS 1K/2 (SE)



Scale/Échelle = 1:150 000  
 Line spacing/Espacement des lignes = 1000 metres

equivalent Uranium/Potassium ( $\times 10^4$ )  
 équivalent d'Uranium/Potassium ( $\times 10^4$ )

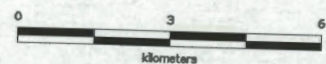




equivalent Thorium/Potassium ( $\times 10^4$ )  
 équivalent de Thorium/Potassium ( $\times 10^4$ )

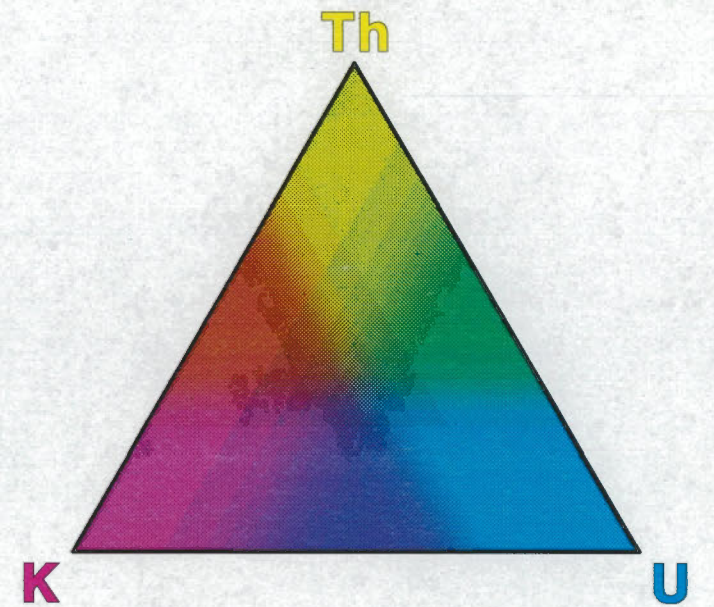
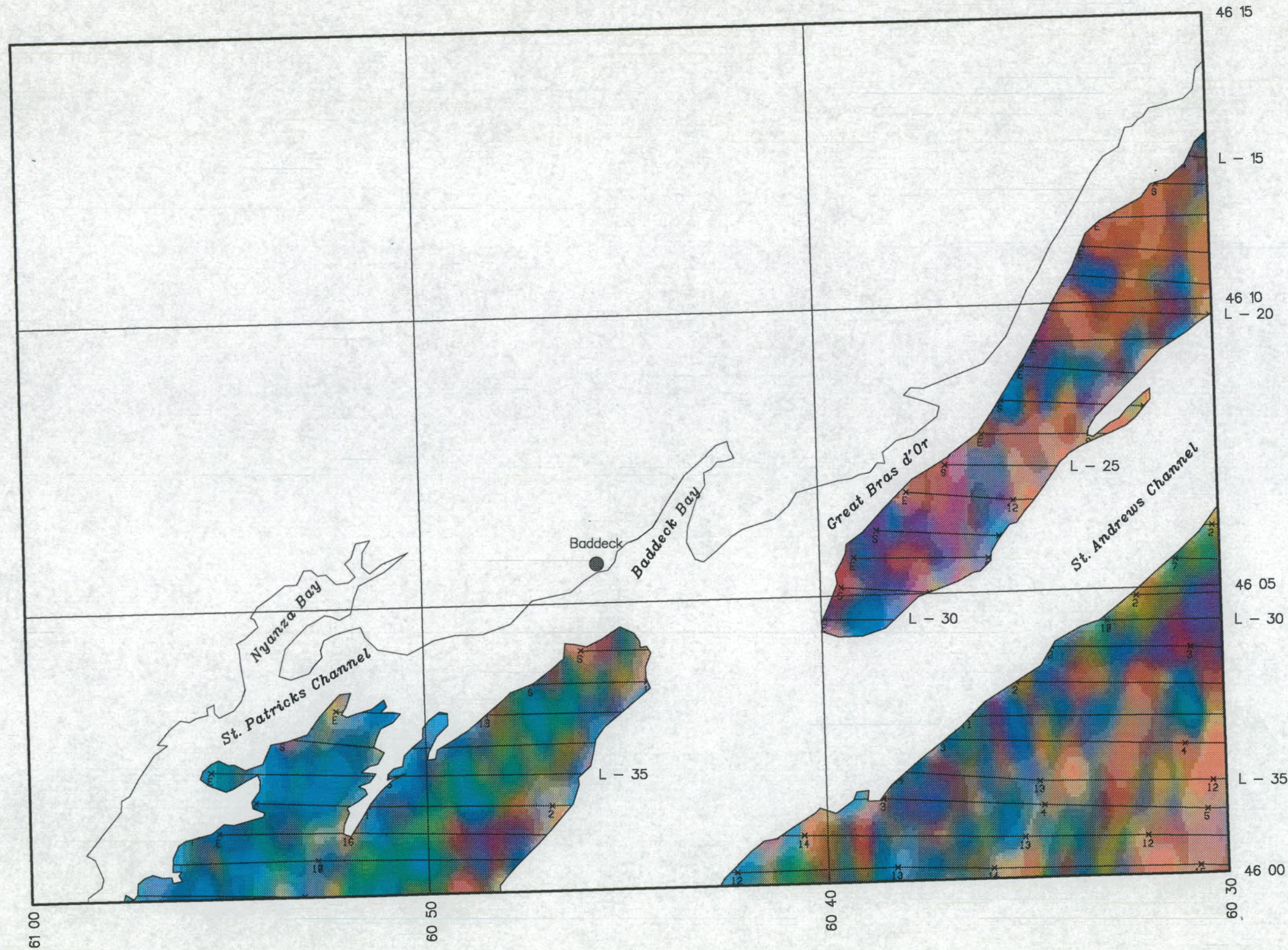
MAP 3611(02)G-SE CARTE

Baddeck  
 Nova Scotia  
 NTS 11K/2 (SE)



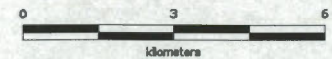
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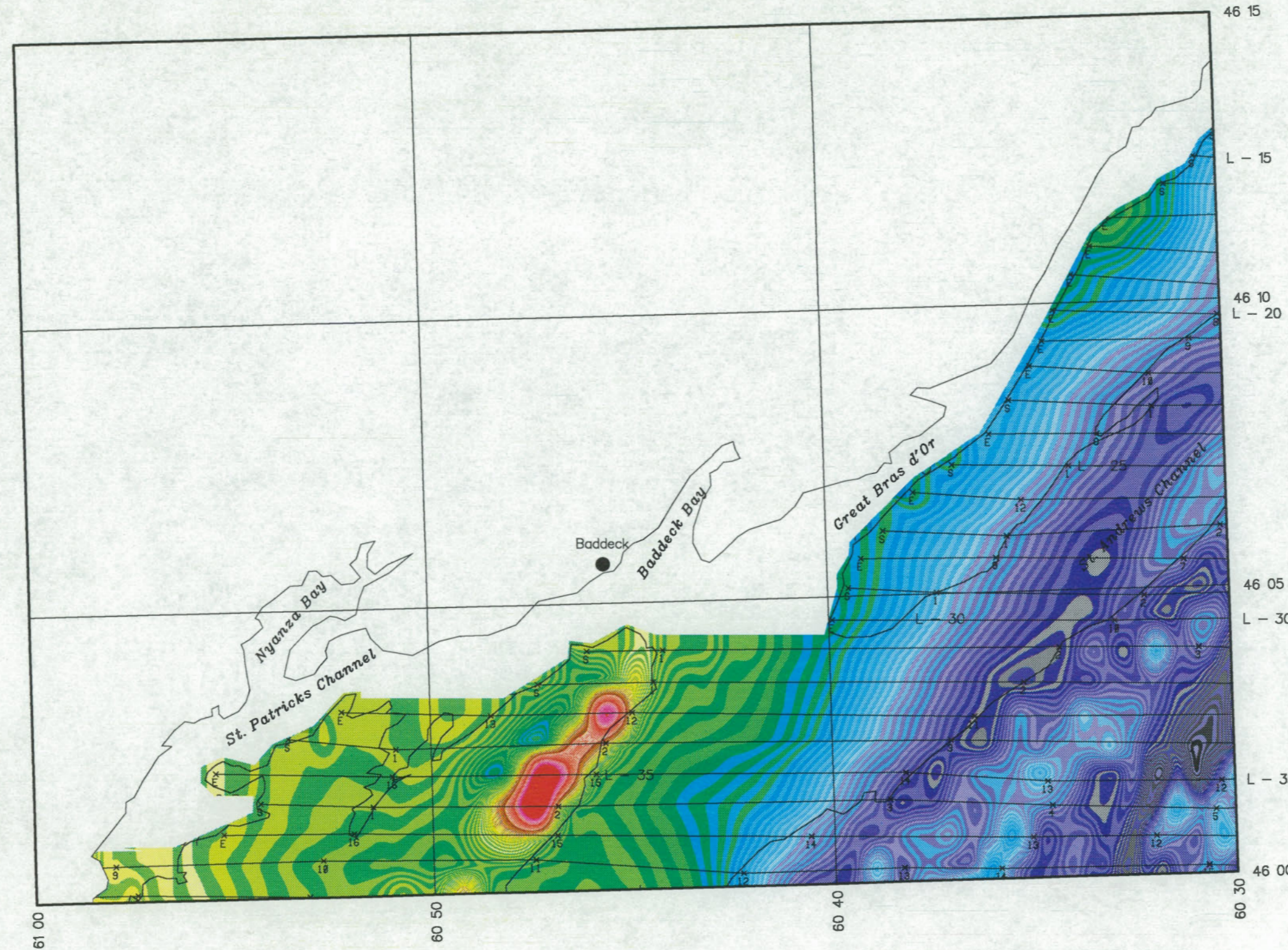
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Baddeck  
 Nova Scotia  
 NTS 1K/2 (SE)



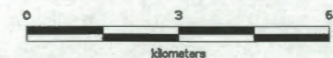
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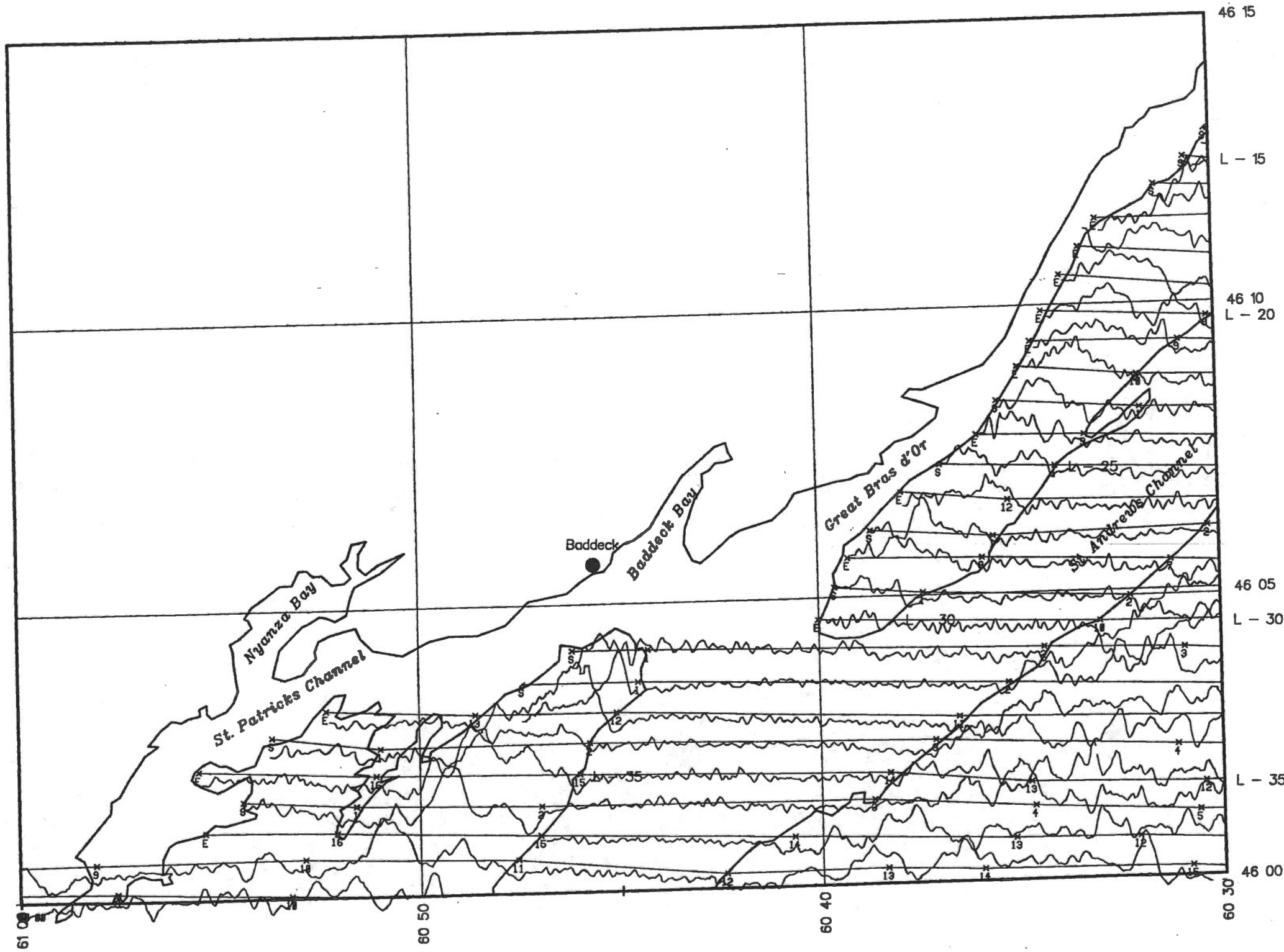
MAP 36111(02)G-SE CARTE

**Baddeck**  
 Nova Scotia  
 NTS 1K/2 (SE)

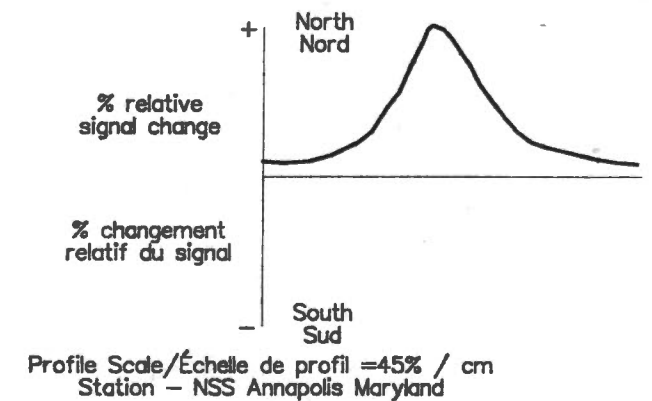


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Total field VLF response  
 Réponse VLF du champ total



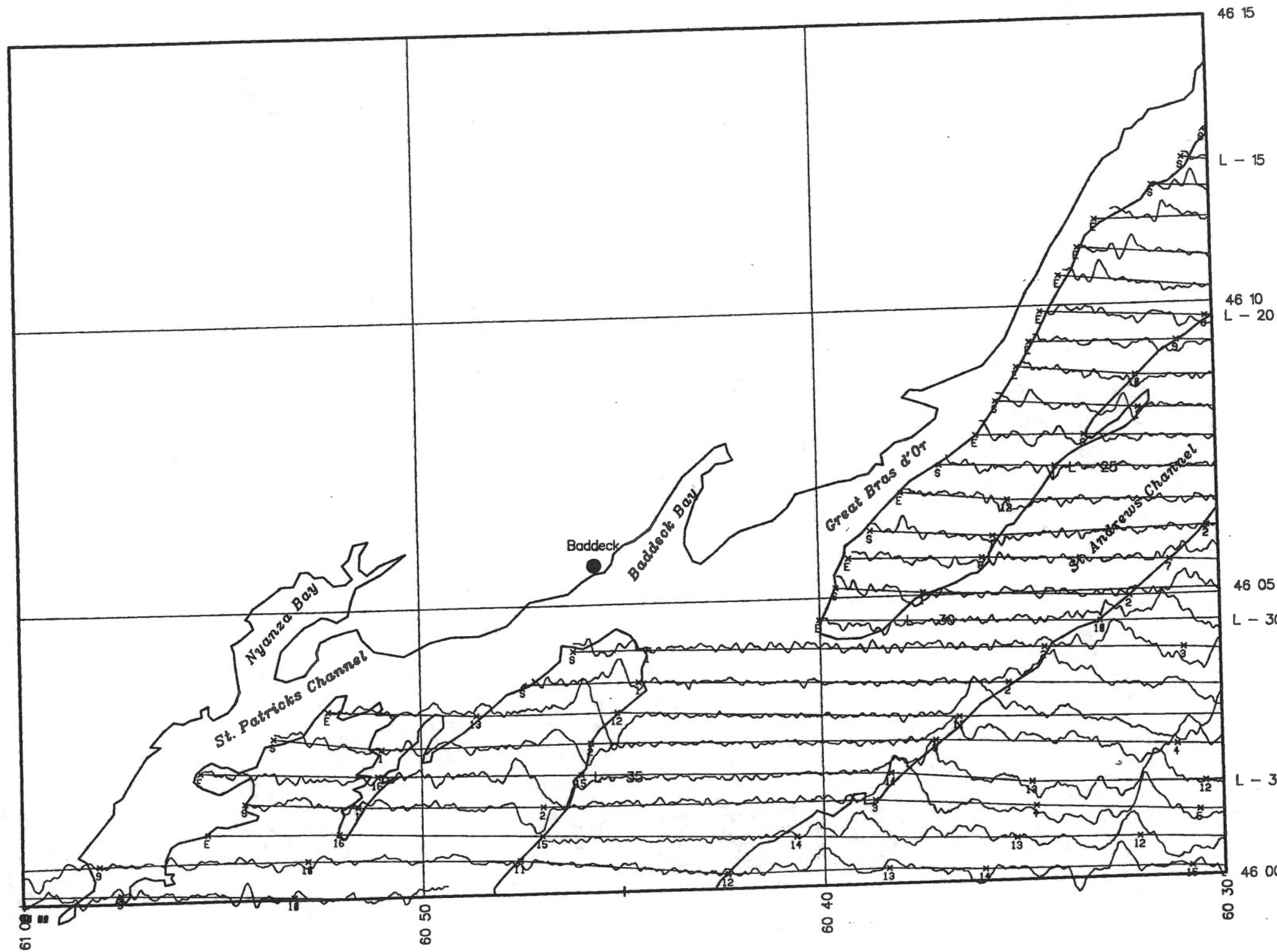
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Baddeck  
 Nova Scotia  
 NTS 11K/2 (SE)

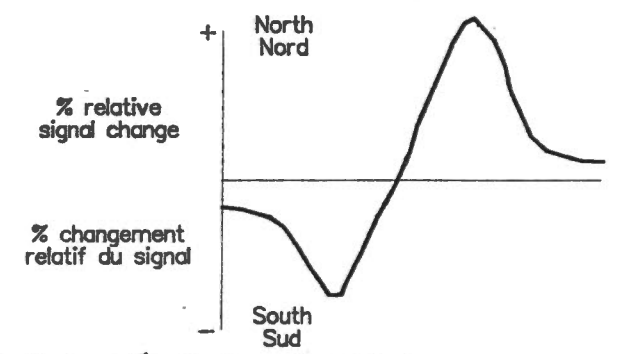


Scale/Échelle = 1:150 000  
 Line spacing/Espacement des lignes = 1000 metres





Quadrature VLF response  
 Réponse Quadrature VLF



Profile Scale/Échelle de profil = 45% / cm  
 Station - NSS Annapolis Maryland

MAP 36111(02)G-SE CARTE

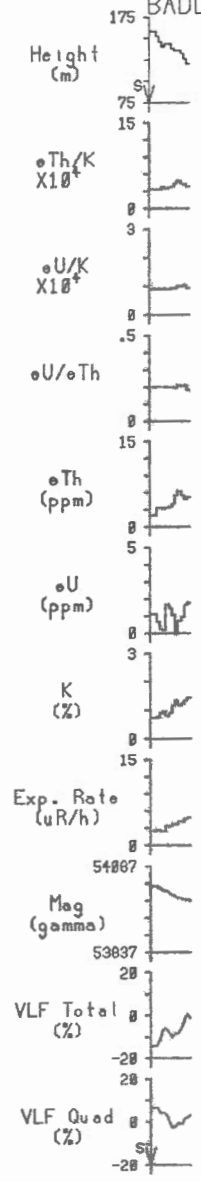
Baddeck  
 Nova Scotia  
 NTS 1K/2 (SE)



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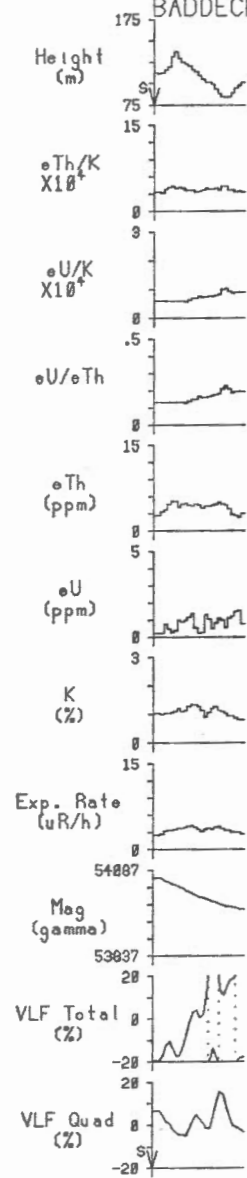
Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
 BADDECK 11K/2





Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2



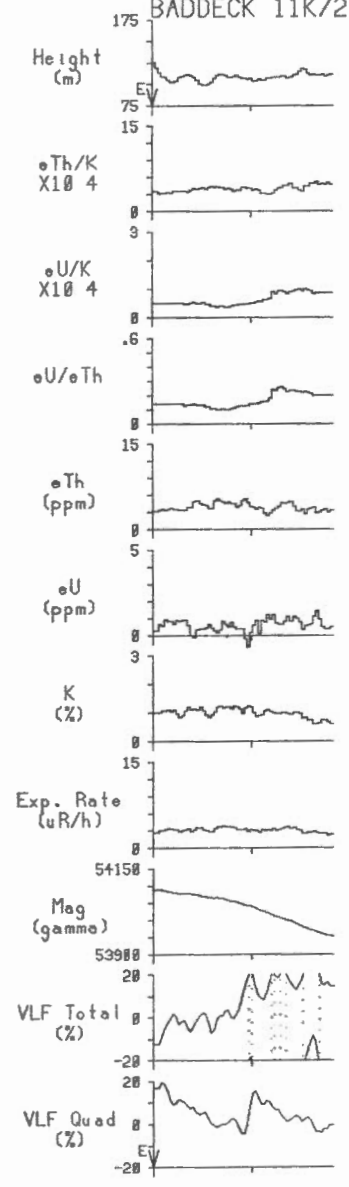
Line 16



Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
 BADDECK 11K/2



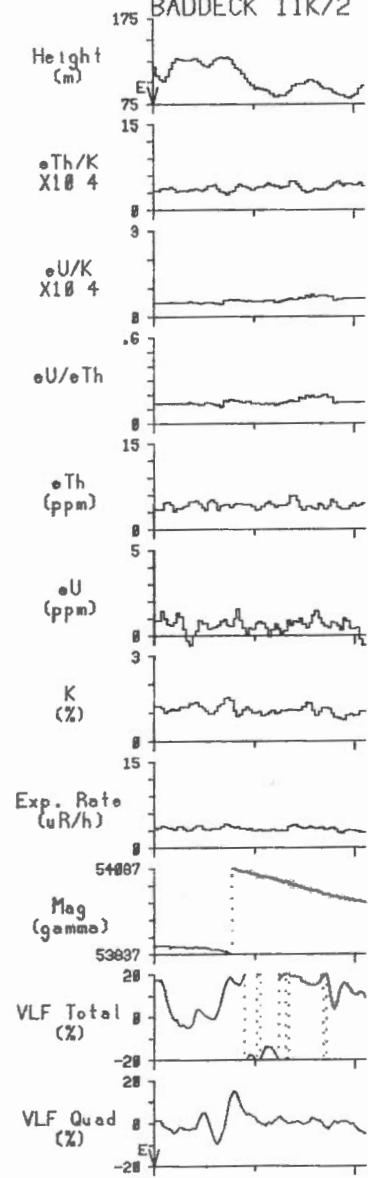
Line 17  2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2

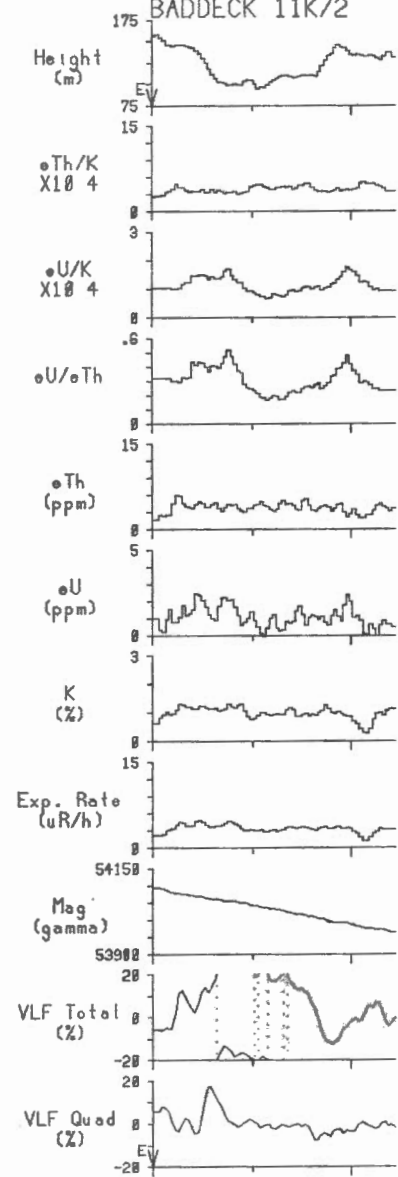


Line 18 | 2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
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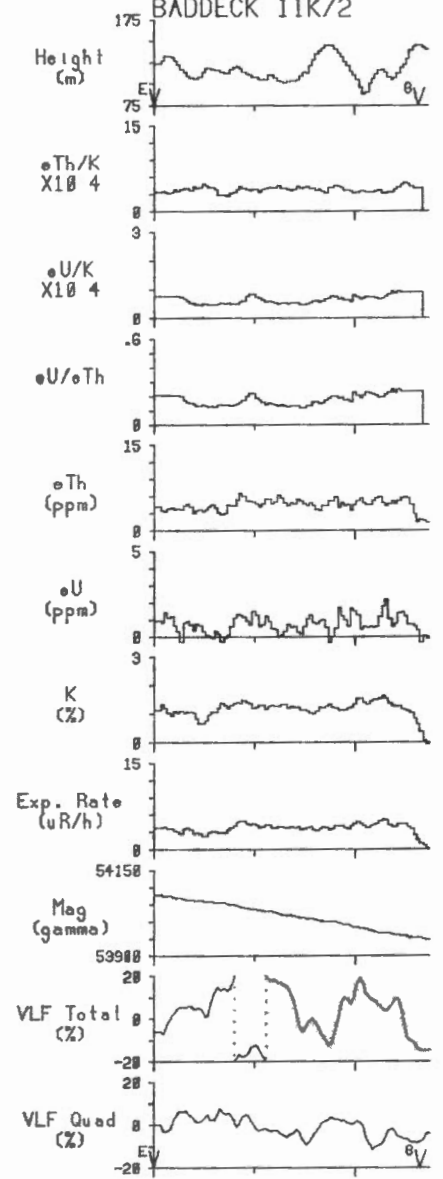


Line 19 | 2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
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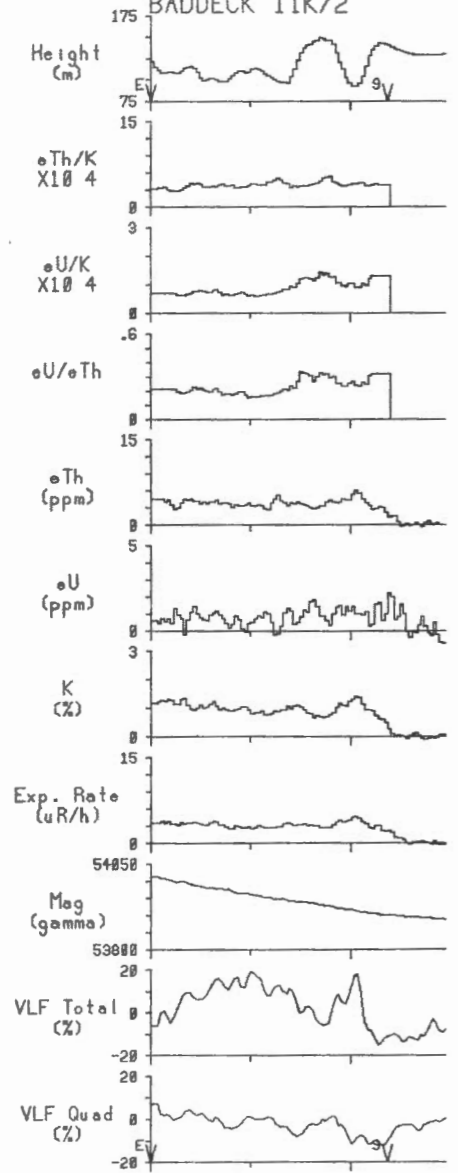


Line 20 | 2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
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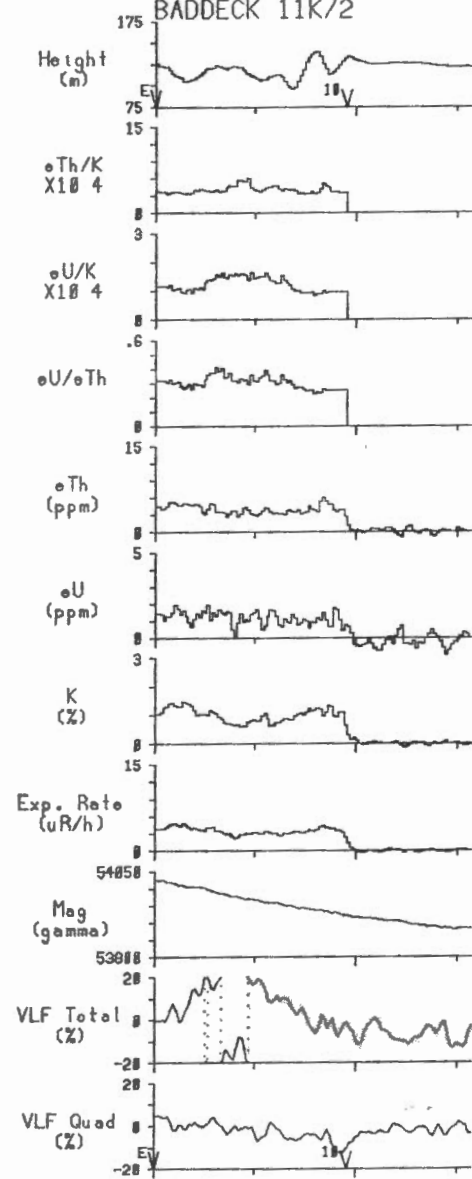


Line 21 | 2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
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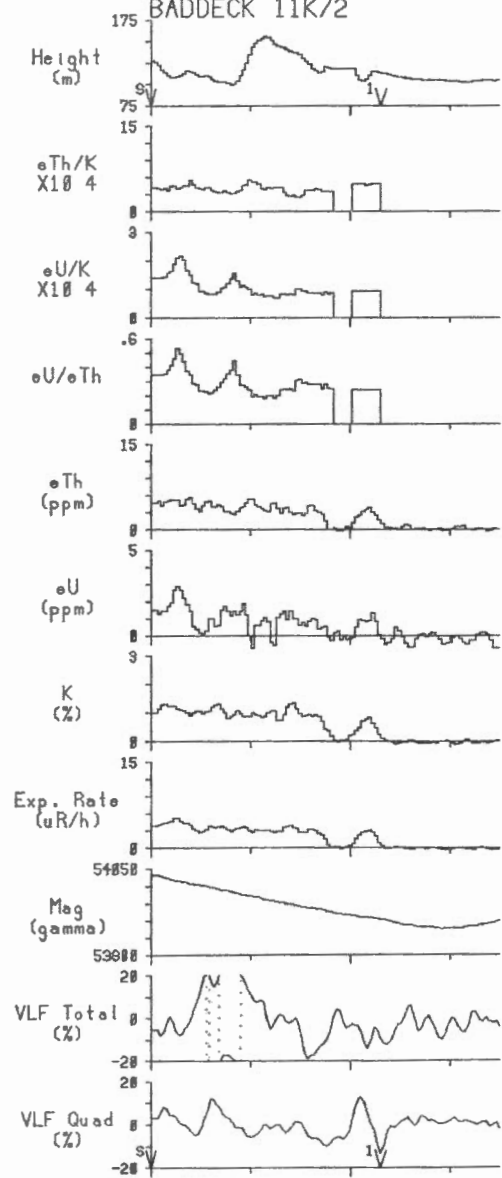


Line 22

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
 BADDECK 11K/2

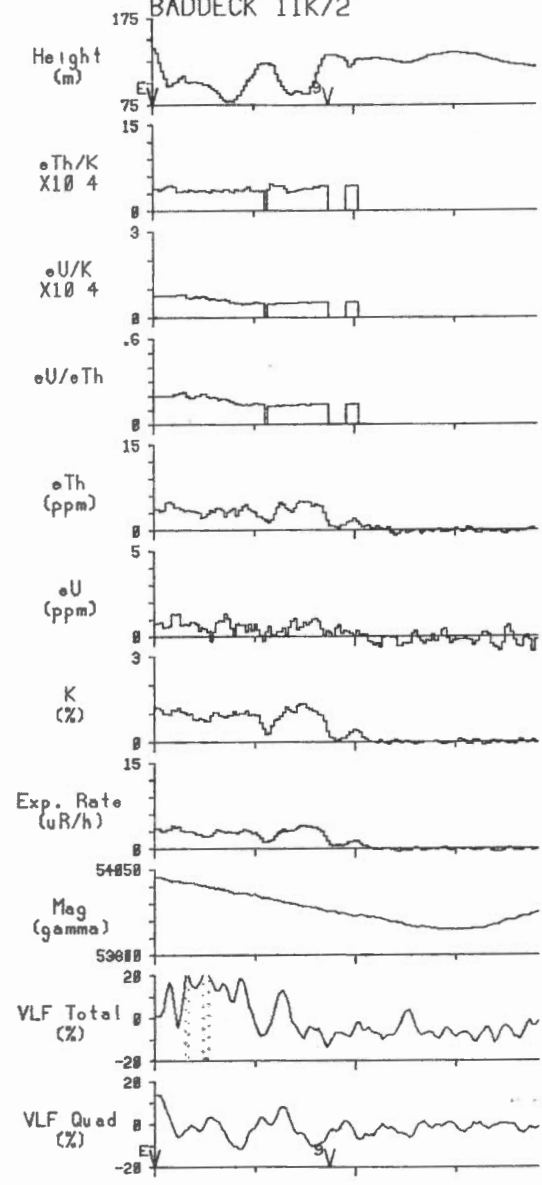


Line 23 | 2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
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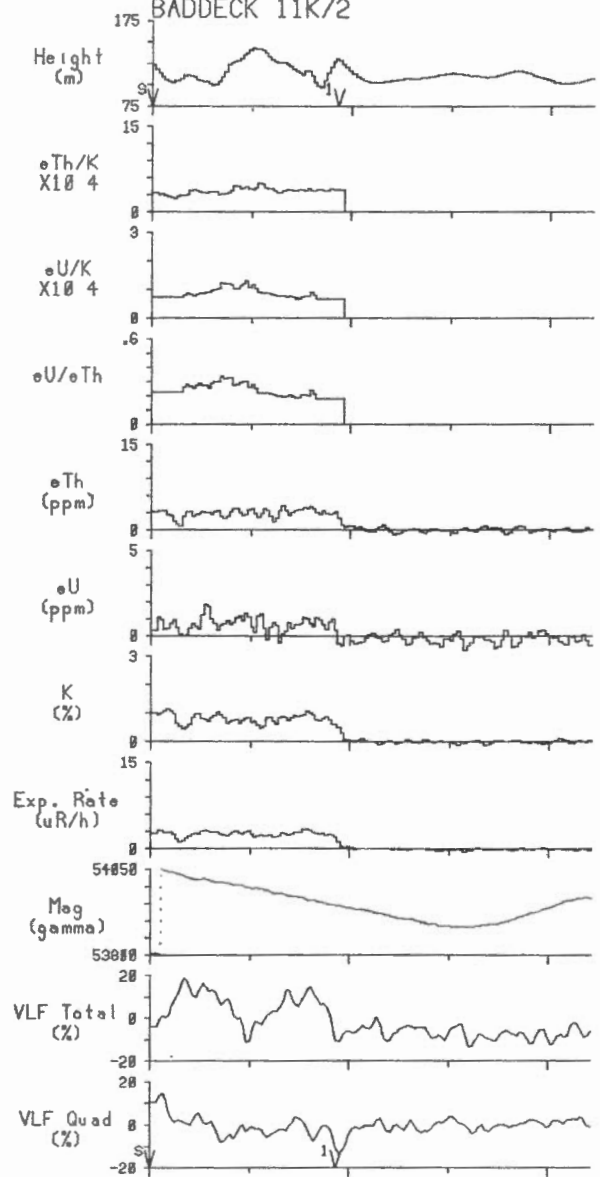


Line 24 | 2 km | Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

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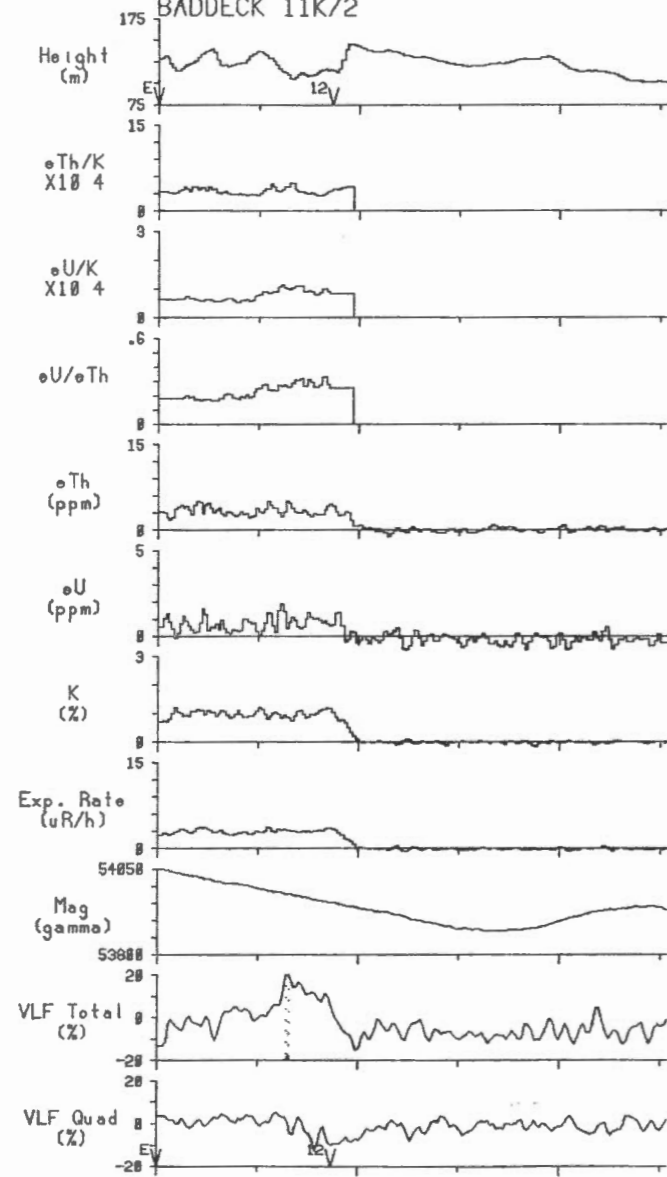


Line 25 | 2 km | Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

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Line 26

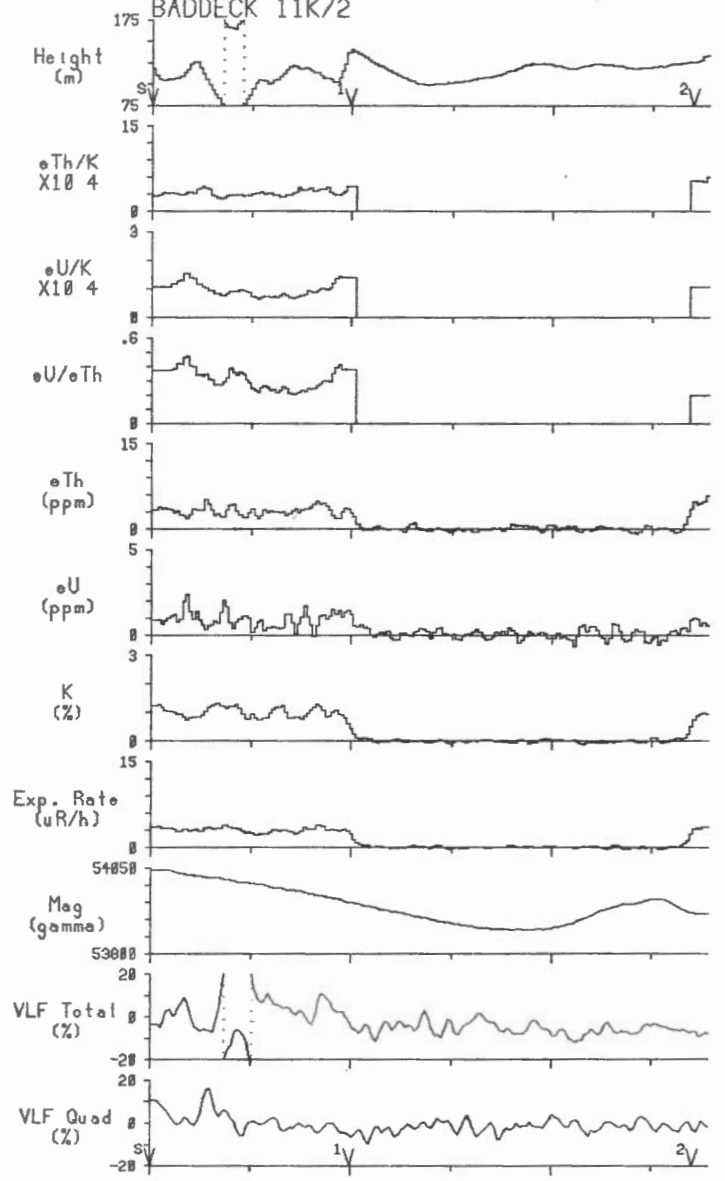
2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

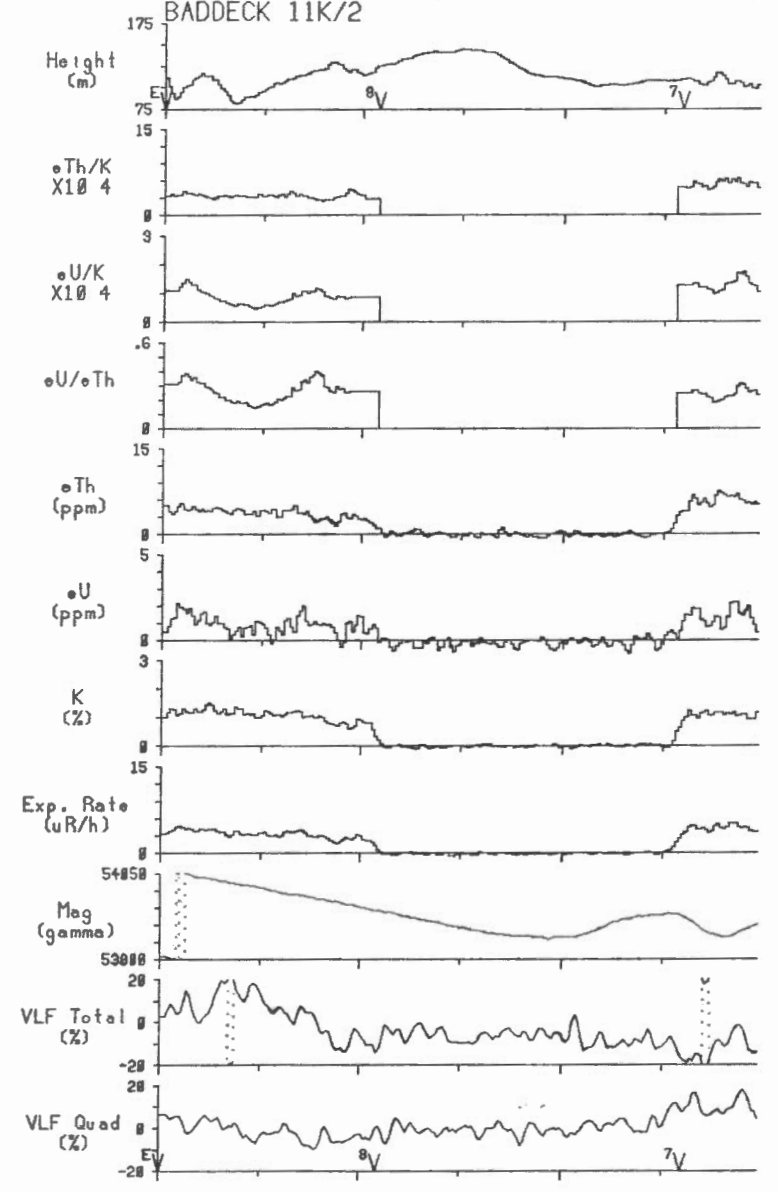
BADDECK 11K/2



Line 27 | 2 km | Scale 1:150000



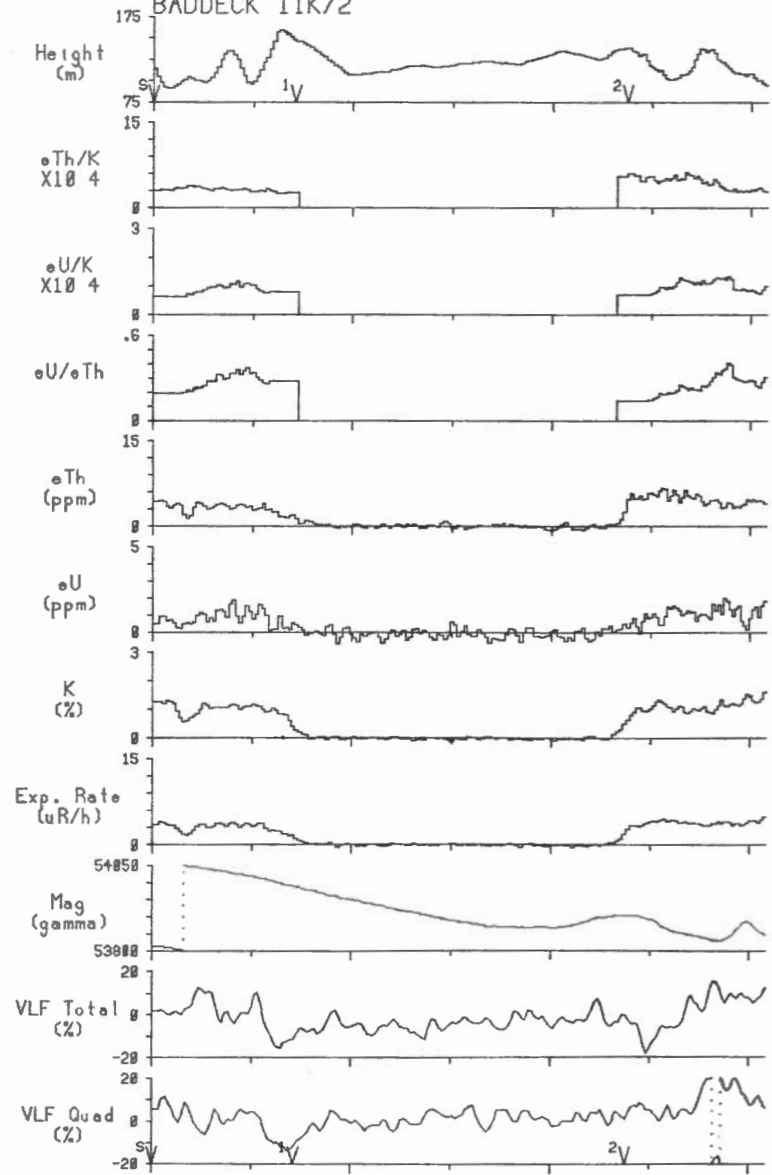
Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
 BADDECK 11K/2



Line 28 | 2 km | Scale 1:150000



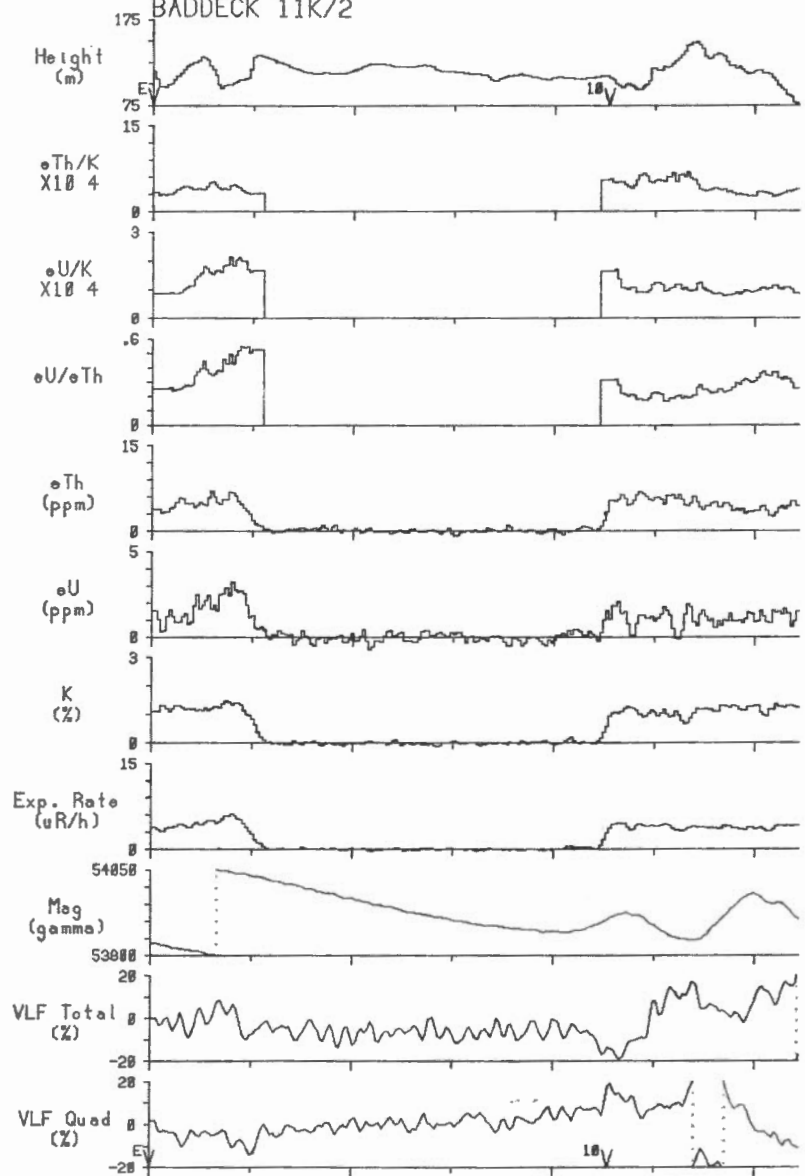
Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
 BADDECK 11K/2





Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2



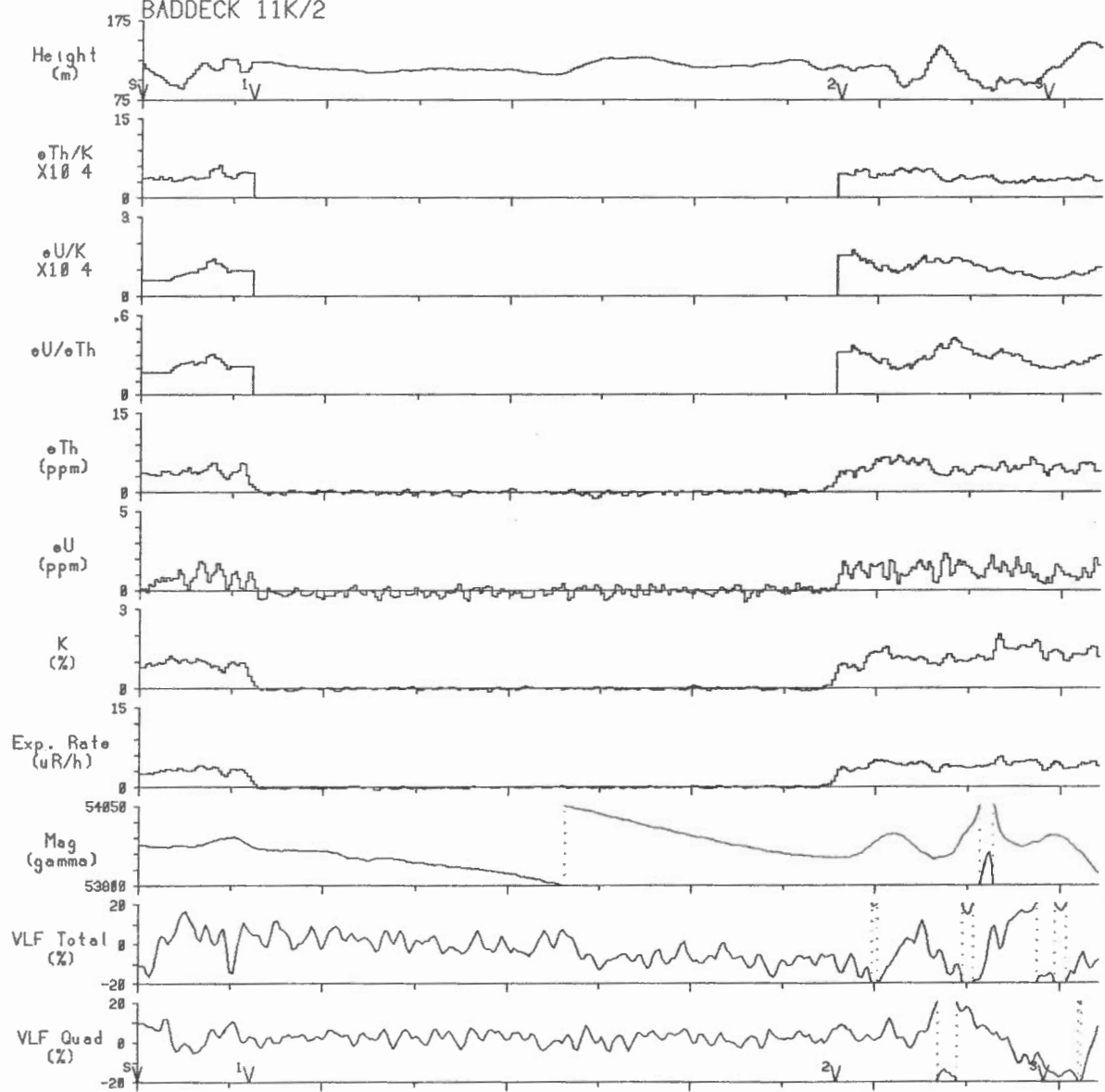
Line 30

2 km

Scale 1:150000



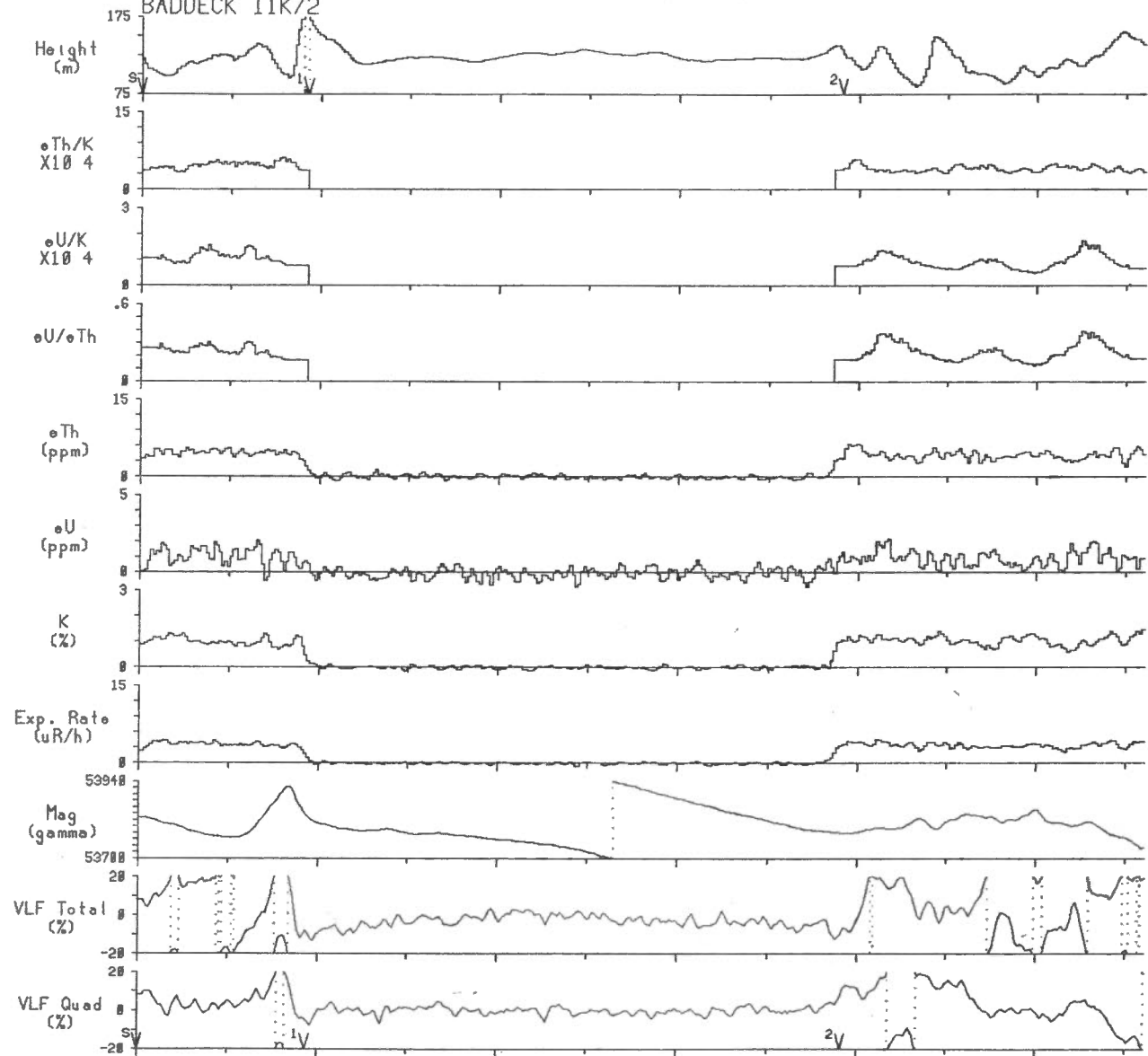
Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
BADDECK 11K/2





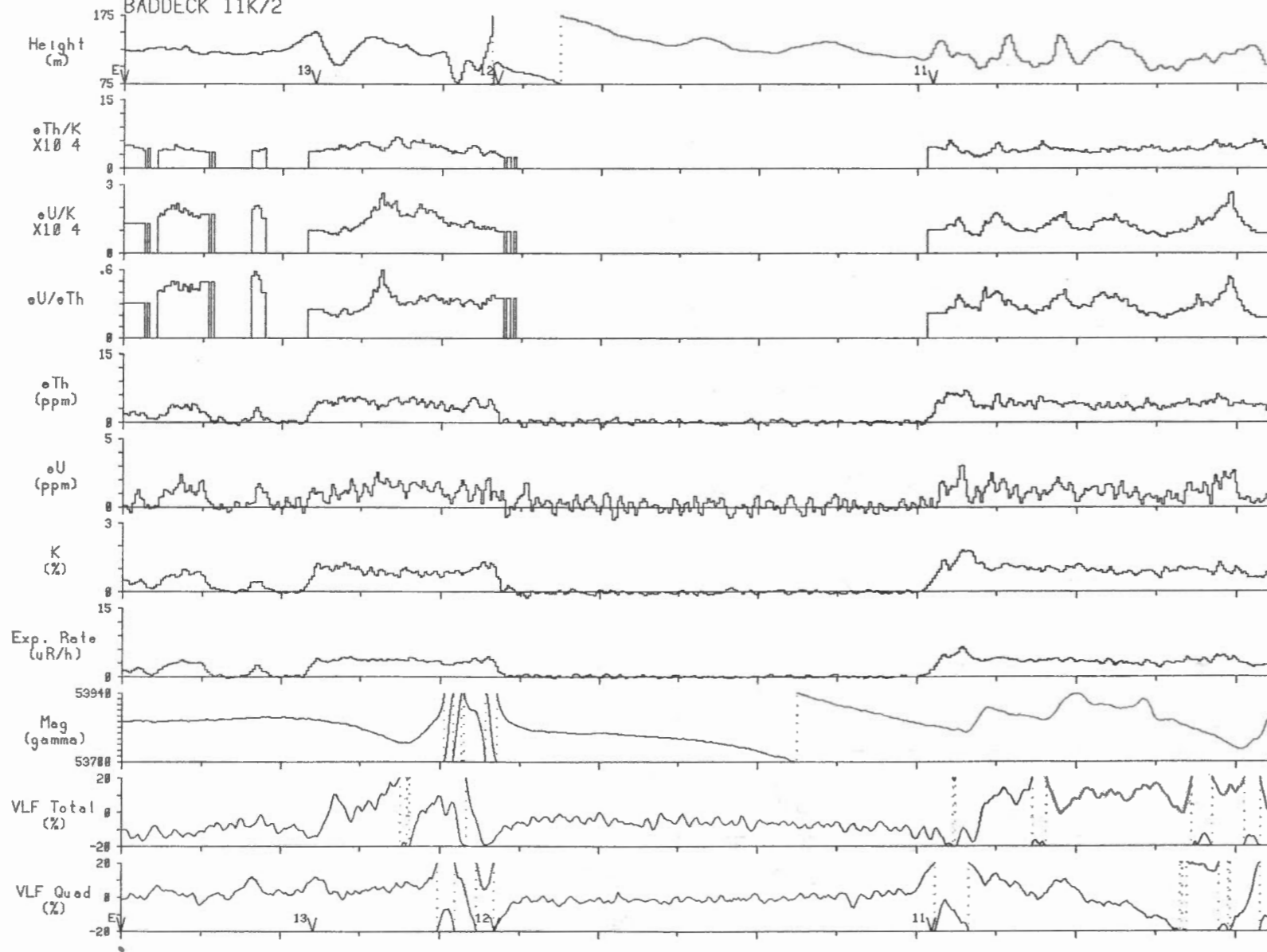
Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2





Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
 BADDECK 11K/2

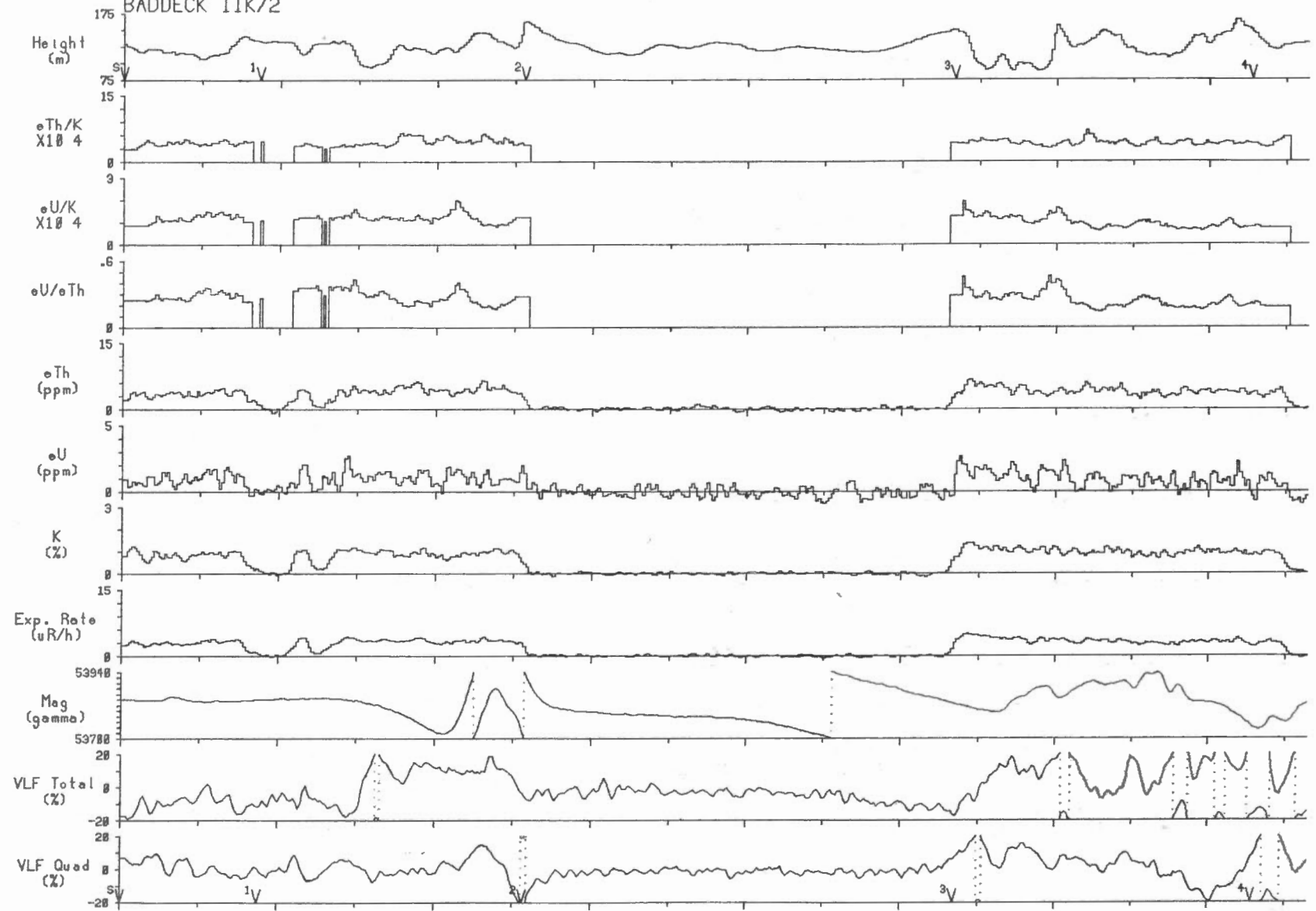


Line 33 | 2 km | Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2



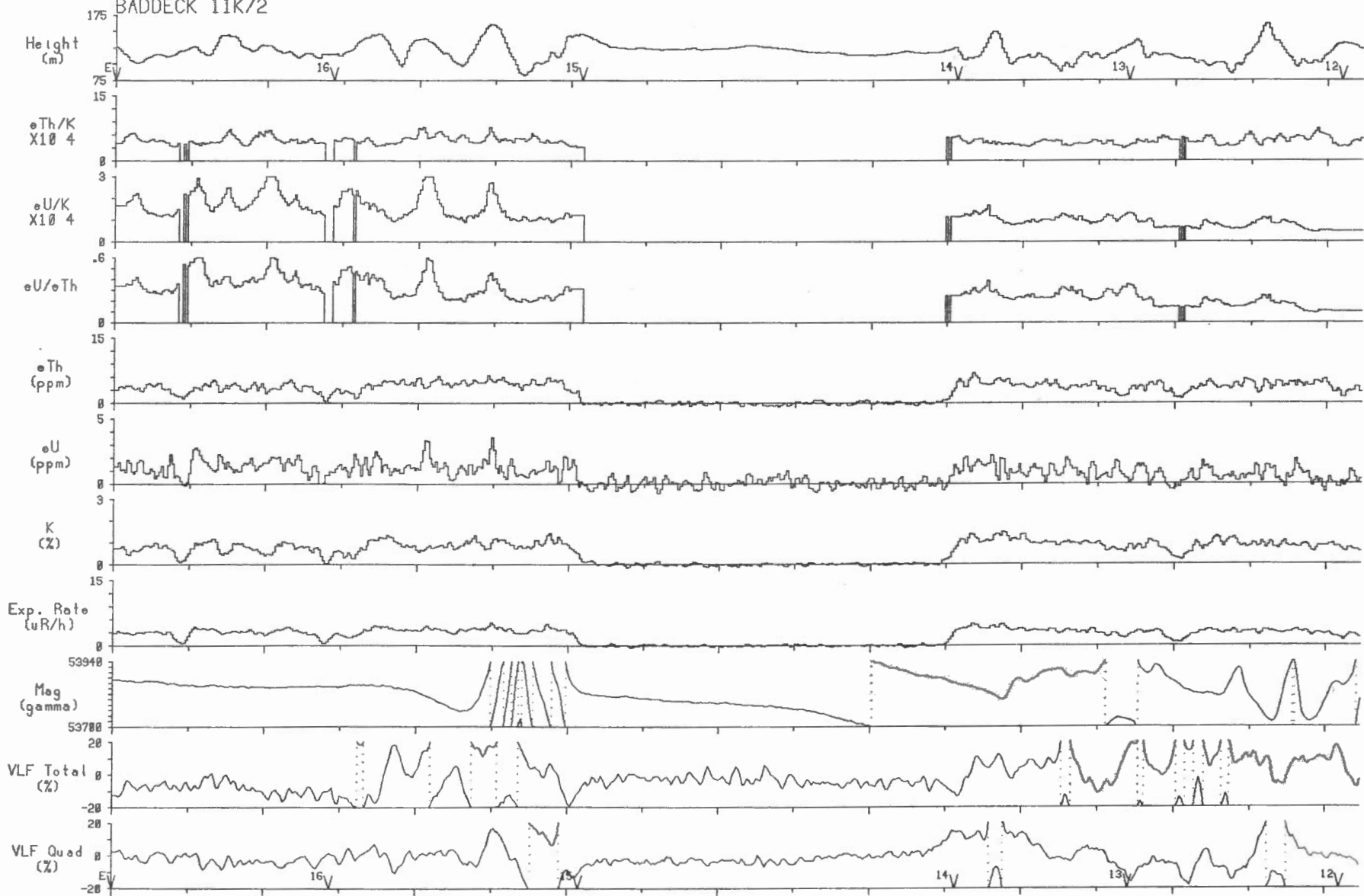
Line 34

2 km

Scale 1:150000



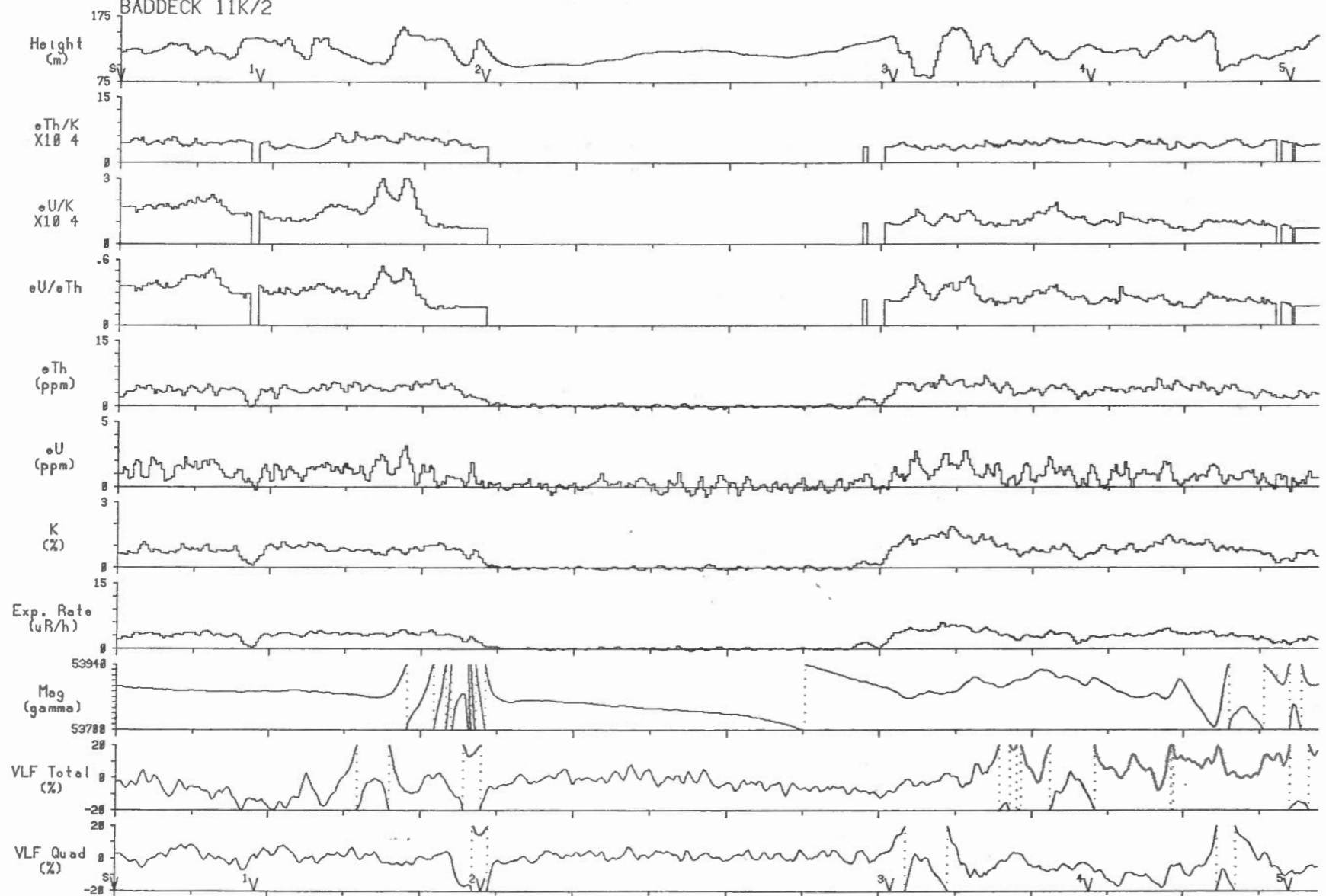
Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)  
 BADDECK 11K/2





Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2



Line 36

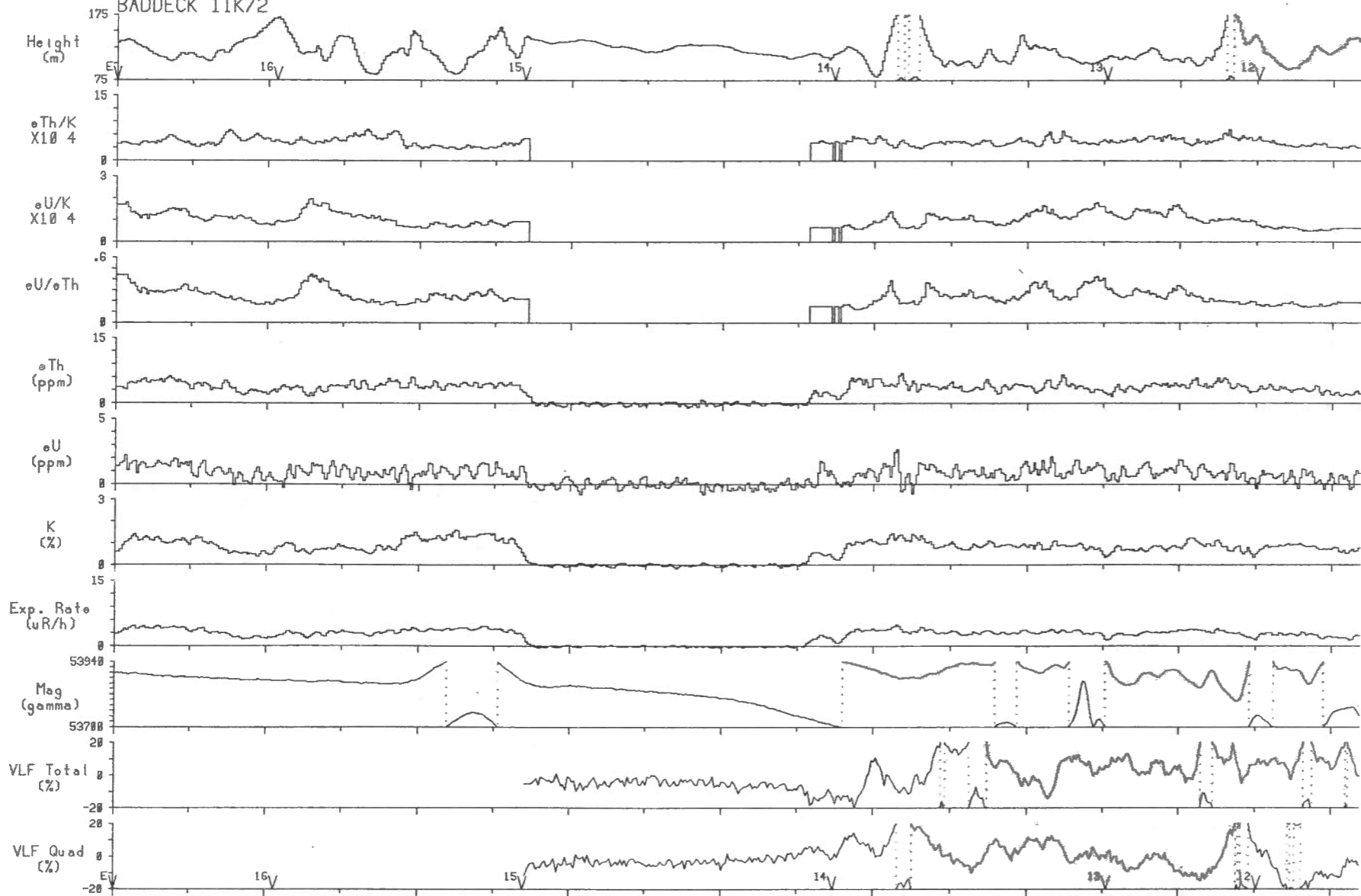
2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2



Line 37

2 km

Scale 1:150000



Bras d'Or Lake Area, N.S. 1990 (line spacing=1 km)

BADDECK 11K/2

