

# New Regional Surveys of Soil Geochemistry in Northern Ireland



**Mike Young**  
**Geological Survey of Northern Ireland**

**Northern Ireland Soils Workshop**  
**Belfast**

**19<sup>th</sup> January 2006**

**Scotland and Northern Ireland Forum for Environmental Research (SNIFFER)**

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# The Tellus Project

## Tasks

- National regional geochemistry survey
- National airborne geophysical survey

## Objectives

- Refine existing geological and soils maps
- Image and model concealed geology
- Map rural and urban geochemical conditions

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# Project goals

- To provide the basic information for controlled development of Northern Ireland's natural resources
  - minerals, hydrocarbons, geothermal
- To establish a geochemical baseline
  - regional scale, rural and urban
- To contribute to sustainable land-use planning
  - contaminated land; land-fills; geo-hazards
- To help to protect human and animal health
  - trace elements, radon gas
- To contribute to compliance with new legislation

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# Funding

- Department of Enterprise Trade and Investment
- The Rural Development Programme, through the Northern Ireland Programme for Building Sustainable Prosperity

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# Stakeholder interests - 1

- Natural resources
  - mining and resources companies
  - monitoring and control
- Environment
  - bio-habitats
  - environmental monitoring (land, water, soils)
  - waste disposal and land-fills
  - radon susceptibility prediction

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# Stakeholder interests - 2

- Agricultural
  - trace elements anomalies and deficiencies
- Medical
  - spatial correlation of geochemistry with disease
- Planning and roads
  - urban re-development
  - geo-hazard prediction

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# EC Directives

- Water Framework Directive
- EC Nitrate Directive
- Directive on Environmental Assessment
- Sewage Sludge in Agriculture Directive
- Habitats and Species Directive
- Directive on Integrated Pollution Prevention and Control
- Framework Directive on Waste
- Soils Directive (pending)

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# Geochemistry – rural soils

- 6,000 sites sampled in 2004-05
- Two sampling depths
- Sampling density 1 per 2km<sup>2</sup>
- 850 remaining samples to be collected in 2006



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# Geochemistry – streams

- Survey completed in November 2005
- 3,300 sites sampled in 2005
- Sampled at 1 site per 2.15km<sup>2</sup>
- Sediments and waters
- Analysis by XRF and ICP



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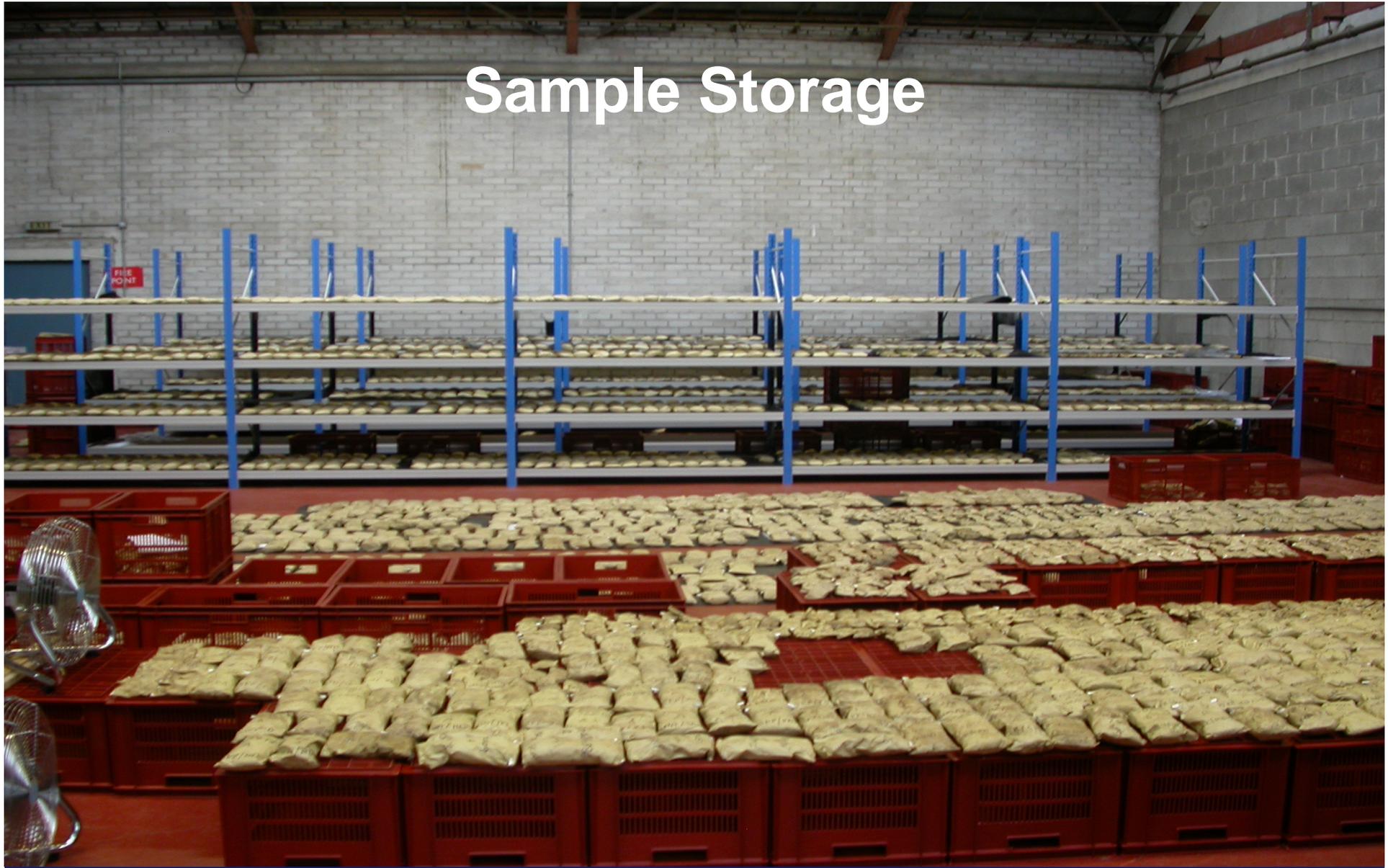
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# Sample Storage



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# Sampling and analysis



## 20cm soil sample

- XRF 40 elements, 12 major oxides
- ICP-MS aqua regia (51 elements)
- pH and Loss On Ignition



## 50cm soil sample

- ICP-MS aqua regia (51 elements)
- ICP-MS "Near-Total" (58 elements)
- Gold, platinum & palladium by fire assay

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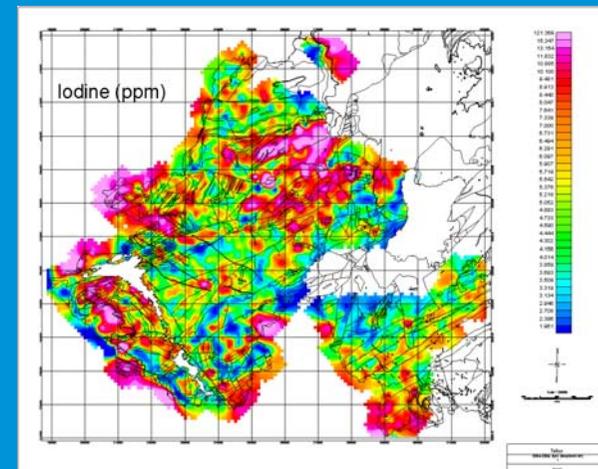
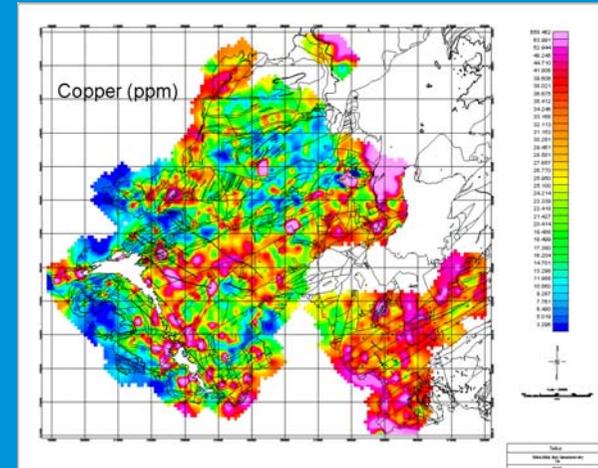


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# Geochemistry products

- Digital datasets, multi-element,
  - rural soils
  - stream sediments
  - stream waters
  - urban soils
- Images, 250 x 250m grid



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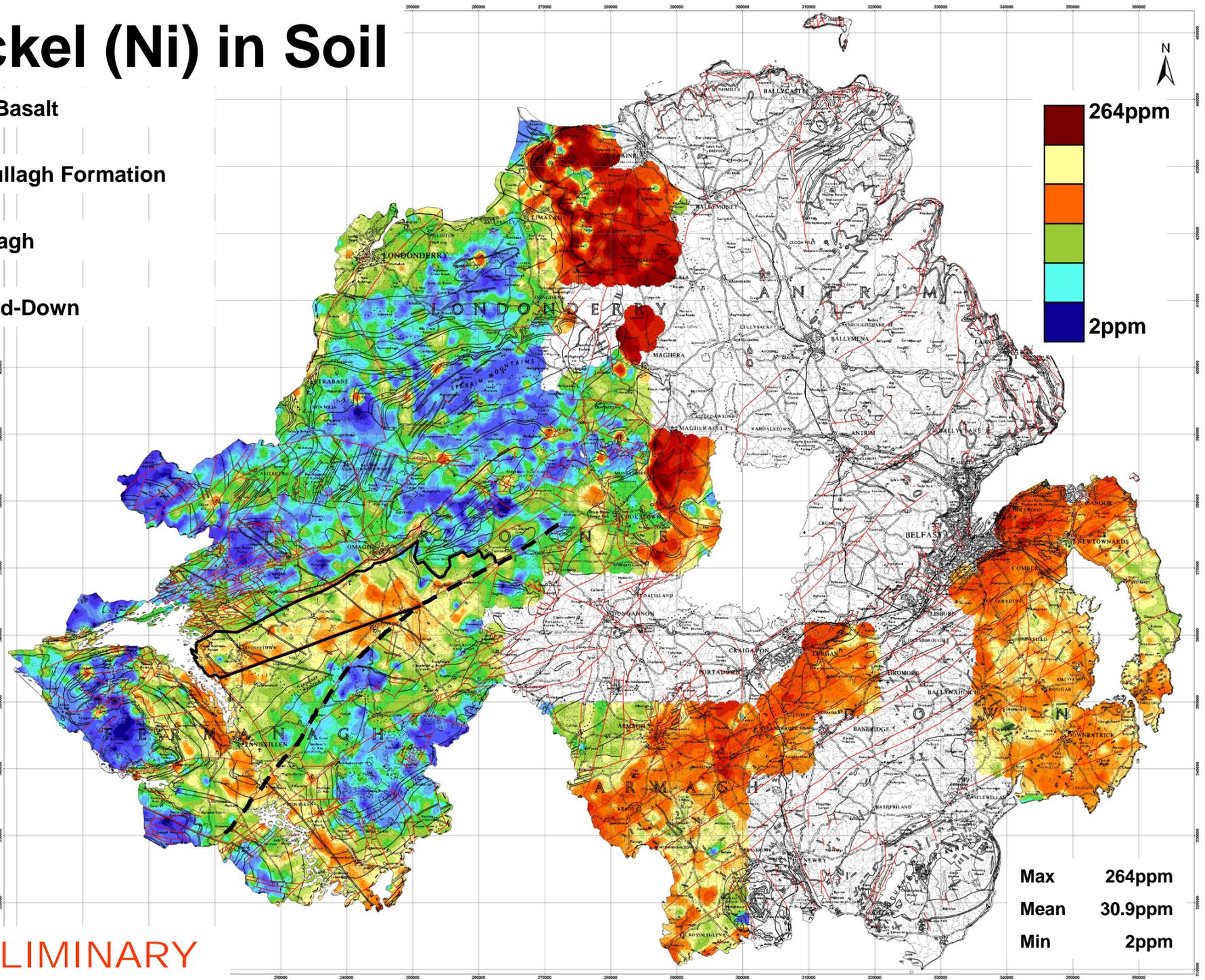
# Nickel (Ni) in Soil

Antrim Basalt

Shanmullagh Formation

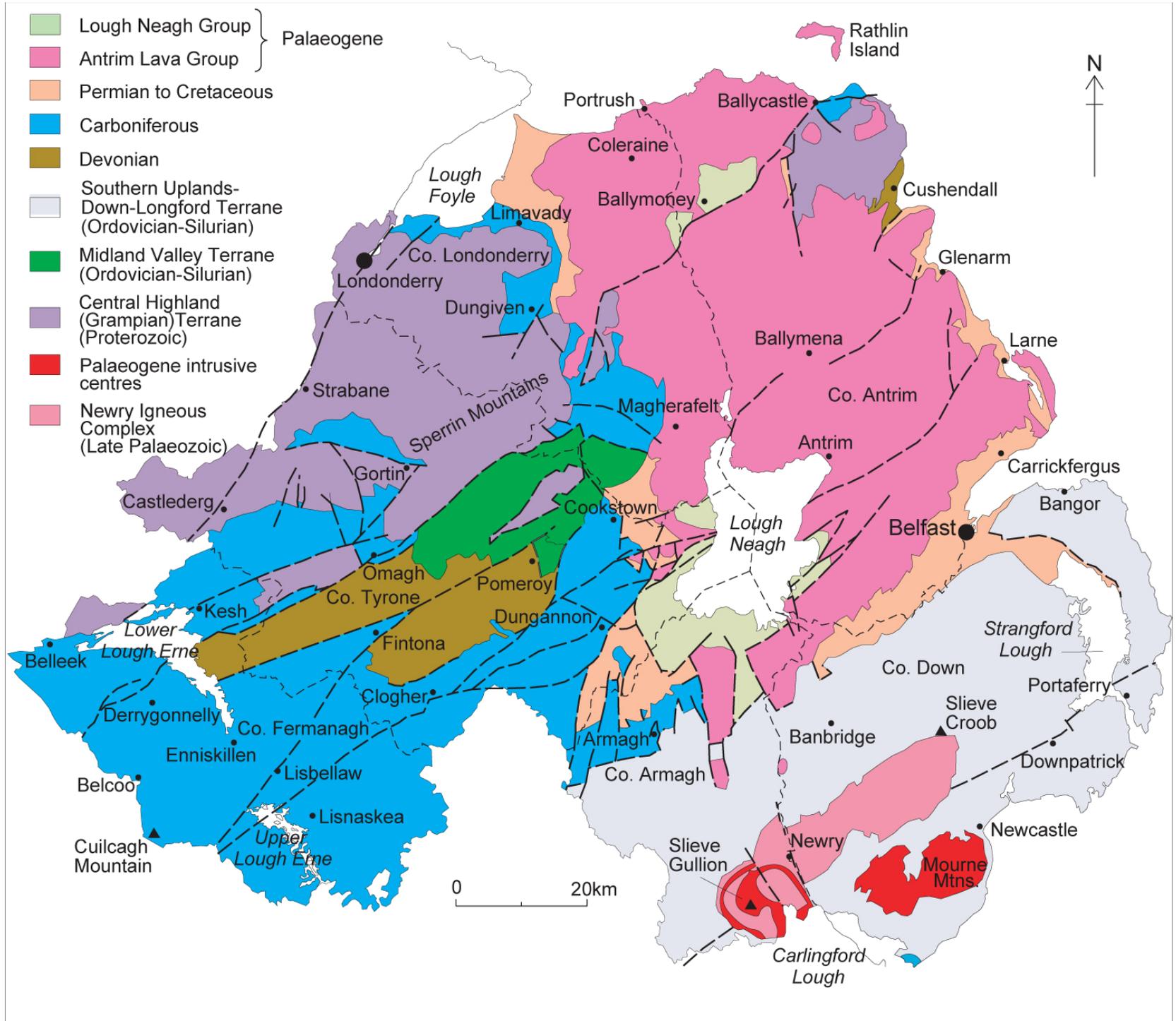
Fermanagh

Longford-Down



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# Geology



# Arsenic (As) in Soil

## Anomalies of Known Mineralisation Source

*N.E. of Omagh*

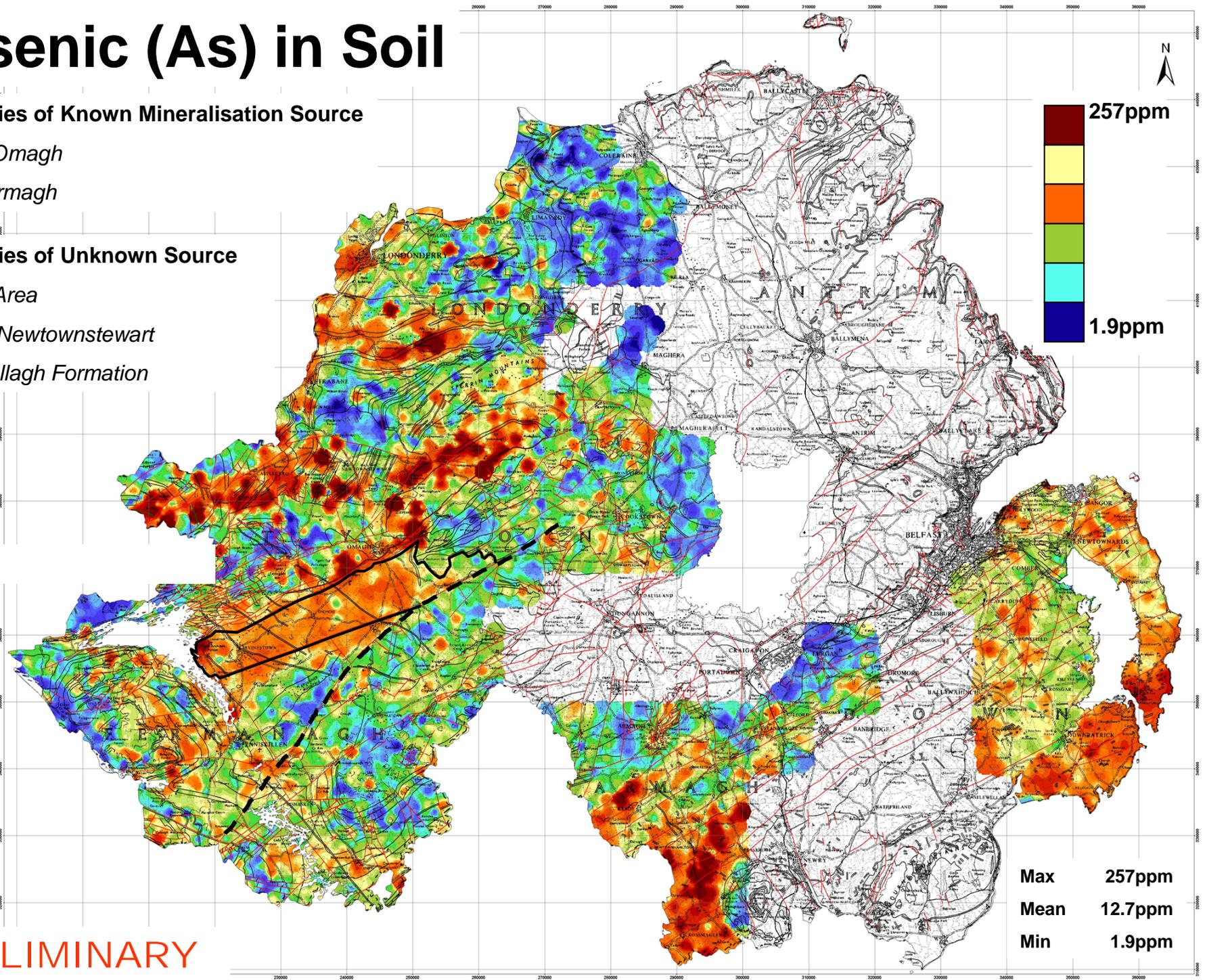
*South Armagh*

## Anomalies of Unknown Source

*Claudy Area*

*Sturrin- Newtownstewart*

*Shanmullagh Formation*



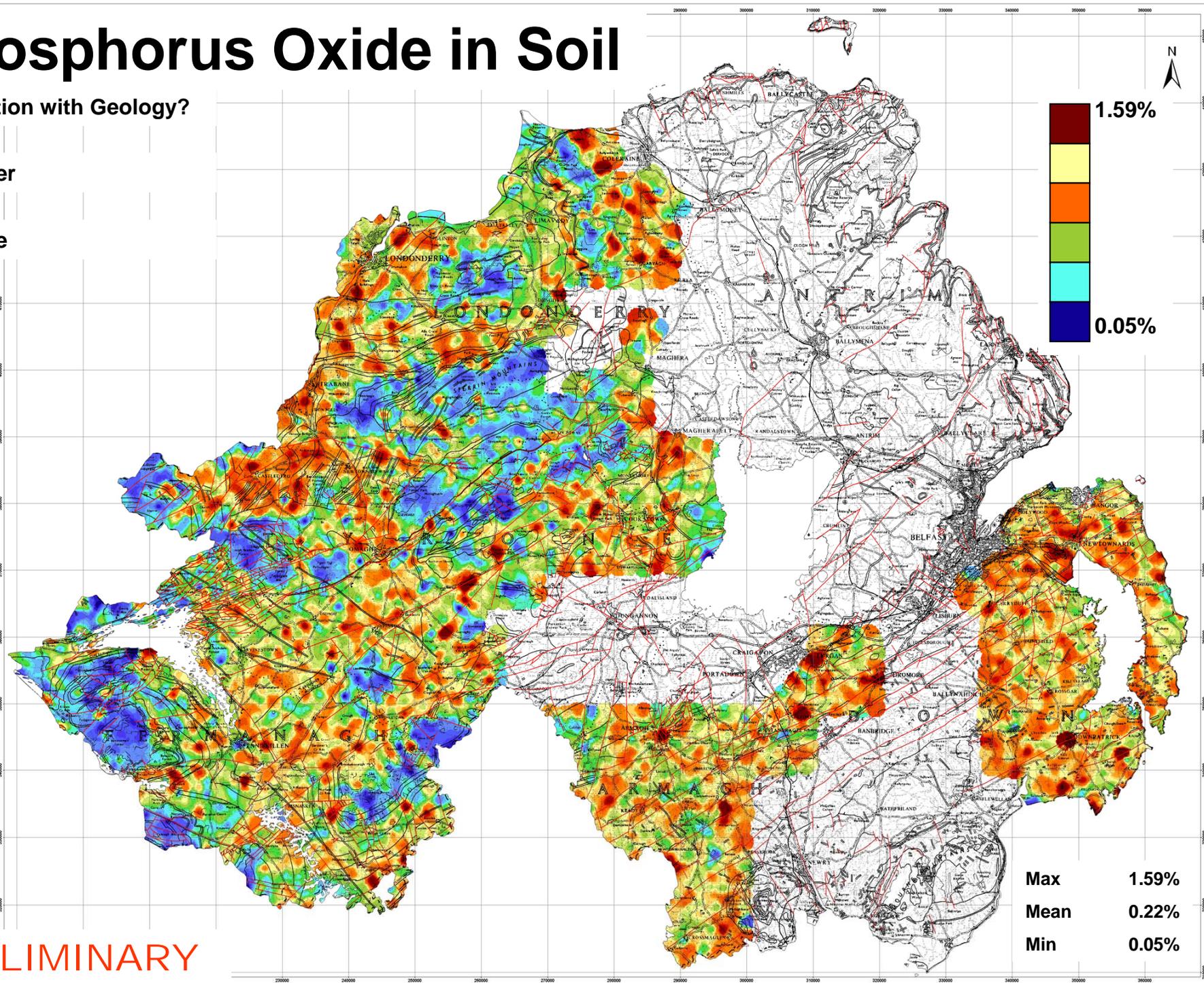
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# Phosphorus Oxide in Soil

Correlation with Geology?

Fertiliser

Landuse



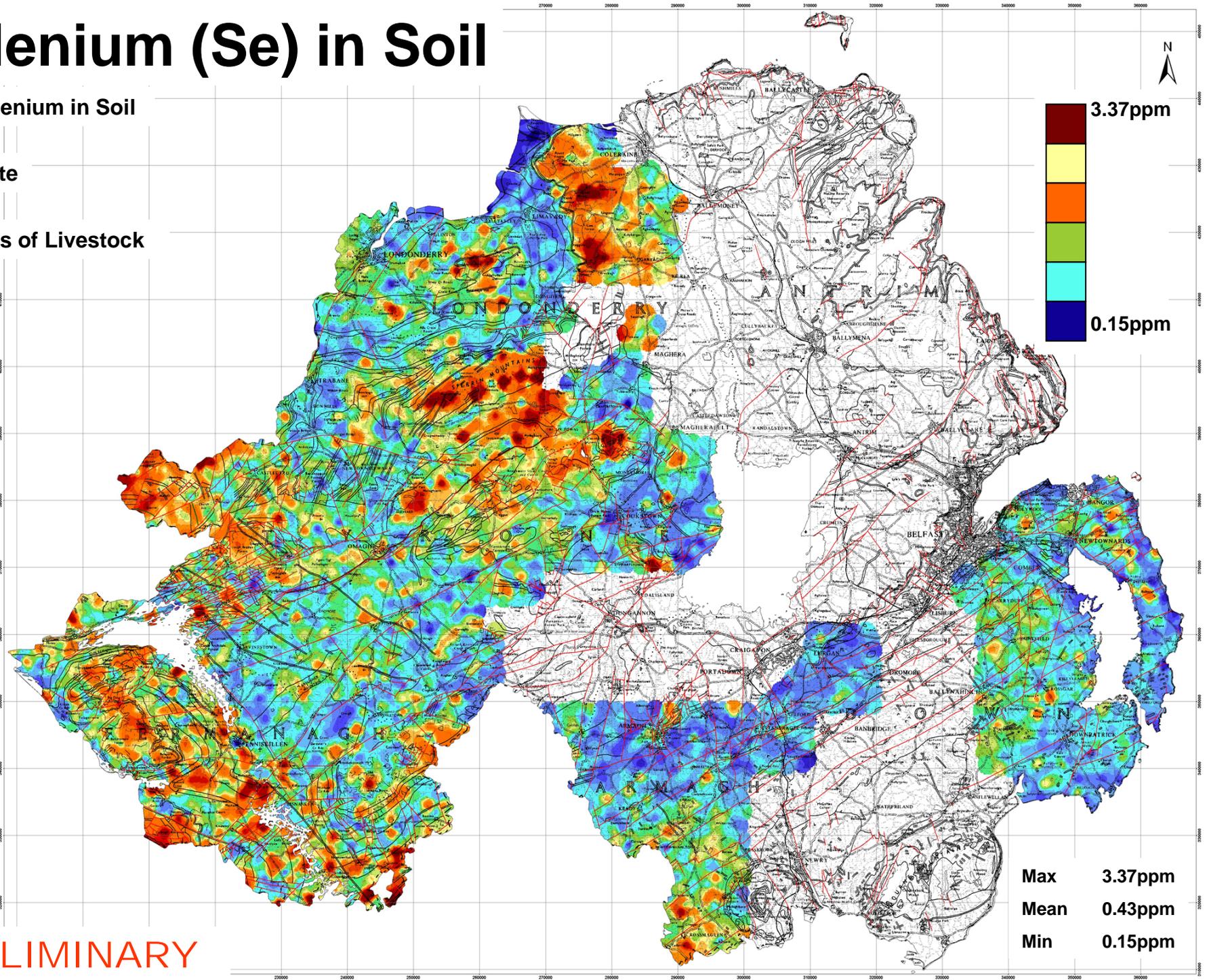
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# Selenium (Se) in Soil

Low Selenium in Soil

Substrate

Diseases of Livestock



PRELIMINARY

# Geochemistry - urban soils 1

- GSUE: Geochemical Survey of the Urban Environment
- Characterises urban geochemistry
- Provides a geochemical framework for more detailed site investigations
- 21 cities surveyed in UK to date

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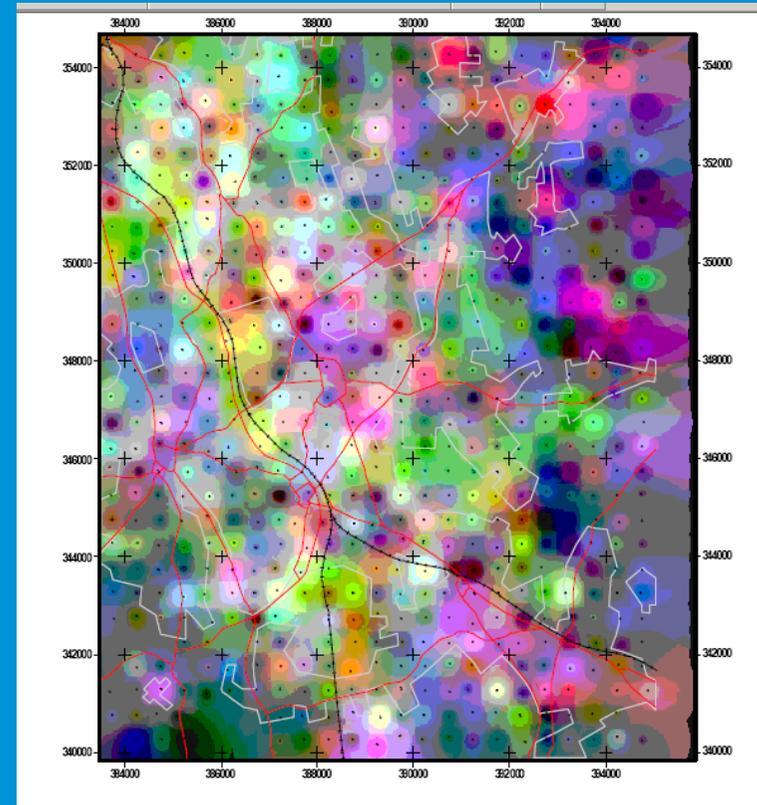


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# Geochemistry - urban soils 2

## GSUE specifications:

- 4 sites per 2km<sup>2</sup>
- 15 and 40 cm sampling depths
- Principally inorganic analytes
- Organic sampling possible



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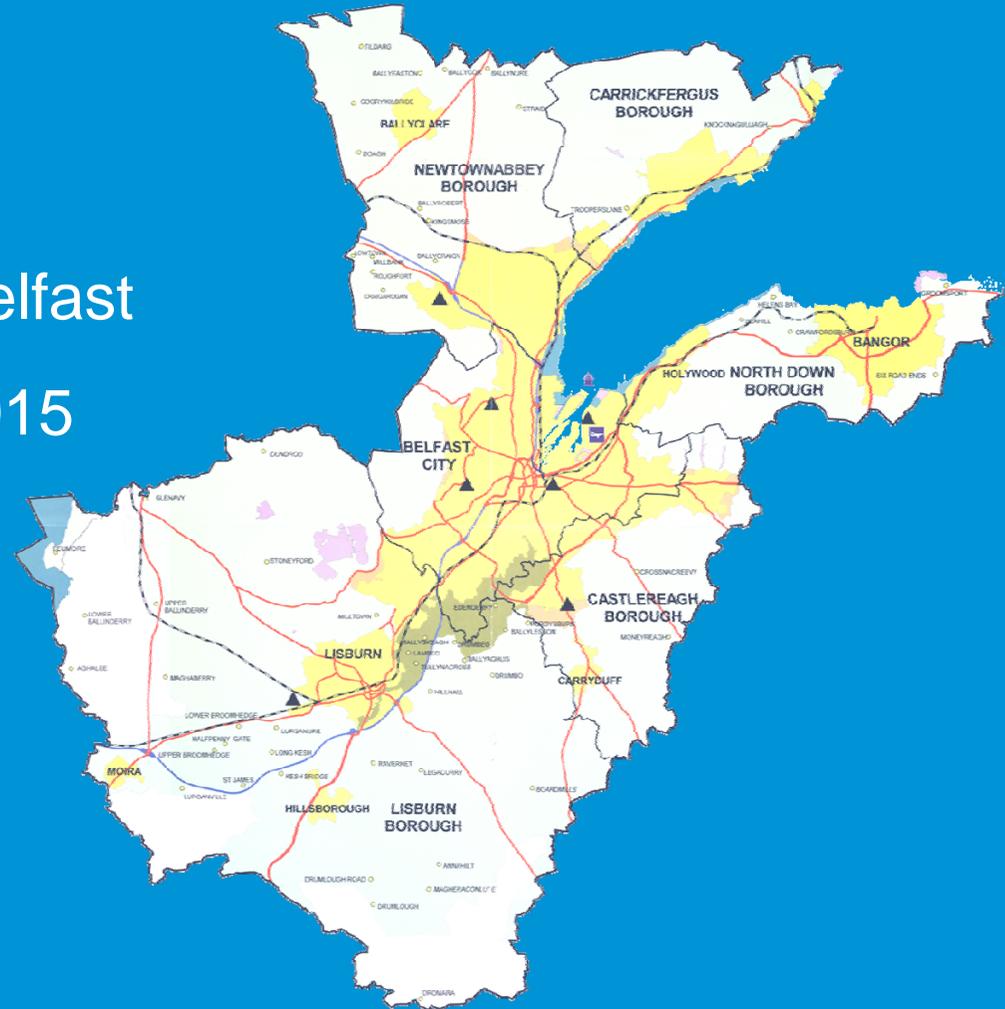
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# Geochemistry - urban soils 3

Proposed survey areas:

- 'Key Settlements' of the Belfast Metropolitan Area Plan 2015
- Londonderry Urban Area
- 230 km<sup>2</sup>, 920 sites



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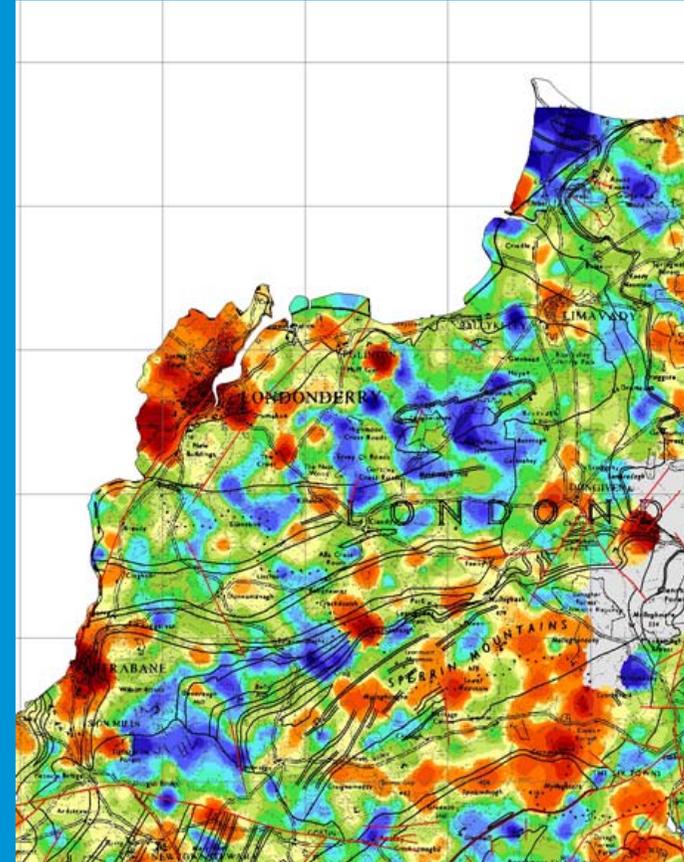
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# Geochemistry - urban soils 4

BMAP 2015 - issues:

- Brownfield development
- Effective protection of the environment
- Transportation links
- Lagan Valley aquifer



Tin in soils - Londonderry

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# Tellus - geophysics

- Data:
  - magnetics
  - ground conductivity
  - radioactivity
- Sampling interval 200m x 65m



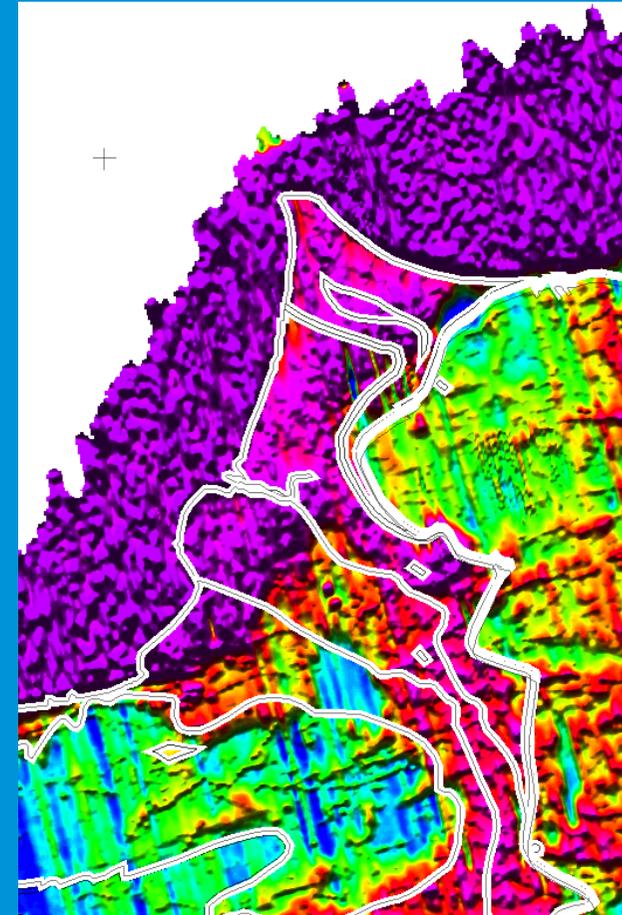
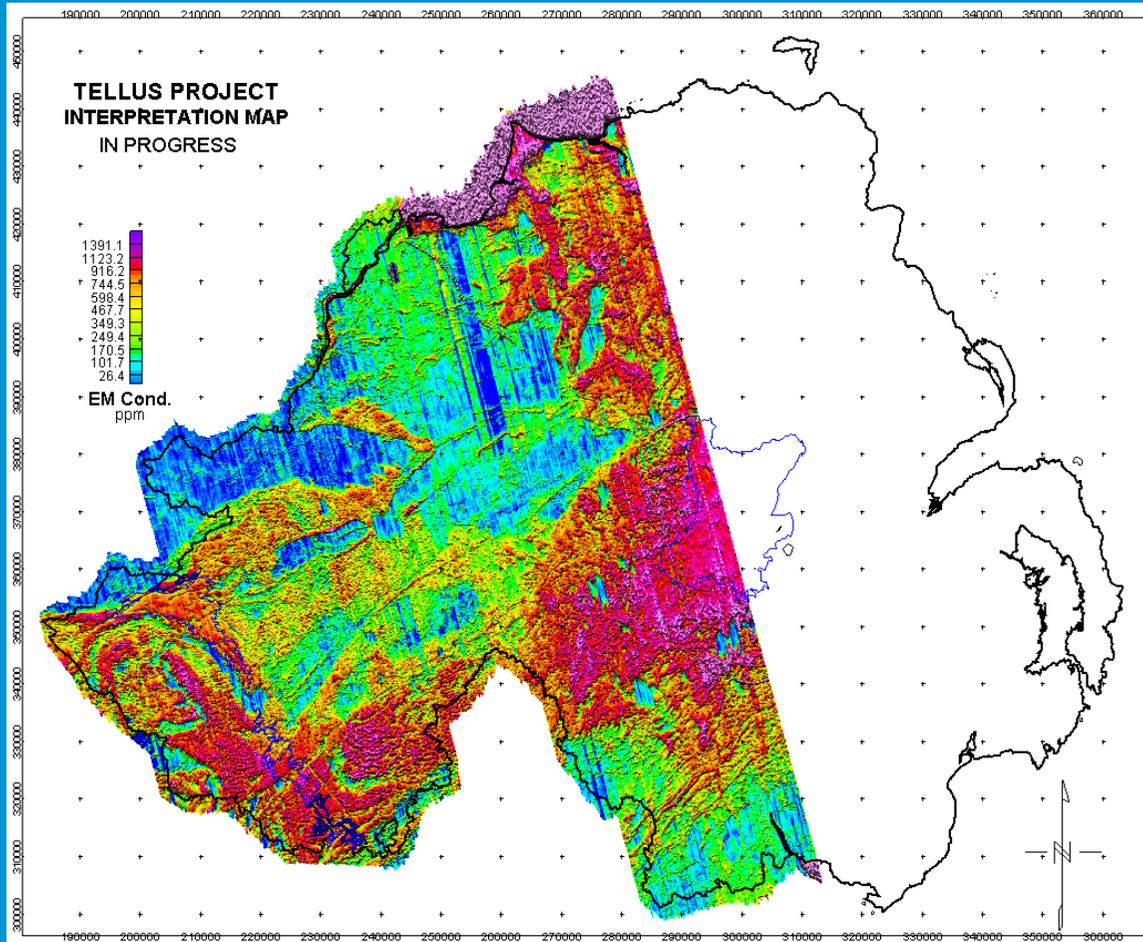
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# Ground conductivity and salinisation



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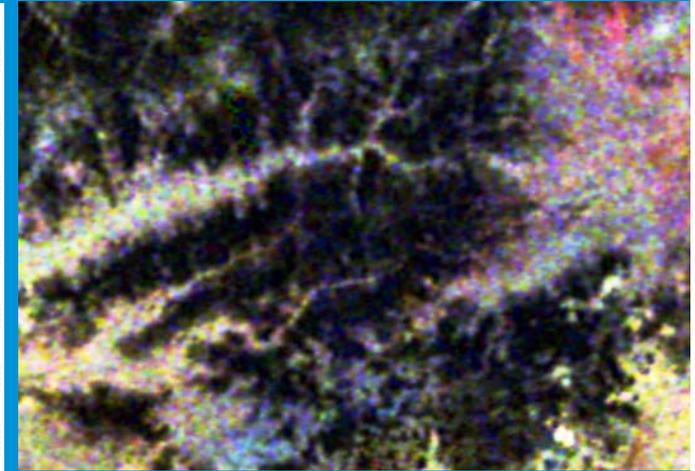
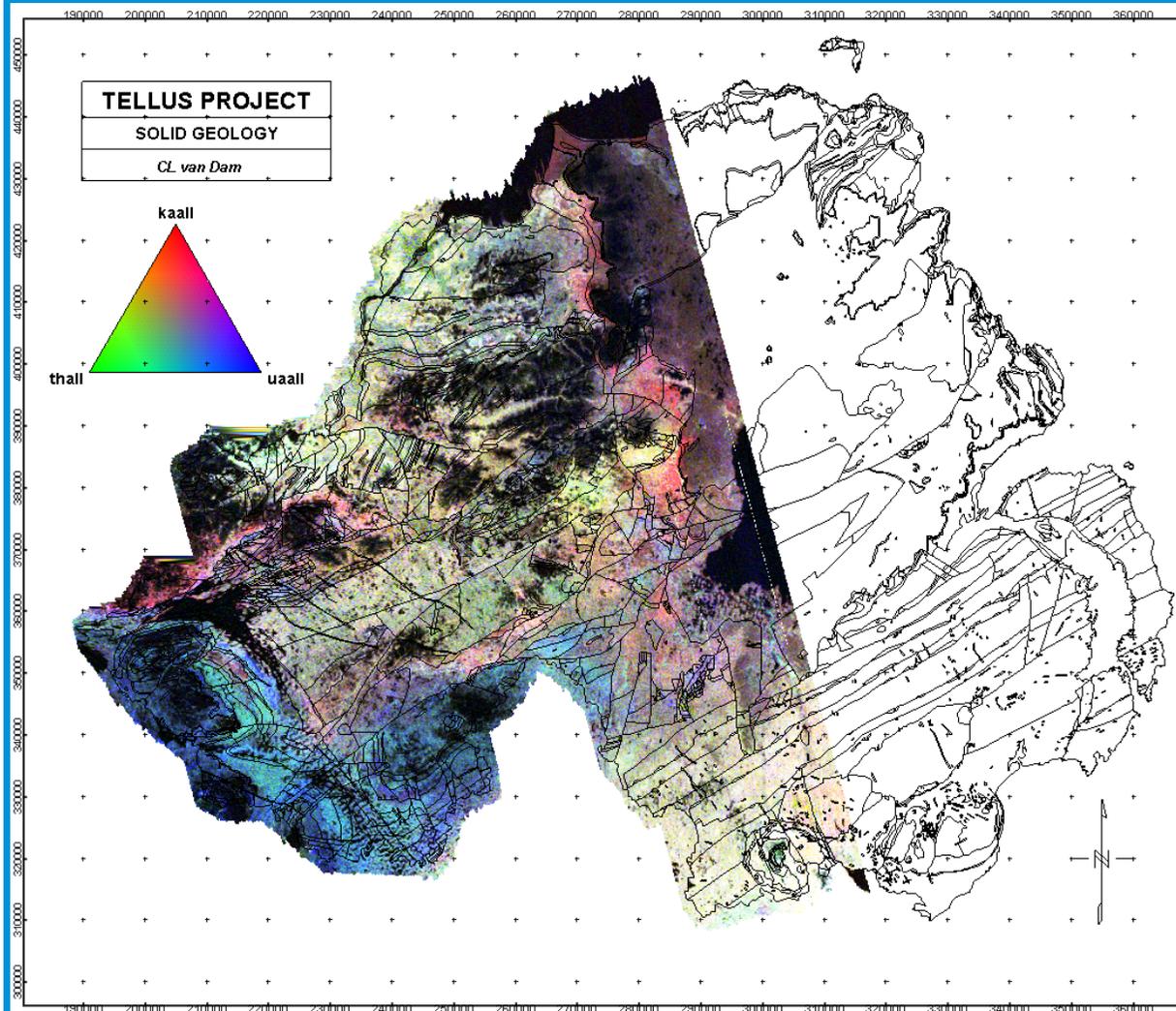
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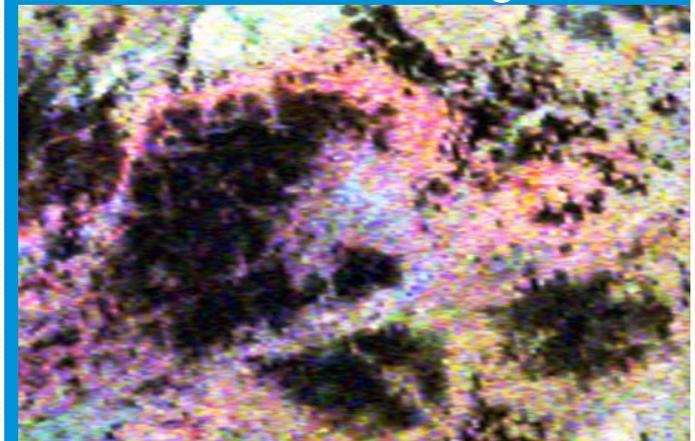
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# Gamma-ray spectrometry for U, Th, K and Cs



Stream Drainage



Peat Bogs

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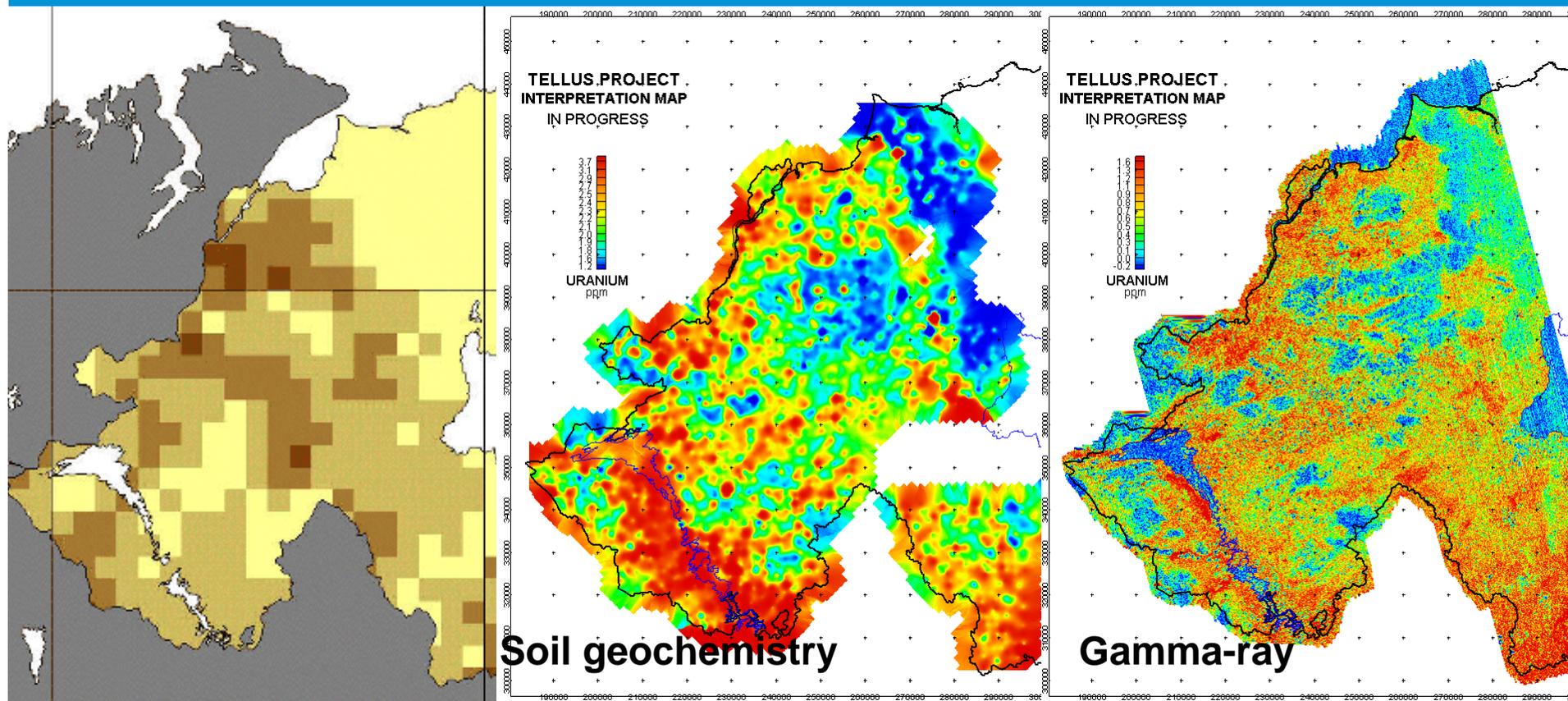
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# In-house radon, soil uranium and gamma-ray equivalent uranium (Bi-214)



5 Km Grid

250 m Grid

50 m Grid

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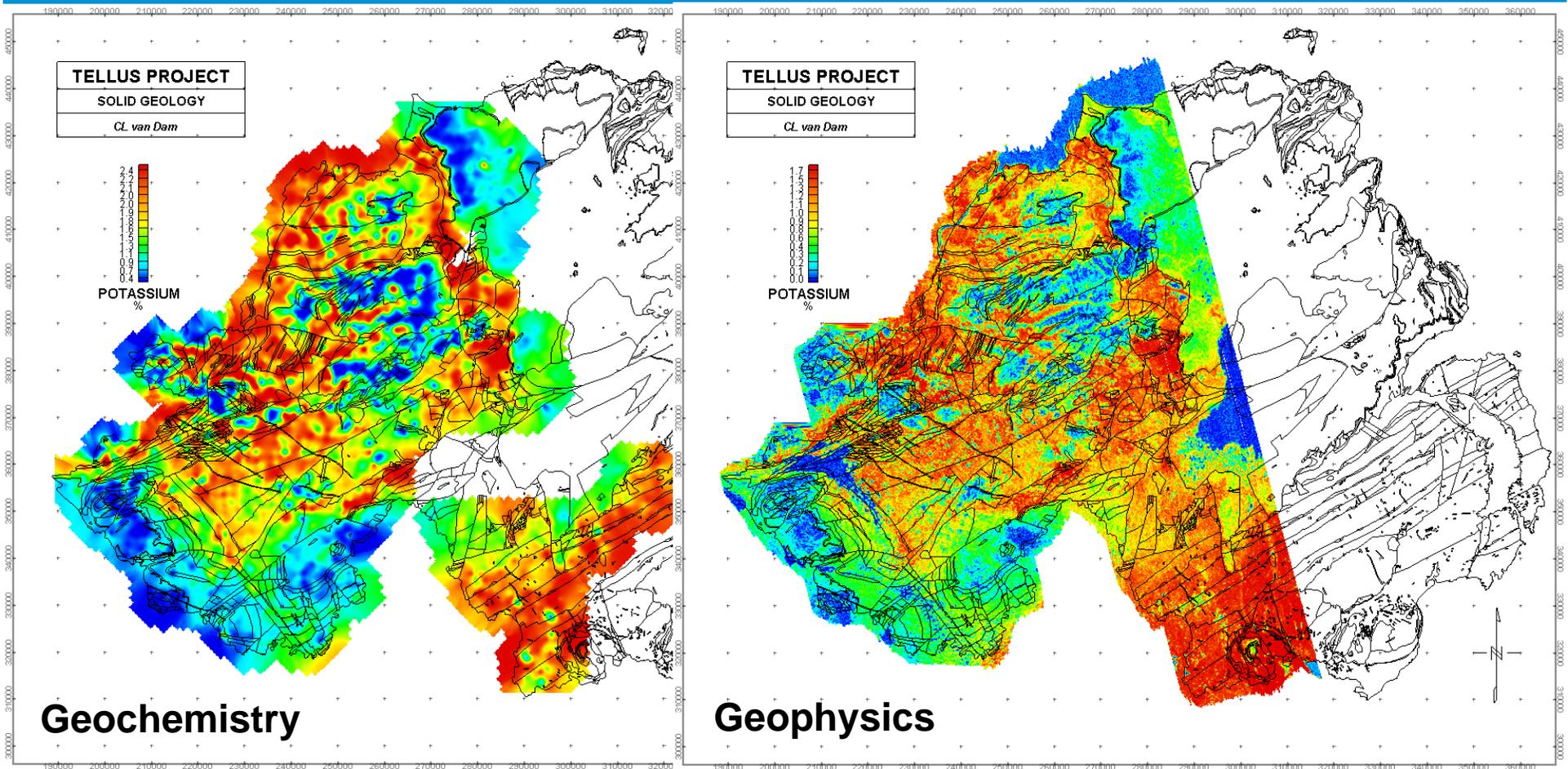
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# Soil geochemistry and radiometrics - potassium



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# Delivery and licensing

## Delivery

- Preliminary data - for consultation
- Fully processed data - available late 2006
- Survey reports - April 2007

## Licences

- Academic - for research and teaching
- Standard - for government and commercial users

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# Images

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