

# **EXPLORATION AND MINING DIVISION IRELAND**

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## **THE NORANDA AIRBORNE TEM AND MAGNETIC SURVEY (1998) OVER THE SILVERMINES AREA**

**August 2002**



Department of Communications, Marine  
and Natural Resources

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(1998) OVER THE SILVERMINES AREA**

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## INTRODUCTION

In March 1998 Noranda Mining and Exploration Inc. flew a 2749 line km magnetic and electromagnetic survey over an area encompassing approximately 800 sq km (Figure 1).

Block	Line km	Approx. Area (km <sup>2</sup> )	Prospecting Licences covered / partially covered by Survey
<b>Silvermines</b>	2749	806	74, 76, 607, 608, 626, 627, 2016, 2323, 2563, 2564, 2567, 2568, 2669, 2670, 2859, 2860, 3082, 3115, 3156, 3159, 3161, 3273, 3283, 3302, 3417, 3418, 3425, 3426, 3441, 3442, 3443, 3444, 3476, 3497, 3499, 3668, 3669, 3677, 3678, 3727, 3878, 3904, 3907, 2671R, 2937R, 649A, 75R, X1, X3R

This survey was acquired over four years ago and is available to the general public in fulfilment of the 'Open Skies' policy of the Exploration and Mining Division (EMD). The Division acknowledges the cooperation of Noranda Mining and Exploration Inc. and the assistance of PGW Europe Ltd.

At this time EMD is primarily concerned with prompt data release and no attempt was made to reprocess or correct survey data. Data is released as submitted and no liability is accepted on the part of the EMD for data quality or accuracy. However, to facilitate ease of use, several grids are provided with an Ordnance Survey base map for ease of geographical reference.

Geoterrex conducted the survey using a towed bird magnetometer and the GEOTEM<sup>®</sup>III electromagnetic system. This consists of 3 receiver coils, the x-coil and y-coil axes along and perpendicular to the flight direction and a vertical z-coil axis.

Time domain electromagnetic (TDEM), magnetic, radar altimeter and navigation data was acquired during the survey. All processing was carried out by Geoterrex, which is now part of Fugro Airborne Surveys.

The survey specifications, data acquisition and processing procedures used, are outlined in a Geoterrex report. A listing of all digital and hardcopy data (databases, grids, maps and company reports) lodged with the Exploration and Mining Division is included in this publication and outlined below in the data listings section.

## SURVEY EQUIPMENT AND SPECIFICATIONS

<b>Flight Line Spacing</b>	300m
<b>Flight Line Direction</b>	NW-SE
<b>Tie Line Spacing</b>	4000m
<b>Mean Terrain Clearance</b>	120 m
<b>Nominal Survey Speed</b>	120 knots ( 62 m/s )
<b>Total Survey Area</b>	800 km <sup>2</sup>
<b>Total Line Km</b>	2749 line km
<b>Magnetometer</b>	CS-2 Cesium Vapour
<b>Sensitivity</b>	0.01 nT
<b>Sample Rate</b>	10 samples /sec
<b>Mounting</b>	Towed Bird
<b>Sensor Height above ground</b>	75 m
<b>TEM Receiver</b>	Horizontal & vertical coils
<b>TEM Transmitter</b>	Vertical axis loop
<b>Cycle rate</b>	75 Hz
<b>Pulse width</b>	2.082 msec
<b>Pulse Delay</b>	0.104 msec
<b>Off-Time</b>	4.480 msec
<b>Sample Rate</b>	4 samples/sec
<b>Mounting</b>	Towed Bird
<b>Sensor Height above ground</b>	64 m

Below are the window mean delay times (in milliseconds), from the end of the transmitter pulse, for a 75 Hz base frequency as listed in the Geotrex report and readme file.

<b>em1</b>	-1.953	<b>em11</b>	1.146
<b>em2</b>	-1.562	<b>em12</b>	1.407
<b>em3</b>	-0.989	<b>em13</b>	1.693
<b>em4</b>	-0.416	<b>em14</b>	2.005
<b>em5</b>	0.163	<b>em15</b>	2.344
<b>em6</b>	0.235	<b>em16</b>	2.709
<b>em7</b>	0.365	<b>em17</b>	3.073
<b>em8</b>	0.521	<b>em18</b>	3.464
<b>em9</b>	0.703	<b>em19</b>	3.880
<b>em10</b>	0.912	<b>em20</b>	4.297

# PROCESSING OVERVIEW AND MAP GENERATION

The information provided in this section was taken from the Geoterrex report and readme files for the survey (included on CD) and from examination of the data.

## Magnetics Processing Sequence

A system lag correction of 3.6 seconds was applied followed by noise editing (de-spiking) and filtering. Appendix A of the Geoterrex report outlines the field processing sequence in more detail. The long wavelength component (greater than 79 seconds) of the diurnal field was removed from the data. The regional magnetic field (IGRF) was also removed. The data was tie-line leveled and then microleveled and gridded using a minimum curvature routine. Automatic culture removal appears to have been carried out using filters. The data was resampled to 5 samples per second for inclusion in the final database.

## Electromagnetics Processing Sequence

A system lag correction of 4.0 seconds was applied followed by drift corrections to the off-time channels 5 to 20 and on-time channel 1. Each EM transient decay curve was de-spiked and the data was then noise filtered and smoothed. Appendix A of the Geoterrex report outlines the field processing sequence in more detail. The data was resampled to 5 samples per second for inclusion in the final database. No correction for flight direction asymmetry (de-herringboning) was applied. Data was gridded using the linear interpolation method.

### EM Decay Constant Calculation

The EM time decay constant was calculated from the z-coil data by fitting channels 8 to 13 (0.521 – 1.693 msec) to a single exponential function. A slow rate of decay gives a high decay constant which indicates a better conductor.

### EM Anomaly Selection

EM anomalies were located by an automatic anomaly picking routine, using channel 12 (mean delay time 0.1407 msec) as a reference. X-coil channels 9-20 were then fitted to the vertical plate model to extract conductance and depth information. Digital anomaly listings are provided and listed in Appendix G of the Geoterrex report. Hardcopy anomaly maps were provided and scanned in EMD.

### Apparent Conductivity Calculation

The apparent conductivity was computed from all 20 channels of both the x and z-coil data.

## **Grid and Map Generation**

Grids were submitted in grid exchange format (gxf). Some of the submitted grids also include data from a joint venture survey completed in 1997 by Noranda and Billiton over the Tullamore area. The 1997 survey data is also available from EMD. The original submitted magnetic and decay constant grids were used to generate the EMD maps on an Ordnance Survey base.

All digital and hardcopy products are in the Irish National Grid (ING) coordinate system:

Datum:	TM65 / Airy Modified 1849
Ellipsoid:	Airy Modified 1849
	Major axis: 6377340.189
	Eccentricity: 0.081673374
	1/f: 299.3249646
Projection	Transverse Mercator
Central Meridian	-8.00.00.000
Latitude of origin	53.30.00.000
False Northing:	250,000 m
False Easting:	200,000 m
Scale factor:	1.000035

## **DATA LISTING**

### **Parameter table files**

Geoterrex supplied seven waveform parameter table files, one for each survey flight, in ASCII format. These files provide information on the system geometry, the channel positions in time and the reference waveform. The waveform is used to remove the effects of the primary field on the received secondary signal.

### **Geosoft polygon files of survey boundaries**

The geosoft polygon file (\*.ply) for the survey area is included on the CD. The file is in ASCII format and can be opened in any text editor to view survey boundary coordinates (in ING).

### **Anomaly Listings**

An anomaly listing is provided in Appendix G of the Geoterrex report. The anomaly listing was also provided in ASCII and MS Excel format and is included on the release CD.

## Databases

The raw and final data was supplied in ASCII format and imported into Geosoft Database format (GDB) by EMD. The data is released on CD in Geosoft format. Geoterrex readme files with channel listings are also included on the CD and summarised here on pages 8 and 9.

### Raw and Processed TEM and Magnetic Data (Geosoft GDB)

Database	Number of Channels	Approx. Size (Mb)	File Name (.gdb)
EM	63	50	silver_rawEM
Magnetics and EM	80	46	silver

## Grids

The following grids in gxf format were submitted by Noranda.

Block	Grid	Grid Name	Grid cell spacing (m)
Silvermines	Total field magnetics (IGRF and culture removed)	464tfnc	75
	Total field magnetics with no culture removal (IGRF removed)	464tfwc	75
	Apparent conductance	464cond	50
	Decay constant (z-coil ch 8-13)	464tau	50
Tullamore (1997 survey) & Silvermines (1998 survey)	Total field magnetics (IGRF removed)	magall	50
	Apparent conductance	condall	50
	Decay constant 1997 & 1998 survey	tauall	50
Silvermines	x-coil channel mean delay time -1.953 msec	x_ch01	50
	x-coil channel mean delay time 0.235 msec	x_ch06	
	x-coil channel mean delay time 0.521 msec	x_ch08	
	x-coil channel mean delay time 0.912 msec	x_ch10	
	x-coil channel mean delay time 1.407 msec	x_ch12	
	x-coil channel mean delay time 2.005 msec	x_ch14	
	x-coil channel mean delay time 2.709 msec	x_ch16	
	x-coil channel mean delay time 4.297 msec	x_ch20	
Silvermines	z-coil channel mean delay time -1.953 msec	z_ch01	50
	z-coil channel mean delay time 0.235 msec	z_ch06	
	z-coil channel mean delay time 0.521 msec	z_ch08	
	z-coil channel mean delay time 0.912 msec	z_ch10	
	z-coil channel mean delay time 1.407 msec	z_ch12	
	z-coil channel mean delay time 2.005 msec	z_ch14	
	z-coil channel mean delay time 2.709 msec	z_ch16	
	z-coil channel mean delay time 4.297 msec	z_ch20	



## Maps

All hardcopy maps submitted by Noranda for this release were scanned and stored in a compressed TIFF format, to keep file sizes manageable. Compression was carried out using Imaging for Windows, which is available under the Accessories menu in Windows. Colour images were compressed using LZW compression, which can be opened in most standard packages. *LZW compressed TIFF images can only be viewed in Geosoft when they are imported as a GeoTIFF file.* Maps produced in EMD, on an Ordnance Survey 1:50,000 base by permission of the Ordnance Survey of Ireland, are available on the release CD as uncompressed images in JPEG format, or in hardcopy format on request.

### Supplied by Noranda

Block	Map Title	Filename	Scale
Silvermines	Z-Coil Amplitude Response (Ch6)	nor12.1.1	1:100,000
	Z-Coil Amplitude Response (Ch8)	nor12.1.2	
	Z-Coil Amplitude Response (Ch10)	nor12.1.3	
	Z-Coil Amplitude Response (Ch12)	nor12.1.4	
	X-Coil Amplitude Response (Ch6)	nor12.1.5	
	X-Coil Amplitude Response (Ch8)	nor12.1.6	
	X-Coil Amplitude Response (Ch10)	nor12.1.7	
	X-Coil Amplitude Response (Ch12)	nor12.1.8	
	Z-Coil Decay Constant Calculated from channels 8-13	nor12.1.9	
	Total Field Magnetics	nor12.1.10	

### Supplied by EMD on Ordnance Survey base

Block	Map	Filename	Scale
Silvermines	TMI (with IGRF and culture removed)	silv_tmi_emd	1:100,000
	Z-Coil Decay Constant Calculated from channels 8-13	silv_ztau_emd	1:100,000
	Apparent Conductance (all 20 x and z coil channels)	silv_cond_emd	1:100,000

These maps are available, on an Ordnance Survey 1:50,000 base, as scanned images (jpeg format) or in hardcopy format.

## **Company reports**

The Geoterrex Logistics and processing report is included on the release CD. No interpretation report was submitted with the survey.

<b>Report Title</b>	<b>Filename (.pdf)</b>	<b>No. of pages</b>
Logistics and Processing Report Airborne Magnetic & GEOTEM Electromagnetic Multicoil Survey over the Silvermines Area	norr12_1	151

# GEOSOFTE DATABASE CHANNEL LISTING 1

## Silvermines Magnetics and EM Database

CHANNEL NAME	DESCRIPTION	UNITS
X	Easting	metres
Y	Northing	metres
FID	Fiducial	seconds
RAW_MAG	Total field magnetics (raw)	nT x 100
DIURNAL	Diurnal magnetics	nT x 100
IGRF	IGRF	nT x 100
MAG_DIURNAL	Total field magnetics - Diurnal	nT x 100
MAG_DIURNAL_IGRF	Total field magnetics – Diurnal- IGRF	nT x 100
FINAL_MAG	Total field magnetics (processed)	nT x 100
MAG_CORR1	leveling values = difference before and after tie-line leveling	nT x 100
MAG_CORR2	micro-leveling values = difference before and after micro-leveling	nT x 100
V_GRAD	Vertical gradient	nT/km x 100
MAG_CULT	Final magnetics – culture edited	nT x 100
RAD	Radar altimeter	feet
BARO	Barometric altimeter	feet
GPS	GPS elevation	cm
PRIMARY_FIELD	Em primary field	uv
POWERLINE_MONITOR	Powerline monitor	uv
X1 to X20	Processed EM channel X1 to X20	ppm
Y1 to Y20	Processed EM channel Y1 to Y20	ppm
Z1 to Z20	Processed EM channel Z1 to Z20	ppm
DECAY_CONST	Decay constant from z-coil channels 8-13	μsec
CONDUCTANCE	Apparent conductance (x and z coil channels)	ms

## **GEOSOFT DATABASE CHANNEL LISTING 2**

### **Silvermines Raw EM Database**

<b>CHANNEL NAME</b>	<b>DESCRIPTION</b>	<b>UNITS</b>
X	Easting	metres
Y	Northing	metres
FID	Fiducial	seconds
RAW_X1 to RAW_X20	Raw EM channel X1 to X20	ppm
RAW_Y1 to RAW_Y20	Raw EM channel Y1 to Y20	ppm
RAW_Z1 to RAW_Z20	Raw EM channel Z1 to Z20	ppm

# SURVEY LOCATION

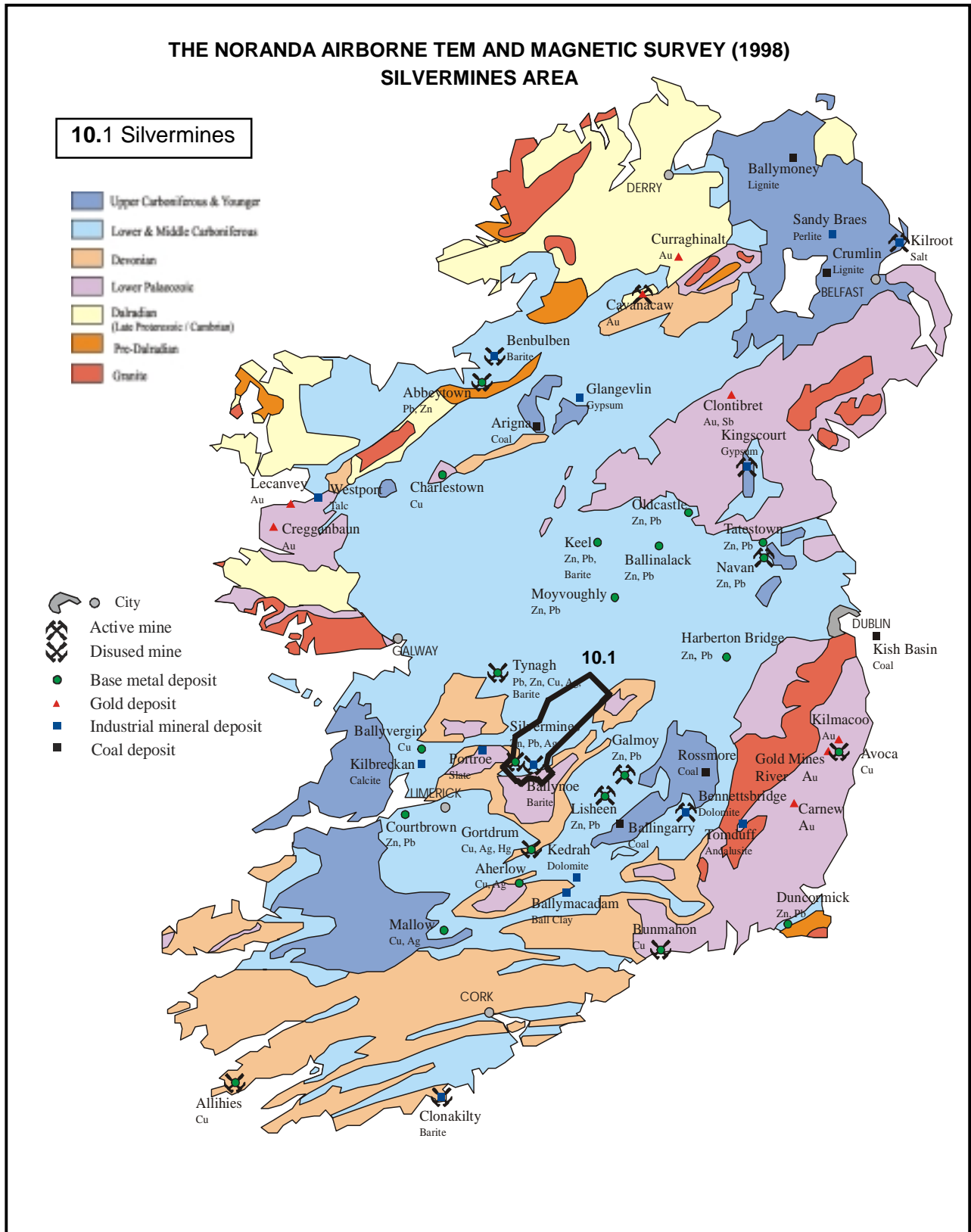


Figure 1. Location of the survey areas on a simplified geology map of Ireland.

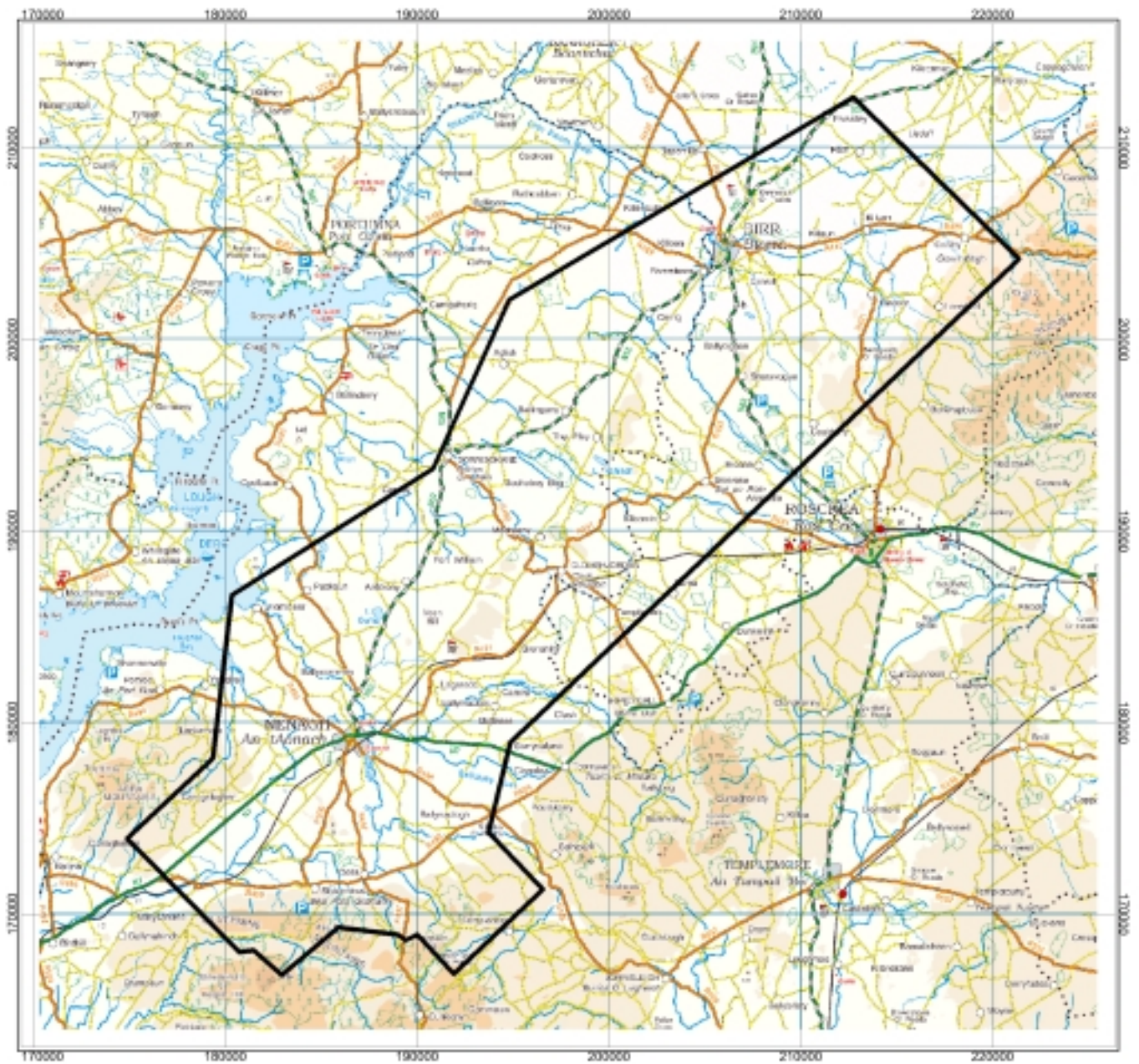


Figure 2. The Silvermines survey area on a 1:250,000 Ordnance Survey base.