EXPLORATION AND MINING DIVISION IRELAND

ZINC • LEAD • COPPER • GOLD • SILVER • BARYTES • GYPSUM • COAL • DOLOMITE •

THE RIO ALGOM/IVERNIA WEST AIRBORNE TEM AND MAGNETIC SURVEY (1996) OVER THE SILVERMINES, LISHEEN AND LOUGH DERG AREAS

December 2001

Department of the Marine and Natural Resources

Roinn na Mara agus Acmhainní Nádúrtha

Department of the Marine and Natural Resources

THE RIO ALGOM/IVERNIA WEST AIRBORNE TEM AND MAGNETIC SURVEY (1996) OVER THE SILVERMINES, LISHEEN AND LOUGH DERG AREAS

Compiled by
Orla Dardis

EXPLORATION AND MINING DIVISION
MINERALS PUBLICATION MP 14/01

DECEMBER 2001

TABLE OF CONTENTS

INTRODUCTION

In July 1996 Rio Algom and Ivernia West flew a 591 line km magnetic and electromagnetic survey over three areas encompassing approximately 200 km^2 (Figure 1). Lisheen and Silvermines were flown as test areas (Figures 2 and 3).

Block	Line km	Approx. Area (km^2)	Prpspecting Licences covered by Survey
Silvermines	60	21	3158, 3660
Lisheen	87	27	3262, 2258
Lough Derg	444	151	2587, 3476, 2564, 3477, 626

This survey is the fifth in a series of surveys, acquired over four years ago, which are due for public release in fulfilment of the 'Open Skies' policy of the Exploration and Mining Division (EMD). The Division acknowledges the cooperation of Rio Algom 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® dual-coil electromagnetic system. This consists of 2 receiver coils, the x-coil axis along 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, and data acquisition and processing procedures used are outlined in the Geoterrex report. The survey interpretation is discussed in a report by consultants CSA.

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

Flight Line Spacing	Silvermines 250-500m Lisheen 250-500m Lough Derg 300m
Flight Line Direction	Silvermines 90° Lisheen 0° Lough Derg 160°
Tie Line Spacing	Silvermines 2000-3200m Lisheen 2000-3200m Lough Derg 3000-4000m
Mean Terrain Clearance	120 m
Nominal Survey Speed	120 knots (62 m/s)
Total Survey Area	200 km^2
Total Line Km	591 line km
Magnetometer	Cesium Vapour
Sensitivity	0.00l nT
Sample Rate	10 samples /sec
Mounting	Towed Bird
Sensor Height above ground	75 m
TEM Receiver	Horizontal & vertical coils
TEM Transmitter	Vertical axis loop
Cycle rate	75 Hz
Pulse width	2.082 msec
Pulse Delay	0.104 msec
Off-Time	4.480 msec
Sample Rate	4 samples/sec
Mounting	Towed Bird
Sensor Height above ground	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 Geoterrex report and readme file. The channel numeration and mean delay times do not increase correspondingly.

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

PROCESSING OVERVIEW AND MAP GENERATION

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

Magnetics Processing Sequence

A system lag correction of 3.7 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 25 seconds) of the diurnal field was removed from the data. The regional magnetic field (IGRF) was also removed but the IGRF channel is not included in the database. The data was resampled to 5 samples per second for inclusion in the final database. It appears that the final data channels were not decultured. A proprietary algorithm, to improve trends along anomalies, was applied. The data was then microleveled and gridded using a modified Akima spline interpolation.

Electromagnetics Processing Sequence

A system lag correction of 4.5 secs was applied followed by drift corrections to the off-time channels 1 to 16 and on-time channel 20. 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. No corrections for flight direction asymmetry (de-herringboning) were applied. The data was resampled to 5 samples per second for inclusion in the final database. It appears that the final data channels were not decultured.

EM Decay Constant Calculation

The EM early to middle time decay constant was calculated from the z-coil data by fitting channels 14, 13 and 1 to 8 (approx. 0.365 – 2.709 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 2 (mean delay time 0.912 msec) as a reference. X and Z coil channels 1-12 were then fitted to the vertical plate model to extract conductance and depth information. Anomaly listings for the three areas are provided in Appendix G of the Geoterrex report. The CSA interpretation report also highlights and describes 17 anomalies for ground follow-up. Hardcopy anomaly maps were provided and scanned in EMD.

Grid and Map Generation

Geosoft grids produced in 1996 were submitted with the survey data. Grids showing the same parameters were also supplied in 1998 in grid exchange format (gxf). The 1998 grids appear to have been fiterered/ noise edited relative to the 1996 grids.

The traverse line spacings were variable within each survey area (250m to 500m) and the choice of grid cell sizes varied from area to area and also with grid age (see Grids listing on pages 5 and 6). In general, the test areas of Lisheen and Silvermines have grid cell spacings of 50m (conductance grid 100m) and Lough Derg I area has a grid cell size of 60m (conductance grid 100m).

As it was not clear what type of gridding algorithms were used, the TMI grids were re-gridded by EMD. Grids were produced from the PRO_MAG channel using a minimum curvature interpolation and are identified by an 'emd' label in the filename. The early-mid decay constant database channel was also re-gridded by EMD using a minimum curvature interpolation.

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

Anomaly Listings

Anomaly listings for the three areas are provided in Appendix G of the Geoterrex report. The CSA interpretation report also highlights and describes 17 anomalies for ground follow-up.

Geosoft polygon files of survey boundaries

Geosoft polygon files (*.ply) for each survey area are included on the CD. The files are in ASCII format and can be opened in any text editor to view survey boundary coordinates (in ING).

Databases

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

Processed GEOTEM and Magnetic Data (Geosoft GDB)

Database	Number of Channels	Approx. Size (Mb)	File Name (.gdb)
Silvermines	52	2.1	silv
Silvermines Conductance	4	0.9	silv_cond
Lisheen	52	2.0	lish
Lisheen Conductance	4	0.8	lish_cond
Lough Derg	52	6.6	lderg1
Lough Derg Conductance	4	1.2	lderg1_cond

Grids

The following grids in Geosoft grid format and gxf format were submitted by Rio Algom and reproduced where required by EMD in Geosoft grid format.

Block	Grid	Grid Name	Grid cell spacing (m)	Date produced
Lough Derg	Channel 2 amplitude from Z-coil	Z2_ld.grd	60	1996
Lisheen		Z2_ls.grd	50	1996
Silvermines		Z2_sm.grd	50	1996
Lough Derg	Early-mid time decay constant (z-coil ch 14,13,1-8)	Tauz_ld.grd	60	1996
Lisheen		Tauz_ls.grd	50	1996
Silvermines		Tauz_sm.grd	50	1996
Lough Derg	Total Magnetic Field	Mag_ld.grd	60	1996
Lisheen		Mag_ls.grd	50	1996
Silvermines		Mag_sm.grd	50	1996
Lough Derg	Apparent conductance (culture edited)	lderg_cond_emd.grd	100	2001
Lisheen		lscond.gxf	100	1998
Silvermines		smcond.gxf	100	1998
Lisheen	Early-mid time decay constant (z-coil ch 14,13,1-8)	lstauz.gxf	100	1998
Silvermines		smtauz.gxf	100	1998
Lough Derg	Early-mid time decay constant (z-coil ch 14,13,1-8)	lderg_ztau_emd.grd	60	2001
Lisheen		lish_ztau_emd.grd	50	2001
Silvermines		silv_ztau_emd.grd	50	2001

Lisheen	Total Magnetic Field	lsmag.gxf	50	1998
Silvermines		smmag.gxf	50	1998
Lough Derg		ldmag.grd	60	1998
Lough Derg	Total Magnetic Field	lderg_tmi_emd.grd	60	2001
Lisheen		lish_tmi_emd.grd	50	2001
Silvermines		silv_tmi_emd.grd	50	2001

Maps

All hardcopy maps submitted by Rio Algom 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. Black and white images were compressed using CCIT Group4 compression, which can be opened in all standard packages. Colour TIFF images were compressed using LZW compression option and can be opened and/or exported into Imaging for Windows and the Geosoft Oasis Montaj 5.0 free viewer. This LZW compression is not supported by Arcview 3.2 but the Geosoft viewer can be downloaded free of charge and gives the option to save compressed TIFF files in other formats. Maps produced in EMD, on an Ordnance Survey 1:50,000 base, are available on the release CD as uncompressed images in JPEG format, or in hardcopy format on request.

Rio Algom submitted no digital or hardcopy maps for the Lough Derg 1 block. An adjacent area, Lough Derg II, was flown in 1998, and maps submitted for that survey include both the 1996 Lough Derg and 1998 Lough Derg II areas. Merged maps showing both areas cannot be released in this publication as the Lough Derg II data remains confidential until June 2002.

Supplied by Rio Algom/Ivernia West

Block	**Map Title**	**Filename**	**Scale**
Silvermines	Residual Magnetic Field (culture edited) Contour Map	rio5.1.1	1:25000
Silvermines	Calculated Vertical Gradient of culture edited Magnetics	rio5.1.2	1:25000
Silvermines	Apparent conductance (culture edited) Contour Map	rio5.1.3	1:25000
Silvermines	EM early-mid time decay constant (culture edited) contour map (z-coil channel 9-17)	rio5.1.4	1:25000
Silvermines	EM early-mid time decay constant (z-coil ch 14,13,1-8) contour map	rio5.1.5	1:10560
Silvermines	Contour map of EM channel 2 amplitude with EM anomalies (z-coil)	rio5.1.6	1:10560
Silvermines	Profile Map of EM channels 2 and 5 with EM anomalies (z-coil data)	rio5.1.7	1:10560
Silvermines	Profile Map of EM channels 2 and 5 with EM anomalies (x-coil data)	rio5.1.8	1:10560
Lisheen	Residual Magnetic Field (culture edited) contour map (with base map)	rio5.2.9	1:25000
Lisheen	Calculated Vertical Gradient of culture edited magnetics	rio5.2.10	1:25000
Lisheen	Apparent conductance (culture edited) Contour Map	rio5.2.11	1:25000
Lisheen	EM early-mid time decay constant (culture edited) contour map (z-coil channel 9-17)	rio5.2.12	1:25000
Lisheen	EM early-mid time decay constant contour map (z-coil channel 14,13,1-8)	rio5.2.13	1:10560
Lisheen	Profile Map of EM channels 2 and 5 with EM anomalies (x-coil)	rio5.2.14	1:10560

Lisheen	Contour map of EM ch 2 amplitude with EM anomalies (z-coil data)	rio5.2.15	1:10560
Lisheen	Total Magnetic Field Contour Map with EM Anomalies (z-coil)	rio5.2.16	1:10560

Supplied by EMD on Ordnance Survey base

Block	Map	Filename	Scale
Lisheen	Processed total magnetic intensity	lish_tmi_emd	1:25,000
Lough Derg 1	Processed total magnetic intensity	lderg1_tmi_emd	1:50,000
Silvermines	Processed total magnetic intensity	silv_tmi_emd	1:25,000
Lisheen	Early-mid time decay constant (z-coil ch 14,13,1-8)	lish_ztau_emd	1:25,000
Lough Derg 1	Early-mid time decay constant (z-coil ch 14,13,1-8)	lderg1_ztau_emd	1:50,000
Silvermines	Early-mid time decay constant (z-coil ch 14,13,1-8)	silv_ztau_emd	1:25,000

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 and an interpretation report by CSA consultants are included on the CD.

Report Title	Filename (.pdf)	No. of pages
Logistics and Processing Report of the Airborne Magnetic and Geotem Electromagnetic Multicoil Survey in Ireland over the Lough Derg, Lisheen and Silvermines Blocks	rior5_2	144
Interpretation of GEOTEM Survey flown by Geoterrex Ltd July 1996. CSA Report No. 102.97	rior5_1	19

GEOSOFT DATABASE CHANNEL LISTING 1

Silvermines, Lisheen and Lough Derg

CHANNEL NAME	DESCRIPTION	UNITS
FID	Fiducial	seconds x 10
EASTING	Easting	metres
NORTHING	Northing	metres
RAW_MAG	Total field magnetics (raw)	nT x 100
PRO_MAG	Total field magnetics (processed)	nT x 100
DIURNAL	Diurnal magnetics	nT x 100
V_GRAD	Vertical gradient	nT x 100/km
ZTDC_EARLY	Decay constant from z-coil channels 14, 13, 1-8	µsec
RAD	Radar altimeter	metres
BARO	Barometric altimeter	metres
X1	Em channel X1	ppm
X2	Em channel X2	ppm
X3	Em channel X3	ppm
X4	Em channel X4	ppm
X5	Em channel X5	ppm
X6	Em channel X6	ppm
X7	Em channel X7	ppm
X8	Em channel X8	ppm
X9	Em channel X9	ppm
X10	Em channel X10	ppm
X11	Em channel X11	ppm
X12	Em channel X12	ppm
X13	Em channel X13	ppm
X14	Em channel X14	ppm
X15	Em channel X15	ppm
X16	Em channel X16	ppm
RAW_X17	Raw Em channel X17	ppm
RAW_X18	Raw Em channel X18	ppm
RAW_X19	Raw Em channel X19	ppm
X20	Em channel X20	ppm
Z1	Em channel Z1	ppm
Z2	Em channel Z2	ppm
Z3	Em channel Z3	ppm
Z4	Em channel Z4	ppm
Z5	Em channel Z5	ppm
Z6	Em channel Z6	ppm

Z7	Em channel Z7	ppm
Z8	Em channel Z8	ppm
Z9	Em channel Z9	ppm
Z10	Em channel Z10	ppm
Z11	Em channel Z11	ppm
Z12	Em channel Z12	ppm
Z13	Em channel Z13	ppm
Z14	Em channel Z14	ppm
Z15	Em channel Z15	ppm
Z16	Em channel Z16	ppm
RAW_Z17	Raw Em channel Z17	ppm
RAW_Z18	Raw Em channel Z18	ppm
RAW_Z19	Raw Em channel Z19	ppm
Z20	Em channel Z20	ppm
PRIMARY_FIELD	Em primary field	uv
POWERLINE_MONITOR	Powerline monitor	uv

GEOSOFT DATABASE CHANNEL LISTING 2

Grid Extracted Conductance

CHANNEL NAME	**DESCRIPTION**	**UNITS**
X	Easting	metres
Y	Northing	metres
FID	Fiducial	seconds x 10
COND	Conductance	mS x 1000

SURVEY LOCATION

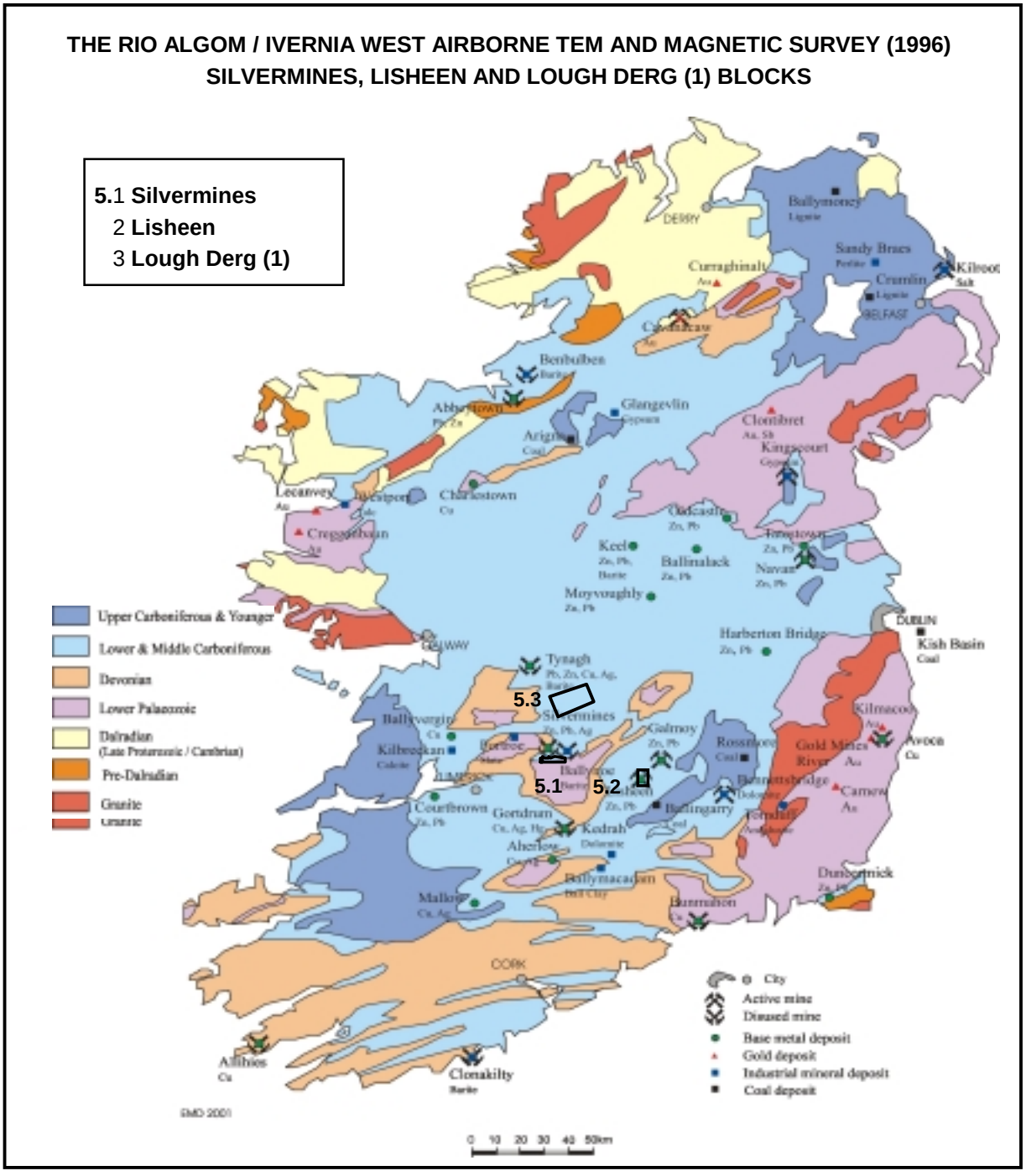

Figure 1. Location of the survey areas on a simplified geology map of Ireland.

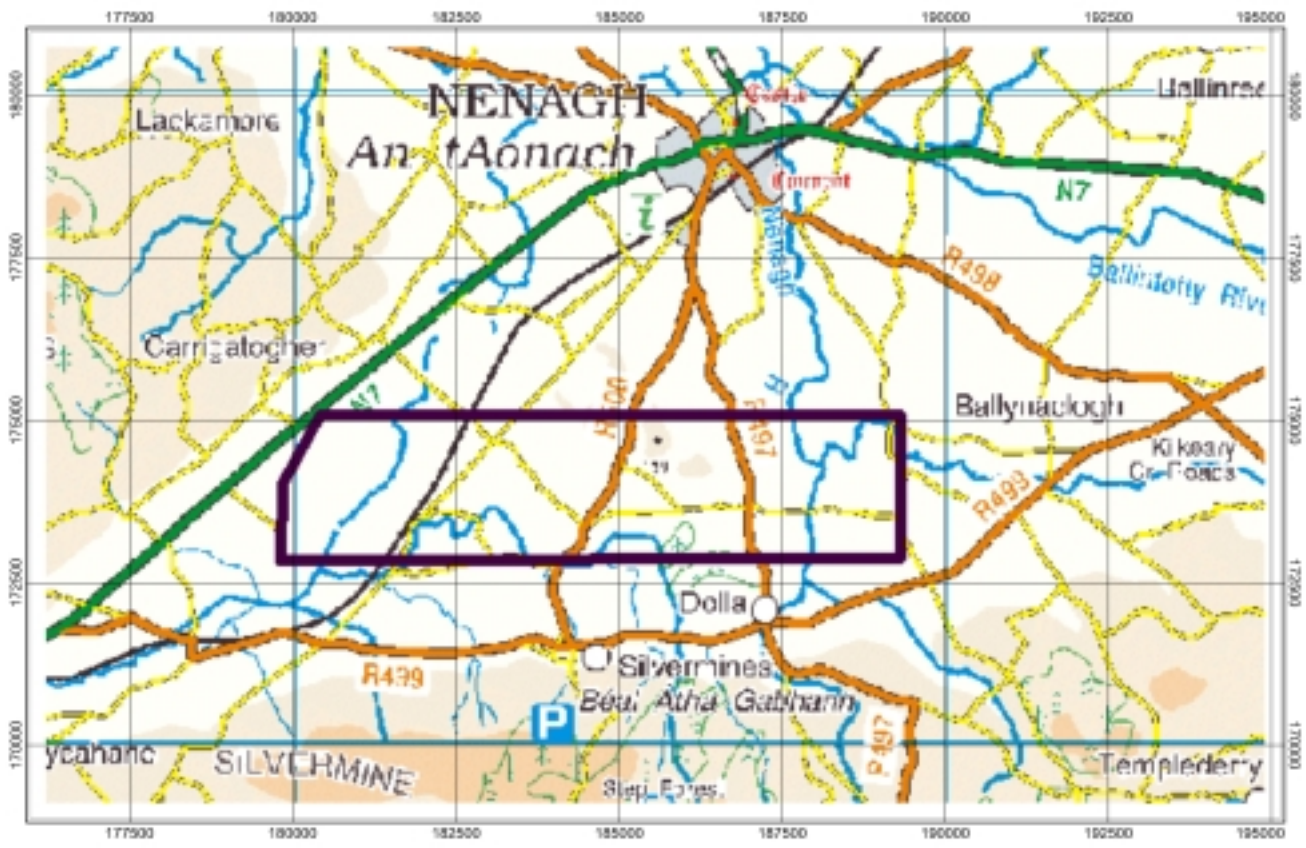

Figure 2. The Silvermines survey area on a 1:250,000 Ordnance Survey base.

Figure 3. The Lisheen survey area on a 1:250,000 Ordnance Survey base.

Figure 4. The Lough Derg survey area on a 1:250,000 Ordnance Survey base.