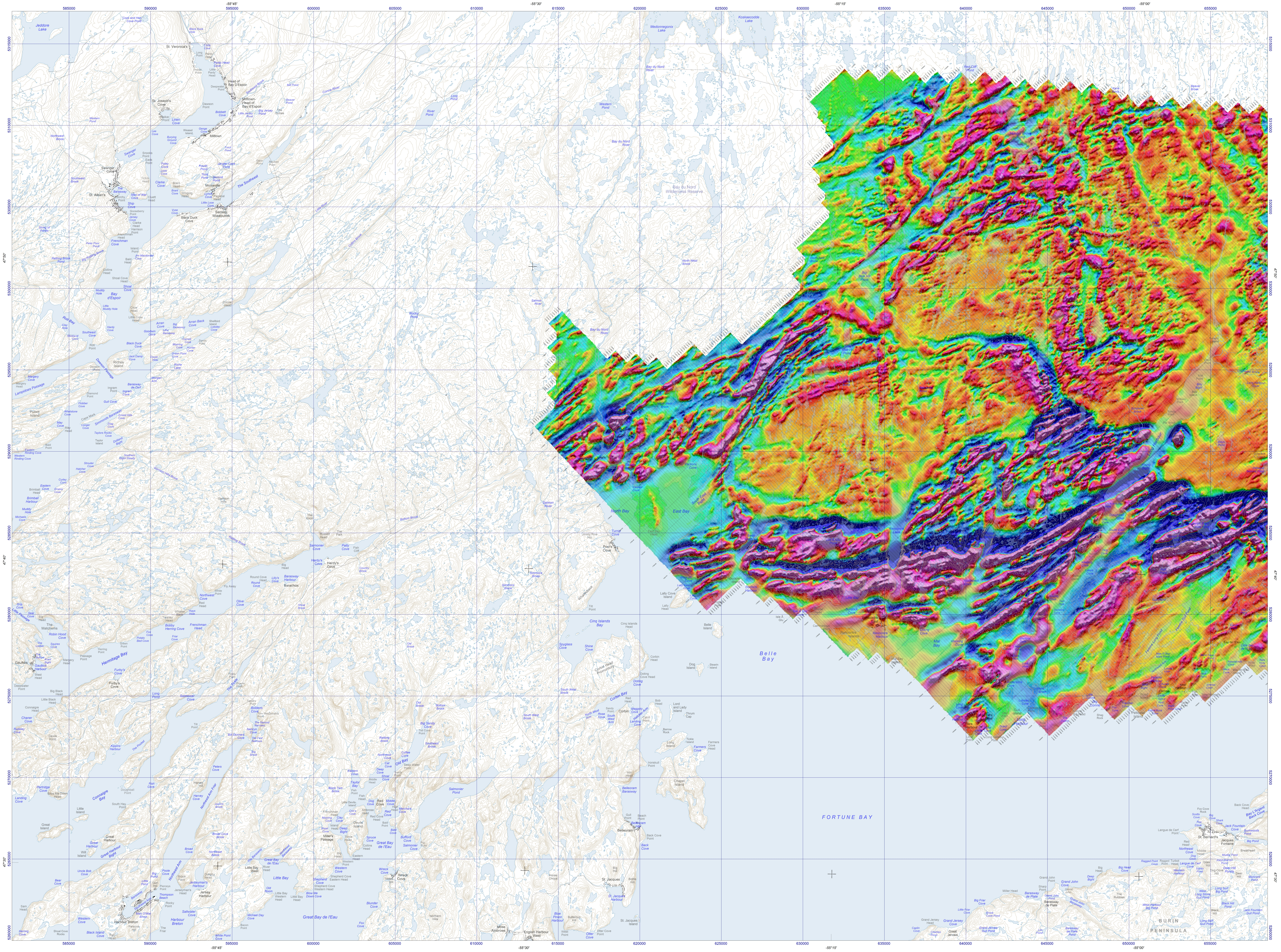
585000
590000
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-55°45'
-55°30'
-55°15'
-55°00'
5315000
5310000
5305000
5300000
5295000
5290000
5285000
5280000
5275000
5270000
5265000
5260000
47°50'
47°40'
47°30'
Jeddore Lake
Cock and Hen Cove Pond
Black Duck Hole
St. Veronica's
Head of Bay D'Espoir
Milltown-Head of Bay d'Espoir
St. Joseph's Cove
Milltown
Swanger Cove
St. Alban's
Morrisville
Samiajij Miawpukek
Black Duck Cove
The Southeast
Conne River
Long Pond
River Pond
Bay d'Espoir
Roti Bay
Riches Island
Dawson Passage
Lampidoes Passage
Pullett Island
Medonnegonix Lake
Koskaecodde Lake
Bay du Nord River
Western Pond
Bay du Nord Wilderness Reserve
North West Brook
Salmon River
Rocky Pond
Hungry Grove Pond
Red Cliff Pond
North East Brook
Big Blue Hill Pond
Little Blue Hill Pond
Kane Brook
Beaver Brook
North Bay
East Bay
Turnip Cove
Pool's Cove
Hardy's Cove
Barachoix
Hermitage Bay
Gaultois
Furby's Cove
Connaigre Bay
Great Harbour
Harbour Breton
Jersey Harbour
Little Bay
Great Bay de l'Eau
Wreck Cove
Salmonier Pond
Old Bay
Cinq Islands Bay
Belle Bay
Corbin
Corbin Bay
Chapel Island
Belleoram
St. Jacques
Mose Ambrose
English Harbour West
FORTUNE BAY
Rencontre East
Rencontre Lake
Mal Bay
Long Harbour
Femme
Femme Long Pond
Femme Gull Pond
New Harbour
Bay de l'Eau
Petticoat Island
Young Bight
St. Bernard's
Jacques Fontaine
Grand John Point
Barasway de Plate
Grand Jersey Cove
Great Jervais
BURIN PENINSULA

Digital topographic data provided by
Geomatics Canada, Natural Resources Canada
Topographic contours at 40 metre interval

# Newfoundland & Labrador
Industry, Energy and Technology

## AIRBORNE GEOPHYSICAL SURVEY OF THE TERRENCEVILLE AREA, SOUTH COAST, NEWFOUNDLAND

Map Sheet 1 - Parts of NTS
1M/10, 1M/11, 1M/14, and 1M/15

## FIRST VERTICAL DERIVATIVE OF RESIDUAL MAGNETIC FIELD

Open File NFLD/3443, Map 2024-76
Map 4 of 42

### ABOUT THE SURVEY

### Introduction

This aeromagnetic gradient, gamma-ray spectrometric, and VLF-EM airborne geophysical survey of Terrenceville area, Newfoundland, was completed by Terraquest Ltd. Acquisition commenced on August 5th 2023 and was completed by October 1st using a Piper Navajo PA31-310 (C-GJBG) and a Beechcraft King Air C90 (C-GCFZ). The nominal traverse and control line spacings were 150 m and 1000 m respectively and the aircraft flew at a pre-planned drape surface at a mean terrain clearance of 131.4 m at a mean speed of 75.8 m/s. Traverse lines were oriented 135° with orthogonal (045°) control lines. The fight path was recovered using a real-time differential GPS navigation system. Terraquest uses a DAARC500 (RMS Instruments Inc.) for magnetic compensation and data acquisition.

### Gamma-ray Spectrometer Data

The airborne gamma-ray measurements were made by a gamma-ray spectrometer using a RS-501 and RSX-5 system by Radiation Solutions Inc. This system included the downward detector of 33.6 L (8 NaI crystals) and an upward detector of 8.4 L (2 NaI crystals). The upward detector was used to monitor variations in background radiation caused by atmospheric radon and was positioned such that it was shielded by the downward crystal array. Each crystal wass individually gain stabilized using a sophisticated multi-peak approach, effectively eliminating the need for any pre-stabilization with external sources (Terraquest also uses external sources).

Potassium is measured directly from the 1460 keV gamma-ray photons emitted by potassium-40 (40K), whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products, bismuth-214 (214Bi) for uranium and thallium-208 (208Tl) for thorium. These daughter products 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: 1370-1570 keV, 1660-1860 keV and 2410-2810 keV, respectively.

Gamma-ray spectra were acquired at one-second intervals. Data processing followed standard procedures as described in IAEA (1991) and IAEA (2003). During processing, the spectra were energy calibrated, and counts were accumulated into the windows as described above.

Counts from the radon detectors were recorded in a 1660 - 1860 keV window and radiation at energies greater than 3000 keV was recorded in the cosmic window. The window counts were corrected for background activity of cosmic radiation, radioactivity of the aircraft and atmospheric radon decay products. The window data were then corrected for special scattering in the ground, air and detectors. Corrections for deviations from the planned terrain clearance and for variation of temperature and pressure were made prior to conversion to ground concentrations of potassium, uranium and thorium, using factors determined from calibration fights over the Breckenridge, Quebec calibration range.

Results of this airborne gamma-ray spectrometer survey represent the average surface concentrations in the region. These results were influenced by overburden, vegetation cover, soil moisture and surface water. As a result, the measured concentrations are typically lower than the actual concentrations in the survey area.

### Magnetic Data

The measured magnetic field was sampled 10 times per second using three split-beam cesium vapor magnetometers (Geometrics 822A) mounted inside two wingtip pods of the aircraft and a tail boom. This sensor array forms a horizontal magnetic gradiometer. By knowing the precise location of the three magnetic sensors in space the In-Line and Cross-Line gradients are calculated. This calculation can be extended to produce the East-West and North-South gradients referenced to geographic North. Furthermore, a Reconstructed Total Field (RTF) is calculated from horizontal gradient data using a method described by Nelson (1994).

The tail magnetometer is used to produce a Total Magnetic Intensity (TMI). For the TMI, the data is lag corrected, and, statistically levelled using the differences in magnetic values at the intersections of traverse and tie lines. The International Geomagnetic Reference Field (IGRF) defined at the average elevation of 320 m for the date October 10th, 2023 was then removed from the statistically levelled corrected magnetic data. Removal of the IGRF, representing the magnetic field of the Earth's core, yields a residual component related essentially to magnetizations within the Earth's crust.

The first vertical derivative of the magnetic field is the rate of change of the magnetic field in the vertical direction. Computation of the first vertical derivative removes long wavelength features of the magnetic field and significantly improves the resolution of closely spaced and superimposed anomalies (Hood, 1965). Similar to the first vertical derivative, the analytic signal of the total magnetic intensity is calculated to highlight regional gradients in the data and to help resolve overlapping anomalies (Miller and Singh, 1994). The tilt derivative is calculated to help identify shallow basement structures.

### VLF-EM Data

Very low frequency (VLF) electromagnetic data were measured by a Matrix-Plus™ VLF-EM system, consisting of 3 orthogonal receiver coils mounted in the tail stinger and a recorder in the cabin of the aircraft. The outputs are the Total Field Amplitude (to the transmitter), the Tilt Angle of the field, Azimuth (to the transmitter), and the Vertical and Planar Ellipticity. From these data, the In-Phase and Quadrature compinents of the vertical magnetic field can be calculated - as a percentage of the horizontal primary field (ie. the tangent of the Tilt Angle and Ellipticity).

The VLF stations monitored during survey are selected prior to the start of survey based on expected station availability and accessible signal. However, not all stations monitored yielded usable signal. Generally, the quality of the signal is dictated by the transmitter source power and its distance from the survey area. Furthermore, as with all electromagnetic (EM) wave propagation, the quality and/or power of the signal may be further degraded by the natural earth features between the transmitter source and the receiver. During this survey, only the recorded signal from the NAA-Culter, Maine (24.0kHz) transmitter provided consistent data with a suitable signal to noise ratio.

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International Atomic Energy Agency, 2003. Guidelines for Radioelement Mapping Using Gamma Ray Spectrometry Data. Technical Reports Series, No. 1363, IAEA, Vienna.

Miller, H.G., and Singh, V.J., 1994. Potential field tilt - A new concept for location of potential field sources. Applied Geophysics, 32, 213-217.

Nelson, J.B., 1994. Leveling total-field aeromagnetic data with measured horizontal gradients. Geophysics, 59, 1166-1170.

### Data Accessibility

Data compilation and initial map preparation were performed by Terraquest Ltd., Markham, Ontario. Contract and project management were provided by the Newfoundland and Labrador Department of Industry, Energy and Technology.

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Copies of this map may be obtained from the Geological Survey, Department of Industry, Energy and Technology, Government of Newfoundland and Labrador, PO Box 8700, St John's, NL, Canada, A1B 4J6. This map is subject to revision and modification. Comments to the author concerning errors or omissions are invited.

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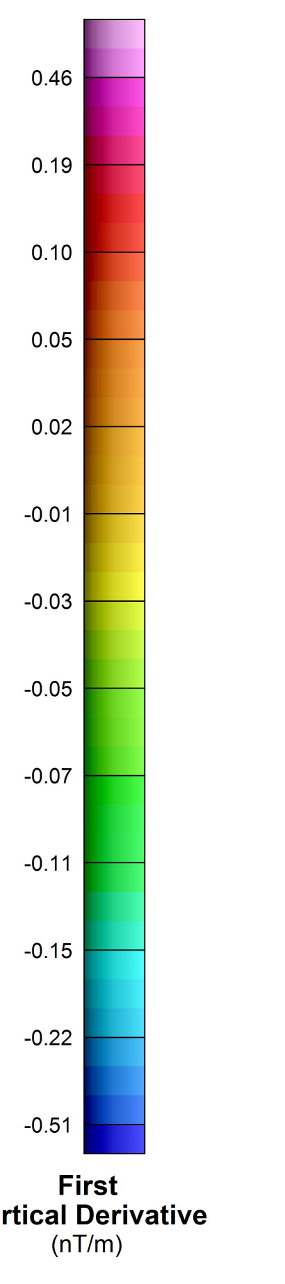
Geoscience Online website: https://gis.geosurv.gov.nl.ca
Email: pub@gov.nl.ca

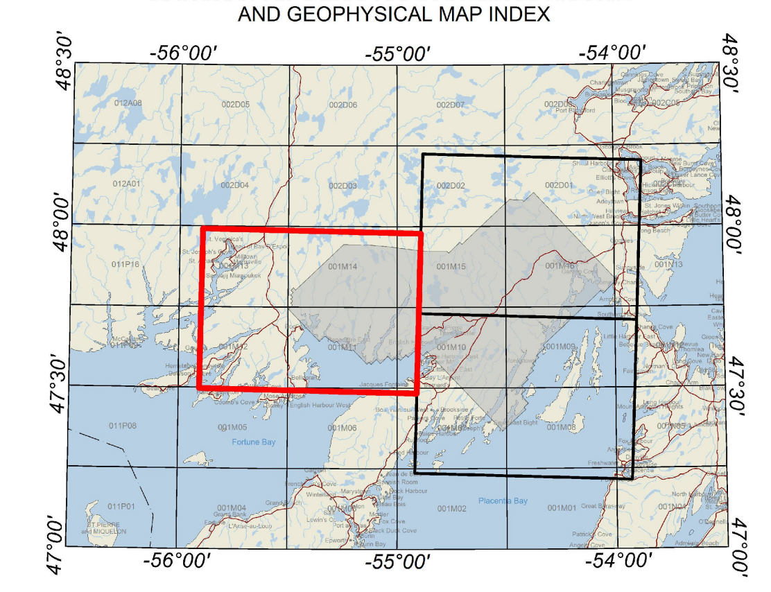


First
Vertical Derivative
(nT/m)

LOCATION MAP

52°
-58°
-56°
-54°
51°
50°
49°
48°
47°
NEWFOUNDLAND

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE
AND GEOPHYSICAL MAP INDEX


48°30'
48°00'
47°30'
47°00'
-56°00'
-55°00'
-54°00'

Planimetric Symbols

Topographic Contour ................................
Water Body and Drainage ..........................
Road ..................................................
Building ..............................................
Powerline ............................................
Flightline ............................................

MAP 2024-76

## FIRST VERTICAL DERIVATIVE OF RESIDUAL MAGNETIC FIELD

**Airborne Geophysical Survey**
**Terrenceville Area, South Coast, Newfoundland**

Map Sheet 1 - Parts of NTS
1M/10, 1M/11, 1M/14, and 1M/15

Scale 1:100 000
2 0 2 4 6
(kilometres)
*NAD83 / UTM zone 21N*
Universal Transverse Mercator Projection
North American Datum 1983

Flown and compiled by
TERRAQUEST
AIRBORNE GEOPHYSICS

Funded by
Atlantic Canada Opportunities Agency
Agence de promotion économique du Canada atlantique
Canada

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