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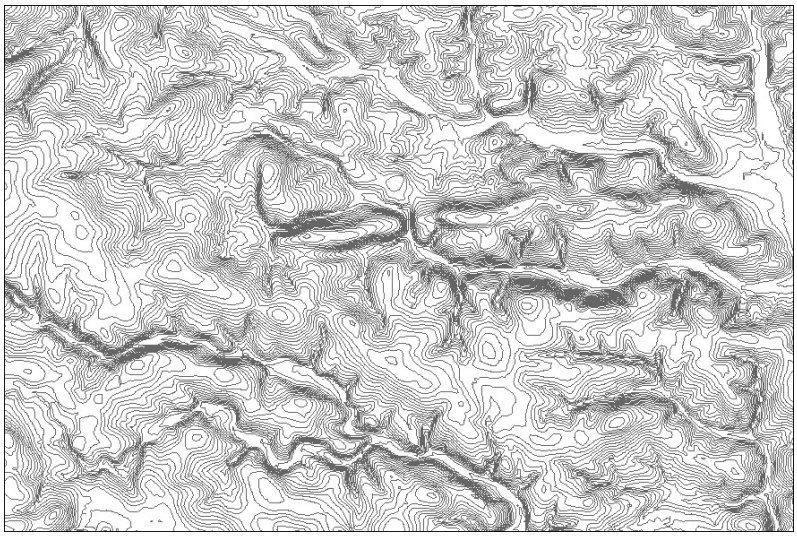
High-resolution gravity surveys at Egloskerry and Combe Martin, SW England

Economic Minerals and Geochemical Baseline Programme

Internal Report IR/02/195



BRITISH GEOLOGICAL SURVEY

INTERNAL REPORT IR/02/195

High-resolution gravity surveys at Egloskerry and Combe Martin, SW England

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Digital terrain model of the Egloskerry region based on a UK 50m DTM.

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Peter Claughton provided a list of mines and a summary history for many of the mines in the Combe Martin area. These locations are plotted in Figures 10 and 11.

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Summary

This report describes the results of two detailed high-resolution (HR) gravity surveys at Egloskerry, Cornwall and Combe Martin, Devon. These areas were selected on the basis of existing exploration data and prospectivity appraisal as potential sites for massive sulphide deposits.

Assessment of the geology of the central part of SW England, between Bodmin Moor and Dartmoor, reveals many similarities with the Iberian Pyrite Belt (IPB) in southern Spain and Portugal, where numerous sediment-hosted massive sulphide (SHMS) deposits occur. Furthermore the geological environment of the Exmoor district is similar to the setting of the major polymetallic sulphide deposit at Rammelsberg in the Rhenish Massif in Germany. A review of existing geochemical, borehole and mineral occurrence data (Rollin et al., 2001) indicated that apparent stratabound sulphide mineralisation occurs at more than 60 sites in SW England. At Egloskerry, near Launceston, extensive exploration in the early 1980's had identified stratabound galena within Lower Carboniferous shales and mudstones of the Liddaton and Crackington formations. At Combe Martin, coastal exposure of the Middle Devonian Lester Slate and Sandstone Formation indicates mineralisation of galena with quartz and carbonate showing evidence of stratigraphic control. This mineralisation is typical of the ore worked in historical times in the Combe Martin silver-lead mines.

At Egloskerry, a detailed HR gravity survey was conducted over an area of about 20 km^2 within the region 225–230 kmE, 083–087 kmN. Previous commercial exploration including drilling and geochemical soil and deep overburden sampling had been supported by ground geophysics using induced polarisation (IP), self-potential (SP), Very Low Frequency (VLF) and magnetic surveys. No previous gravity survey had been carried out. A total of 181 new gravity stations were observed at station positions located by GPS. This compares with only 14 regional gravity stations in this block.

At Combe Martin, North Devon, extensive historic mining for lead-silver in part of the Lester Slate Formation is apparent at several localities inland and minor stratabound galena (sphalerite) quartz-carbonate veining can be observed at Lester Point (Scrivener and Bennett, 1980). There are however no known ground geophysical surveys in this district and the main surveys of the Mineral Reconnaissance Programme (MRP) work in this region was focused towards regional drainage geochemistry and ground magnetic surveys to explore the linear magnetic anomalies across Exmoor. At Combe Martin a total of 167 new gravity stations were observed at station positions located by GPS within a survey block of about 40 km^2 defined by 257–265 kmE, 143–148 kmN. This compares with 25 regional gravity stations observed previously in this area.

For both areas the new gravity data were collected using LaCoste and Romberg gravity meters with elevation and position determined using a Leica 530 GPS in Real-Time-Kinematic (RTK) mode. Gravity data were reduced to Ordnance Datum at a density of 2.70 Mgm^{-3}, and corrected for terrain effects out to 48 km (Hammer Zone X) using a high resolution (50 m) and a low resolution (1 km) DTM. In both regions observed gravity was referred to the National Gravity Reference Net 1973 (NGRN73) and showed no significant difference from the observed regional gravity data. Terrain corrections at duplicate stations also showed no significant or systematic errors with the regional data. The data for each of the surveys was gridded at an interval of 50 m. A regional field based on the existing survey was generated and subtracted from the new grids to provide residual anomaly maps for both regions.

At Egloskerry, a positive residual gravity anomaly of up to about 1 mGal shows a strong correlation with the digital 1:50 K geology and also with detailed geochemical data. Anomalous concentrations of zinc and lead in soil also show good correlation with the gravity residual anomaly.

At Combe Martin, a small positive residual anomaly shows a general correlation with the outcrop of the Lester Slate Formation to the east of the main mining district and might warrant further exploration with a ground contact electrical method such as self potential SP or induced polarisation IP.

Future exploration for stratiform base metal deposits will depend on the particular style of mineralisation of the target. For targets in the central region where IPB type deposits are to be expected the exploration practice might include further high-resolution gravity and subsequent investigation of minor positive gravity anomalies with an electrical survey to define drilling targets. In other regions, such as Exmoor, where the prospective targets are sedimentary exhalative (Sedex) deposits, there has been relatively little previous ground geophysical survey there is potential for targeted exploration of several horizons, particularly over existing residual gravity anomaly features.

1 Introduction

South-west England has over 60 occurrences of possible stratiform mineralisation and provides a close geological analogy with the Iberian Pyrite Belt (IPB) of southern Spain and Portugal where major sediment-hosted massive sulphide (SHMS) deposits have been worked for many centuries (Leistel et al., 1998). In North Devon there is also a thick shallow-marine Devonian sequence which is comparable to the Harz Massif in Germany which hosts the major polymetallic sulphide deposits at Rammelsberg (Large and Walcher, 1999).

- The main items of evidence supporting the potential for stratiform base metal deposits in south-west England are:
- high-grade stratiform sulphide mineralisation at Egloskerry, near Launceston.
- apparent stratabound galena mineralisation in the Lester Slates near Combe Martin, Devon
- magnetic anomalies in the central part of the region to the north of, and between, the Bodmin and Dartmoor granites. These anomalies are attributed to stratiform pyrite mineralisation subsequently recrystallised as pyrrhotite. These have been explored at Wilsey Down, Sourton and Bovey Tracy. Comparison of the geological setting of this area with the Iberian Pyrite Belt confirms the prospectivity for stratiform base-metal deposits in this area.
- linear geochemical drainage anomalies for zinc over Exmoor associated with regional magnetic anomalies near the base of the Ilfracombe Slate Formation. The geological setting of Exmoor is comparable with the Harz Massif of Germany which hosts the major Rammelsberg deposit provides further evidence of prospectivity in this part of the target region.
- the extensive exhalative mineralisation and disseminated sulphide identified by MRP studies in altered volcanic rocks in south Devon suggest the activity of large, convective hydrothermal cells. The strong similarities in the geological setting and mineralisation in south Devon with the Rhenish basin in Germany, which hosts the major Sedex deposit at Meggen, indicate prospectivity for submarine exhalative mineralisation (Rollin et al., 2001).

Table 1 Summary of stratiform mineral occurrences in the target areas

Deposit Name	Easting (m)	Northing (m)	Stratigraphy	Major (minor) elements	Remarks	Source
Lester Point	25750	14761	IFS	Pb (Zn,Cu)	Sulphides + Fe carbonate in slate	Edmonds et al., 1985
Combe Martin Mine	25889	14654	IFS	Pb (Zn,Cu)	Sulphides + Fe carbonate in slate	Edmonds et al., 1985
Knap Down Mine	25975	14667	IFS	Pb (Zn,Cu)	Sulphides + Fe carbonate in slate	Edmonds et al., 1985
Honeymead No.1 BH	27989	13935	IFS	Fe	Disseminated py+po	Jones et al., 1987
Honeymead No.2 BH	27990	13934	IFS	Fe	Disseminated py+po	Jones et al., 1987
Egloskerry	22819	8524	Lower Carboniferous	Pb, Fe, Zn	4.5 m stratiform fine-grained galena (10% Pb) in siltstone faulted on black shales	Easterbrook, 2001
Abbreviations: IFS, Ilfracombe Slate; py, pyrite; po, pyrrhotite						

This report describes the results of detailed high-resolution gravity surveys at Egloskerry in the central belt of Cornwall and at Combe Martin in North Devon (Figure 1). The report forms a record of the data collected, a summary of the GPS method for gravity survey, a description of the main anomalies and associations with other data and some recommendations.

Previous ground-based gravity surveys by BGS, as part of the national survey, have been made using Ordnance Survey spot heights and bench marks across the region. Regional gravity data have a distribution of about one station per km^2. Detailed profile and infill gravity surveys have also been carried out at several localities across the region (Figure 1, Table 2) as part of the Mineral Reconnaissance Programme (Tombs, 1980) and to support the BGS mapping programme (Rollin, 1988). Many of the detailed surveys were to explore the form and structure of the concealed margins of the Cornubian granites. These surveys typically provide data at a station distribution of about 3-5 per km^2. However stations and traverses were generally located along public highways and consequently lack the regular distribution favoured for the detection of small deposits.

Table 2 Detailed gravity surveys in East Cornwall and Devon

Survey	**Number stations**	**Reference**
St Austell #	1669	Beer et al., 1975
SW Dartmoor #	434	Tombs, 1980
Tavistock	1461	Rollin, 1985
Boscastle	3 traverses	McKeown et al., 1973
Okehampton	8 traverses	Edmonds et al., 1968
Crediton	11 traverses	Cornwell et al., 1992
Chillaton #	2 traverses	Leake et al., 1994
Brownstone #	2 traverses	Leake et al., 1992
West Down	2 traverses	BGS Records
Teign Valley #	3 traverses	Beer et al., 1992
# data collected as part of the Mineral Reconnaissance Programme (MRP)		

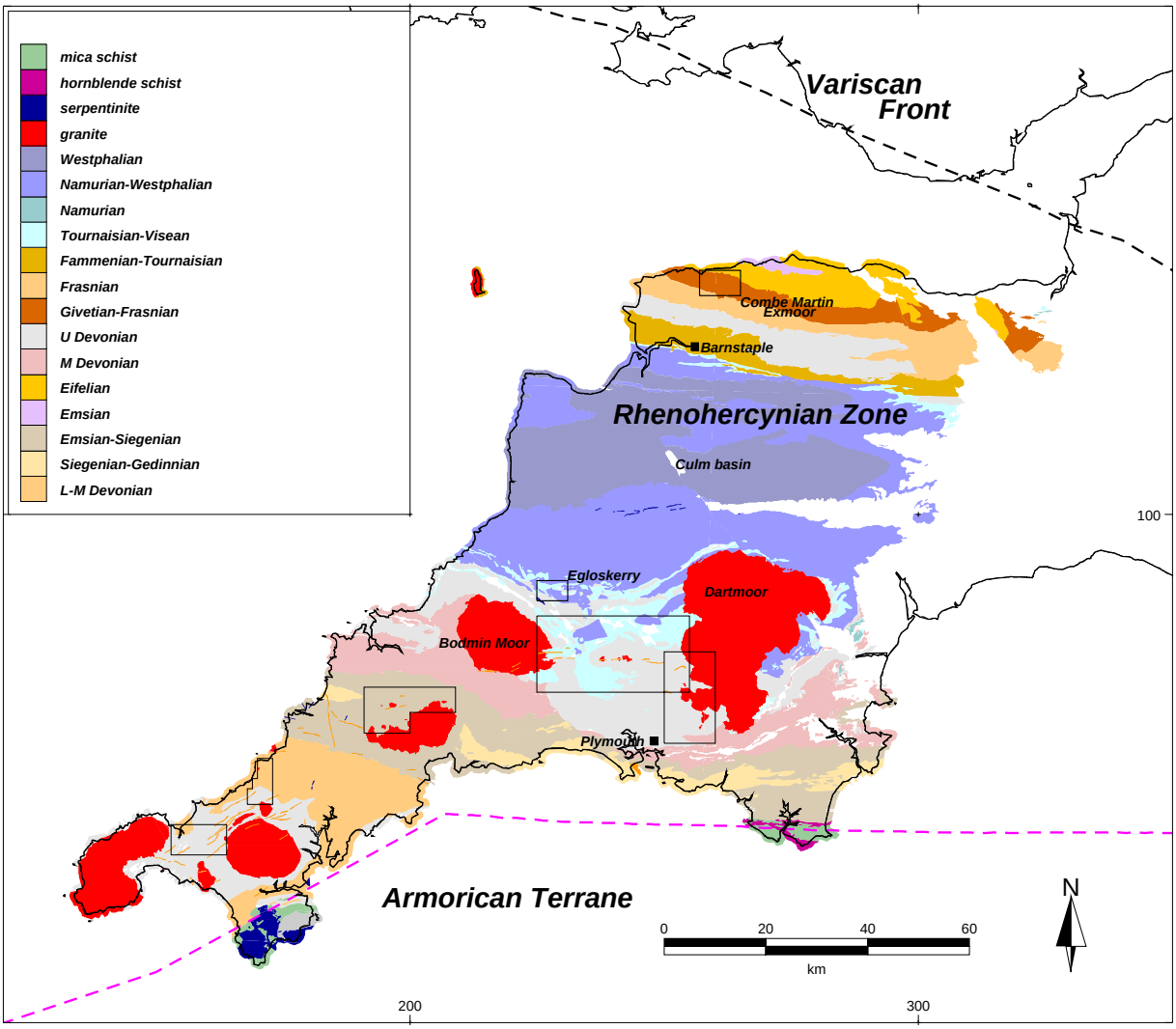

Figure 1 Simplified geology of south-west England and location of the survey areas

Two detailed (infill) gravity surveys have previously been carried out in the central area between Dartmoor and Bodmin Moor:

1. A detailed gravity survey (station distribution c. 5 per km^2) of the south-west margin of Dartmoor (Tombs, 1980), including the Hemerdon tin-tungsten stockwork, was interpreted to indicate the depth to buried granite. The results suggested that the Hemerdon Ball granite is an isolated block that does not extend to depth and that no vertically continuous shallow granite occurs at any distance from the known outcrop. These data were not utilised for any appraisal of potential massive sulphide deposits.

2. A detailed gravity survey over 1800 km^2 between Dartmoor and Bodmin Moor, with an average station distribution of about 3.25 per km^2, was interpreted in terms of the depth to the buried Cornubian granite (Rollin, 1988). Large areas were defined where the granite surface lies within 1 km of sea level; in contrast, the north-eastern edge of the Bodmin granite dips steeply to depths of at least 3 km. A closed minimum Bouguer gravity anomaly at Lamerton, north-west of Tavistock, produces a negative residual anomaly of about 2 mGal. This has been interpreted as a Tertiary basin filled with argillaceous sediments. A shallow piston core to a depth of about 15 m, together with a resistivity depth sounding, supported the sedimentary basin interpretation of the Lamerton anomaly, and suggests a thickness of about 150 m of Tertiary clays in a fault-bounded basin, elongated to the north-west.

On Exmoor there have been previous detailed gravity traverses in the Honeymead and West Down areas. These data have not been published but are held in BGS records.

2 The Gravity Method

Gravity varies across the earth in relation to a number of factors, most importantly latitude and elevation. An observation of gravity at any point integrates the effects of these factors, one of which represents the density structure of the Earth. Gravity meters of the balance type can read differences in gravity to the order of 0.01 mGal which represents about 1 part in 10^7 of the Earth gravity field which is about 980 Gal (1 Gal= 1cm/s^2).

Bouguer gravity anomalies represent an enhancement of the signal due to the geological component included in the observed gravity. Bouguer gravity anomalies g_B are observed gravity values corrected for latitude, for elevation relative to the reference surface, for the density of material between the observation and reference surface and for topography. More realistically the observed gravity at any position can be considered to consist of several components:

$$\mathbf{g}_{OBS} = \mathbf{g}_{o} + \mathbf{g}_{fa} + \mathbf{g}_{tide} + \mathbf{g}_{E} + \mathbf{g}_{Ba} + \mathbf{g}_{TOPO} + \mathbf{g}_{i}$$

1. The latitude component or Normal gravity g_o
2. Free-air correction g_{fa} Since the geoid corresponds to sea level, ship-board gravity observations require no free-air correction. The free-air correction is given by:

   $g_{fa} = 0.3086\ h$
3. Tidal correction $\mathbf{g}_{tide}$ generally are less than 0.3 mGal show strong periodicity of about 12 hours and are largest near the equator
4. Eőtvős correction. Gravitational attraction is significantly modified for a moving observer. At latitude 45N an observation made on a ship moving east at 1 knot has a Eőtvős correction of 5.4 mGal. The E-correction is given by:

   $g_E = 7.503\ v \cos L \sin a + 0.004154\ v^2$
5. Bouguer correction $\mathbf{g}_{Ba}$. A simple Bouguer correction accounts for the mass of material between the observation level and sea level using an approximation for the infinite slab. For gravity observations over water then a simple Bouguer correction effectively replaces the water column with a layer of rock at the Bouguer density so that the density used in the slab correction is given by (1.03 - Bouguer density). Simple Bouguer corrections offshore are opposite in sign to those onshore.
6. Terrain correction g_{TOPO}. A simple Bouguer correction ignores the effects of terrain within the Bouguer slab around the gravity station. Adjacent higher terrain effectively produce a positive gravitational attraction and hence a reduction in observed gravity while adjacent terrain below the gravity station also means a positive effect because of the absence of the Bouguer slab. Distant terrain effects need to incorporate earth curvature effects.
7. Isostatic correction g_i. These effectively are a correction to account for anticipated density structure of the lithosphere. Global maps of the geoid indicate a broad compensation across ocean basins so that large mass variations in the lithosphere are effectively compensated at some depth, by isostasy, either Pratt or Airy type. In the Airy model of isostasy the total mass above any unit area must be equal at some depth of compensation. So that a topography of height h and density ρ is compensated at the base of the crust by a root of height h_r given by:

   $h_r = h\ \rho\ /\ (\rho_m - \rho_c)$

   where ρ_m is the mantle density and ρ_c is the lower crustal density. Regional terrain models allow the calculation of Airy root shape and from that the calculation of the isostatic correction. Some form of crustal flexure or rigidity is often incorporated. The isostatic component is negative over continents and positive over oceans and can be calculated from a

regional topographic model. Some texts refer to a decompensative anomaly which is a further correction for the deeper masses which support the main crustal variations in density.

For static observations corrected for earth tide with no correction for isostasy:

$$g_B = g_{OBS} - g_o + g_{Fa} - g_{Ba} + g_{TOPO}$$

Bouguer gravity anomalies g_B used for maps and presentational purposes are frequently corrected for a reduction density close to the density of near-surface rocks, typically 2.70-2.75 Mgm^{-3}. Terrain corrections incorporated into Bouguer gravity anomalies are generally calculated at the same density.

Stratiform massive sulphide deposits are commonly associated with a small (typically 1–2 mGal) positive residual gravity anomaly. Pyrite has a density of 4.8–5.1 Mgm^{-3} (Read, 1970) and massive pyrite deposits commonly have density values exceeding 4.5 Mgm^{-3} (Strauss et al., 1977). Consequently some IPB deposits are associated with small high-frequency residual gravity anomalies up to 4 mGal.

The regional gravity survey of the UK was not designed for detection of such anomalies. Furthermore, although the region has two detailed gravity surveys in the zone of interest the gravity field is still relatively under-sampled in comparison with exploration practice in the IPB. Both the previous detailed gravity surveys used public highways and tracks to make observations so that station distribution is not uniform. Both of the detailed gravity surveys had originally been interpreted for residual negative anomalies associated with stockwork and cusp structures in the granite roof rather than for small positive features related to massive sulphide mineralisation.

Terrain corrections are variable in SW England but can be up to about 3 mGal for some stations. Accurate terrain correction is an essential part of high-resolution gravity survey and generally requires either concentrated manual appraisal of terrain at each gravity station or access to a high-resolution digital terrain model (DTM). Previous regional surveys in SW England have generally made Hammer zone A-H terrain corrections (c.3.5 km) using graticules to estimate 40 heights in concentric annuli from 1:25000 scale maps. Outer zone corrections (to Hammer zone X, about.48km) have been made using grids of mean heights for 1 km and 5 km squares. The present surveys have done all inner-zone terrain corrections using a 50m DTM based on the 1:50000 scale OS contour vectors corrected for formlines and streamlines. The existing terrain corrections have been used to check and validate the digital procedure.

3 Target areas

3.1 EGLOSKERRY

Extensive geochemical prospecting was carried out by RioFinex over the Lower Carboniferous succession in the central region, together with much of north Cornwall and Devon, in 1980. Initial roadside soil sampling was followed up by deep overburden sampling using Cobra percussion drilling. A high tenor geochemical anomaly was found at Egloskerry, situated two miles west of Launceston, Cornwall. RioFinex subsequently investigated this anomaly for stratiform lead-zinc in the early 1980s, with funding support from the MEIGA scheme (MEG 223). Ground geophysics was limited to IP, SP magnetic surveys and VLF (Easterbrook, 2001).

In the Egloskerry area the overburden sampling comprised 14 north–south traverses, spaced at 200–300 m over an east–west tract of approximately 3 km. The samples, collected at 30 m intervals, were analysed for Cu, Pb, Zn and Mn. Anomalous Pb values, in excess of 4000 ppm, were encountered at two localities that were subsequently drilled. Zinc and to a lesser extent Cu and Mn, were also markedly enriched at these sites. Extremely high Zn values, up to a maximum of 29800 ppm, also occurred in the floodplain of the River Kensey near BH1. It is highly probable that these near-surface anomalies are attributable to hydromorphic upgrading.

In 1981, five diamond drill holes were drilled to investigate the principal soil anomalies at Egloskerry. Three holes were situated in the vicinity of Westend Farm, in the valley of the River Kensey [228 085], while the others were located approximately 1.5 km east-north-east, in the vicinity of Trewithick Farm [229 085]. Borehole EG1 intersected significant lead mineralisation: 10% Pb over 4.5 m (4.1 m true thickness) in a 45 m thick laminated siltstone unit forming part of a volcano-sedimentary sequence. The base of the siltstone was faulted out against pyritic black shales. The lead mineralisation occurs in the form of fine-grained stratiform galena, locally remobilised into narrow quartz veinlets within the mineralised zone. Within the mineralised zone the bedding intersection angle was 65° to the drillcore axis. Borehole EG2 was drilled vertically at the same location as EG1. Although the hole collared in laminated siltstones, it intersected a major fault at 32 metres, and encountered only minor lead mineralisation. Borehole EG3, located some 280 m west of EG1 and 2, intersected black shales overlying volcanic rocks. Although the black shales were pyritic, their Pb and Zn contents were not anomalous. Borehole EG4, located at Trewithick farmhouse, intersected brecciated volcanic rocks overlying black pyritic shales and pyroclastics. These in turn overlie calcareous siltstones and shales. Pyrite occurs as disseminated nodules and veinlets, while minor galena and sphalerite occur in thin veinlets and on joint fractures. Borehole EG5, situated 180 m east-north-east of Trewithick farmhouse, intersected intercalated shales and volcanics. Minor fracture-filling galena and sphalerite are also present. Maximum assay values were 0.37% Pb and 0.29% Zn, between 38.32 and 39.25 m.

In 1982 a further series of holes was drilled at Egloskerry, with most in the Westend Farm area, and a single hole (EG9), located at Trewithick Farm to test a Cobra geochemical anomaly. The follow-up drilling at Westend Farm (boreholes EG6, 7, 8, 10 and 11) identified lead mineralisation in black shales, as well as in the previously identified laminated siltstones. Lead enrichment is associated with enhanced Zn and As values. Maximum levels were encountered in the black shales in EG6, although the mineralisation is mainly concentrated in fracture zones, rather than being stratiform in type. At Egloskerry, the geological environment of the galena occurrence in BH1 was considered to be similar to those at Meggan and Rammelsberg in Germany, but no further work has been carried out to pursue this analogy further.

In 1981-82 Riofinex carried out soil and overburden geochemical surveys over a Lower Carboniferous shale-siltstone sequence near Bridestowe, located about 13 km south-west of Okehampton. Lead and zinc anomalies defined in these investigations were tested by diamond

drilling at Burley Wood [249 087] in 1982. Three boreholes were drilled to an aggregate depth of 371 m. Geochemical analysis of groove samples showed low tenor enrichments in Cu, Pb and Zn in the upper (20–40 m) sections of each borehole in black cherts and silicified mudstones. The underlying shales and siltstone sequences showed no significant enrichments in base metals. Visible mineralisation in core was dominantly disseminated pyrite with traces of galena and sphalerite associated with quartz veining.

3.2 COMBE MARTIN

MRP investigations have been carried out over extensive areas in north Devon. Drainage geochemical surveys over Exmoor and the Brendon Hills identified several areas of anomalous metal concentrations (Jones et al., 1987). Some of these anomalies relate to vein-style mineralisation, but others suggest a stratiform distribution of ore metals. Barium anomalies were also recognised and indicate previously unrecorded baryte mineralisation.

A distinct aeromagnetic anomaly of amplitude about 60 nT trends west-north-west–east-south-east over the upland areas of Exmoor and approximately follows the boundary between the Ilfracombe Slates and the Morte Slates. A less prominent linear anomaly to the south occurs over the upper part of the Morte Slates, with maximum amplitudes in the west. Detailed soil-geochemical studies over some of the aeromagnetic anomalies identified some minor Zn-Pb anomalies and a general association of Zn in soil with the magnetic anomaly. Preliminary interpretation assumed that the magnetic anomaly comprised components from both deep and shallow sources (Jones et al., 1987).

A strong linear gravity gradient trends east-south-east across Exmoor with minimum gravity values in the central Bristol Channel syncline. Models to interpret this gradient include Variscan thrusts and relatively dense basement rocks (Mathews, 1975, Brookes et al 1977). Edwards (1999) shows a model of a thrusted anticline of middle and Lower Devonian strata above a magnetic basement which form a decollement to thrusts dipping south.

Previous ground geophysical work on Exmoor has been concentrated over the magnetic anomalies observed in the 1958 regional aeromagnetic survey. Table 3 indicates the records of historic geophysical surveys in the region:

Table 3 Summary of previous ground geophysics over Exmoor

date	source	methods	type	N-n	Digital data
1966	BGS	Magnetic, gravity	traverse	4-1	Y
1967	BGS	Magnetic	traverse	5	Y
1970	BGS	Magnetic, gravity	traverse	3-2	Y
1973	BGS	Magnetic, EM	traverse	8-3	Y
1974	BGS	Seismic-gravity	traverse	1-1	Y

N and n are the number of traverses for the main and secondary survey methods.

The 1966 magnetic survey also observed a single gravity traverse just east of Simonsbath. The 1970 survey included two gravity traverses at West Down and Simonsbath. The incomplete Bouguer gravity anomaly data for the West Down traverses are available but no observed gravity data are available. Bouguer gravity data are also available for the 1970 Simonsbath traverse but the observed gravity are not available. Gravity data were observed along the Exmoor seismic profile and corrected for inner-zone terrain (A-H).

Two boreholes at Honeymead Farm, about 2 km east of Simonsbath, were sited on the results of the 1973 magnetic survey. These showed that the shallow magnetic source was probably pyrrhotite mineralisation in the form of fine crystals on the cleavage faces. It should be noted that the Honeymead boreholes were not drilled at the preferred site because of access

restrictions. Pyrite was also present in drillcore occurring as fine dissemination in sandstones, with calcite in tension gashes and minor veins. Numerous field and borehole magnetic susceptibility data indicated that the volume susceptibility of the core was very low, typically 0.70 x 10^{-3} SI. This would provide an induced magnetisation of less than 0.03 A/m. The aeromagnetic anomaly along three profiles was modelled in terms of south-dipping structures with total magnetisation vectors up to about 0.2 A/m implying significant Natural Remanent Magnetisation (NRM), typically about 5–10 times the induced component (Edmonds et al., 1985). The modelled magnetisation vector had a southerly declination and a steep dip of 40–80° although no measurements of NRM were made on the core samples. The pyrrhotite is either recrystallisation of pyrite to pyrrhotite or to new mineral growth.

The Rhenohercynian zone of the Variscan terrane includes conformable Devonian-Carboniferous clastic and volcanic rocks folded and thrust northwards over the amalgamated Laurussia terrane (Laurentian-Baltica-Avalonia). The basement rocks are generally poorly exposed. The stratigraphic and tectonic setting of the Devonian sediments on Exmoor is compared with those of the Harz basin in Germany which hosts the major polymetallic copper-lead-zinc-baryte deposits at Rammelsberg and Meggen (Large, 1988).

The Rammelsberg deposit is hosted in Middle Devonian (Eifelian) shale along a structural line which marks rapid changes in thickness of the dark shales and is the focus of mafic volcanic rocks which now occur in the thicker part of the unit. The orebodies comprise stratiform massive sulphides strongly deformed into tight isoclinal synclines, commonly with tectonic contacts. The Old Orebody, with a strike length of 600 m, extends to 300 m depth and is 12 m thick. The larger New Orebody has a vertical extent of 500 m with a thickness up to 40 m and had an average grade of about 6% Pb, 14% Zn and 1% Cu. The main ore minerals are sphalerite, pyrite and baryte, with lesser galena and chalcopyrite. The deposit is characterised by high values of Sb, As, Co, Bi and Sn. The estimated total tonnage over 1000 years of working at Rammelsberg is about 30 Mt with an average grade of 14% Zn, 6% Pb, 2% Cu, 140 g/t Ag, 1 g/t Au and 20% baryte (Large and Walcher, 1999).

The stratiform mineralisation at Meggen (Krebs, 1981) comprises a 3.5–8 m thick bed with continuity over a strike length of 6 km occurring in the Upper Givetian to Lower Frasnian (Middle to Upper Devonian transition). The ores at Meggen comprise fine-grained massive pyrite, marcasite, sphalerite, galena and baryte. Total tonnage was 50 Mt at 8% Zn and 1% Pb.

The Upper Devonian–Lower Carboniferous sequence in North Devon has similarities with that of the Harz Massif of Germany. In North Devon, outcrops of Dinantian strata occupy limited areas within second-order folds at the northern margin of the Culm synclinorium. Much of the ground to the north in Exmoor and the Brendon Hills is underlain by Upper Devonian sandstones and slates. In the Harz Massif, the ore horizon in the Rammelsberg deposit occurs in dark grey shales of Eifelian age. The Eifelian Hangman Grits in Devon are more arenaceous than the Harz Eifelian sequence. The Hangman Grits are overlain by the Ilfracombe Slates which are primarily grey slates with minor sandstone and a few discontinuous limestones in the Morte Slates and Kentisbury slates.

High concentrations of zinc occur widely on Exmoor. For example, sporadic high Zn values occur over the Morte Slates, but the main anomalous zone is close to the base of the Ilfracombe Beds. The anomaly occupies an area in which mining has never been carried out and has a strike length of several kilometres. Sphalerite was also recorded in some panned concentrates from this zone. Jones et al. (1987) also identified widespread Ni enrichment over the Ilfracombe Beds. This could be related to stratiform pyrrhotite-bearing mineralisation that gives rise to the coincident magnetic anomaly. The median Zn content of stream-sediment samples collected over Lower Carboniferous strata is 160 ppm, with high values occurring mainly in the central zone and in the Teign valley. Zinc contents of stream sediments from Middle Devonian rocks on the south side of Dartmoor are generally low. Silver analyses are not available for panned-concentrate samples from Exmoor. Arsenic drainage data are also not available for north Devon.

In north Devon there is a cluster of high Sb values to the south of Exmoor, especially around the villages of Twitchen and Molland. Jones (1987) suggests that these anomalies may relate to undiscovered mineralisation.

At Lester Point, [SS 576476], near Combe Martin, Scrivener and Bennett (1980) described galena and sphalerite mineralisation hosted in a fold closure and showing evidence of stratabound character (see Appendix 5). A visit to one of the old lead-silver mines in the Combe Martin area (Harris's shaft) was undertaken in an attempt to clarify the nature and extent of the mineralisation of the area. The workings in the area probably date back to the 13th century (Claughton, 1997) and have been closed and re-opened several times since then. Only minor amounts of mineralisation remain underground. This occurs as discrete stinger veins a few centimetres to tens of centimetres long and a few millimetres in width. The mineralisation comprises predominantly galena, though limonitic and sideritic alteration is also extensive (see Appendix 5). The mineralisation is associated with discontinuous veining and lenticular pods of quartz occurring on the limb of a small asymmetric fold. This occurrence is similar to that observed at Lester Point. From the evidence in Harris' shaft and at Lester Point, the veining and associated sulphides are conformable to the stratigraphy and therefore appear to be stratabound on the outcrop scale. However none of the occurrences display features typical of Sedex stratiform mineralisation.

Further exploration in North Devon should be aimed at important structural lines indicated by regional gravity and magnetic anomalies and minor positive residual gravity anomalies especially where these show some relation to geochemical anomalies and historic mining.

4 Results

Gravity data were collected with La Coste and Romberg Gravity meters 280 and 456. Station positions were collected using a Leica 530 GPS system using in Real Time Kinematic (RTK) mode. Local reference points in each survey region were linked to the Ordnance Survey Passive station network and sited on local high points to provide good 2-way radio communications between reference GPS receiver and roving GPS receiver.

4.1 EGLOSKERRY SURVEY

4.1.1 Data collection

A local gravity base was established at Ta Mill (SX 186 848) and linked to the NGRN73 network at Liskeard FBM and Boscastle FBM. Table 4 shows the results of the base links.

Table 4 Base link information for Egloskerry

FBM	Gravity	Meter	Difference	Base gravity
Liskeard FBM	1081.08	280	+1.45	1082.53
Liskeard FBM	1081.08	456	+1.42	1082.50
Boscastle FBM	1101.27	280	-18.82	1082.45
Boscastle FBM	1101.27	280	-18.81	1082.46
Boscastle FBM	1101.27	280	-18.83	1082.44
Ta Mill base (5)				1082.48

Local survey control points were established within the survey block at sites with good intervisibility across the ground. These were used as base stations for the reference GPS receiver and would therefore be sites of radio transmission. The points were on Treguddock Down [SX 277 838], Red Down [SX 266 857] and East Down [SX 284 861]. These control points were linked to the Ordnance Survey passive station network which provides positions in WGS84 coordinates updated on a 5-year cycle. The nearest passive station to the Egloskerry site is at Bray Shop which is about 15 km from the survey block. A base receiver was established at Bray Shop and short static observations were made at the control points in turn. Since the baseline distances were of the order of 10-20 km observation times were about 15 minutes at each control point. Because of limited time, the control network was not closed by moving the base receiver to one of the controls and observing at other control points. Post processing of the static observation as the passive station and the three control points gave accurate WGS84 coordinates for the 3 control points.

Daily survey procedure involved setting up a reference GPS receiver at one of the control points and using the second receiver in Real-Time-Kinematic (RTK) mode. Radio signals were generally good and high precision positions were generally available within a few seconds at each site. The roving GPS receiver moved with the gravity meter and positions were observed at the centre of the gravity meter dish. Station positions were not marked although a field sheet was filled in at each site to provide a record of satellite configuration and position accuracy. Generally satellite configuration was good with up to 10 satellites in the sky at the base station. Occasional short spells of poor configuration occurred close to 1630-1700 each day but these generally only lasted about 30-45 minutes. No reliable positions were obtained when the number of visible satellites reduced to 4.

All positional survey data were collected in WGS84 coordinates which provides latitude, longitude and ellipsoid height in metres (x,y,z). The ellipsoid heights are approximately 50m above the OSGB36 levelling datum to which map contours and heights are related. Daily survey data using the RTK mode were downloaded each night and converted to OSGB36 Easting, Northing and orthometric height (E,N,h) using freeware software. Local coordinates were combined with gravity meter readings and base loop data, corrected for earth tides and reduced using the BGS package BREDUC. This provided a field output of the incomplete Bouguer gravity anomaly (i.e. without terrain correction). These data were imported into ArcView and gridded to review survey progress and target anomalies.

The area of detailed gravity survey and location of survey control points are shown in Figure 2.

4.1.2 Terrain correction

Local and distant terrain affects the value of gravity at any point. The effect is inversely proportional to distance squared. Even in undulating open country terrain corrections can still be up to about 3 mGal, which is of the order of the anomalies caused by small high-density masses. In order to reduce immediate terrain effects it is good practise to locate gravity stations where there is flat or evenly sloping ground within 10 metres of the gravity meter. Alternatively a visual estimation of local terrain can be made at each gravity station.

A high-resolution (HR) digital terrain model (DTM) for the Egloskerry area was extracted from the UK digital terrain model compiled at the Centre for Ecology and Hydrology (CEH). This is based on the Ordnance Survey contour vectors for the 1:50,000 Series maps. Elevation at a grid of points with a mesh size of 50 m has been estimated by a ray-method. Additional control on the DTM was achieved using streamlines, breaklines and formlines. The DTM for the Egloskerry area is shown in Figure 2 with the locations of the survey control points. Inner zone terrain corrections, out to a few kilometres were made using the 50m DTM.

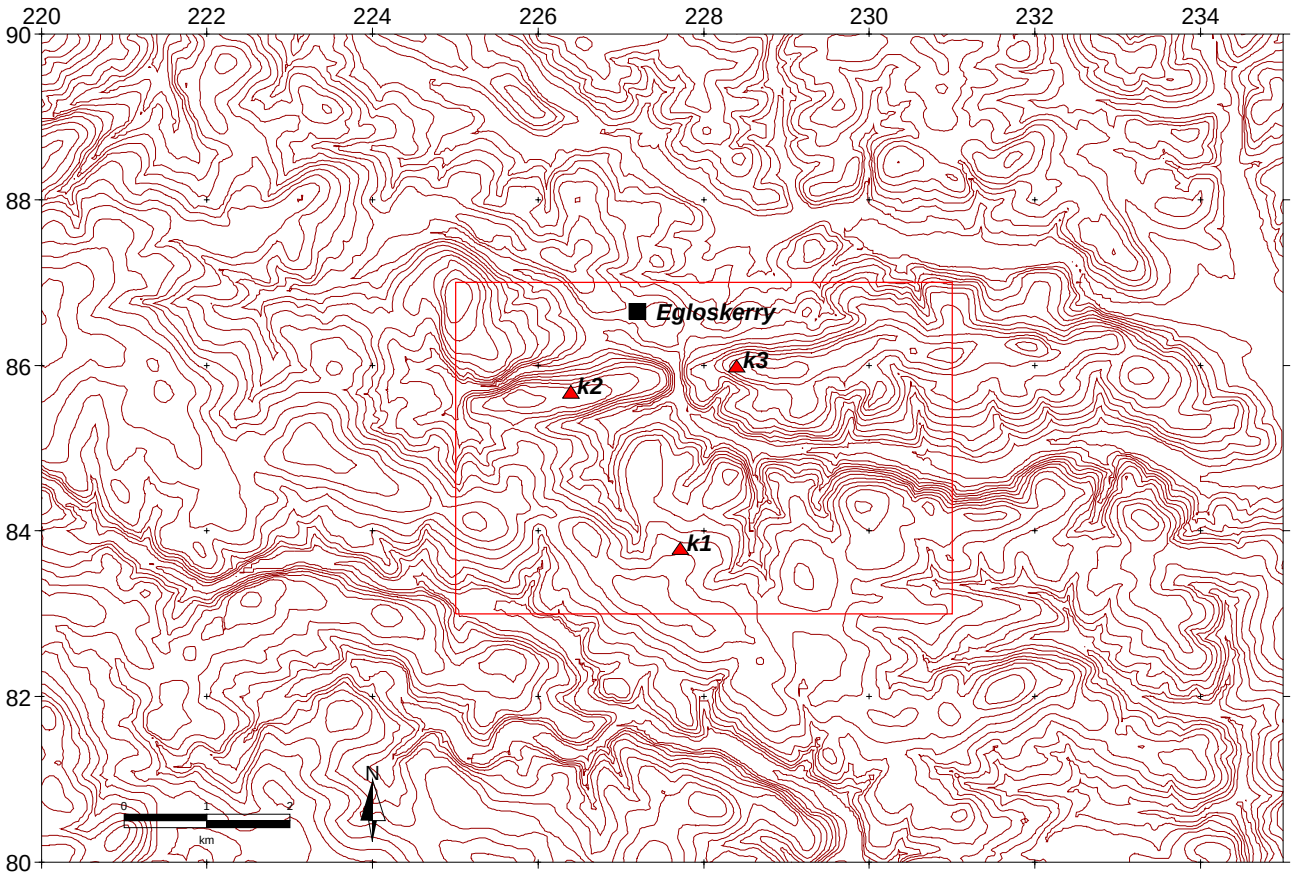

Figure 2 Digital Terrain Model (DTM) for the Egloskerry area

Outer zone terrain corrections relate to the topographic effect of the more distant terrain, typically more than 5 km from each gravity station. These corrections are generally much smaller than inner-zone terrain corrections but are still significant and need to be made. Past practice for the UK regional data has been to use mean elevations in 1km British National Grid squares for near terrain and mean elevations in 5x5 squares for more distant terrain. For many areas of the UK, BGS has mean elevation data for each 1 km grid square. Outer zone terrain corrections were made to 48 km using a low-resolution DTM based on mean elevations at the centre of each 1 km grid square. The estimated mean elevations were inserted into a grid of elevation data derived from onshore and offshore gravity stations and the revised DTM was sub-sampled to provide a grid of mean heights for SW England.

Inner zone terrain corrections were made using the 50m DTM and terrain effects were calculated for each gravity station for a square region 7x7 km with the gravity station occurring within the central 1 km square. This allows the inner-zone terrain to be added to the outer zone terrain correction based on a 1 km DTM without overlap.

All terrain corrections were calculated using the BGS package **xdtmtc.** This generates a terrain correction for each gravity station. The program is executed twice, once for the inner zone correction and once for the outer zone correction. The listing of gravity data for the Egloskerry region is given in Appendix 1 and shows the contribution of inner-zone and outer-zone terrain.

4.1.3 Data validation and gridding

Data validation is difficult because there are only 14 regional gravity stations within the survey block and most are located at OS spot heights rather than bench marks. Road surfaces change significantly over decades and exact relocation is difficult. Four sites occupied as part of the original regional survey provide a check on the new data. These are summarised in Table 5.

Table 5 Comparison of regional and new gravity data Egloskerry

Station	Type	Height	Observed	Terrain	Bouguer
SX28SE09	SH	176.6	1097.53	0.14	7.77
P3	GPS	178.84	1097.38	0.15	7.69
SX28SE03	SH	133.5	1102.22	0.40	3.91
P502	SH	133.5	1102.23	0.42	3.95
SX28NE15	SH	125.0	1111.89	0.30	10.07
P67	GPS	125.48	1111.70	0.35	10.04
SX28NE17	SH	168.2	1100.76	0.26	7.59
P63	GPS	168.57	1100.66	0.25	7.55

The new gravity data for Egloskerry were combined with the existing regional data. The data were edited to remove the duplicate regional points in the Table 5 and gridded at an interval of 50 m using a minimum tension algorithm with a tension factor of 0.3.

4.1.4 Regional residual separation

Bouguer gravity anomalies (Figure 3) reflect the integrated effects of all density structure of the earth's crust. Much of the anomalous signal is sourced in the ground immediately beneath and close to the gravity station but there are considerable effects from large geological structures such as late-tectonic granites, which extend through the upper 10-15 km of the crust. Separation

of local effects from more regional sources is always ambiguous and can be based on a variety of methods. Regional fields can be determined by upward continuation, graphical means, data sub-sampling or frequency filtering. In this case a form of data sub-sampling was used to define a regional field.

As a first approximation the Bouguer gravity values for the regional gravity stations within the Egloskerry area were gridded on a mesh of 50 m and used to define the regional anomaly (Figure 4). This field shows a general decrease in gravity across the area from north-east to south-west in response to proximity to the Bodmin Moor Granite. Two of the regional stations can be identified as indicating local gravity anomalies relative to this field. The regional grid was then subtracted from the new Bouguer gravity anomaly field to provide a residual anomaly map.

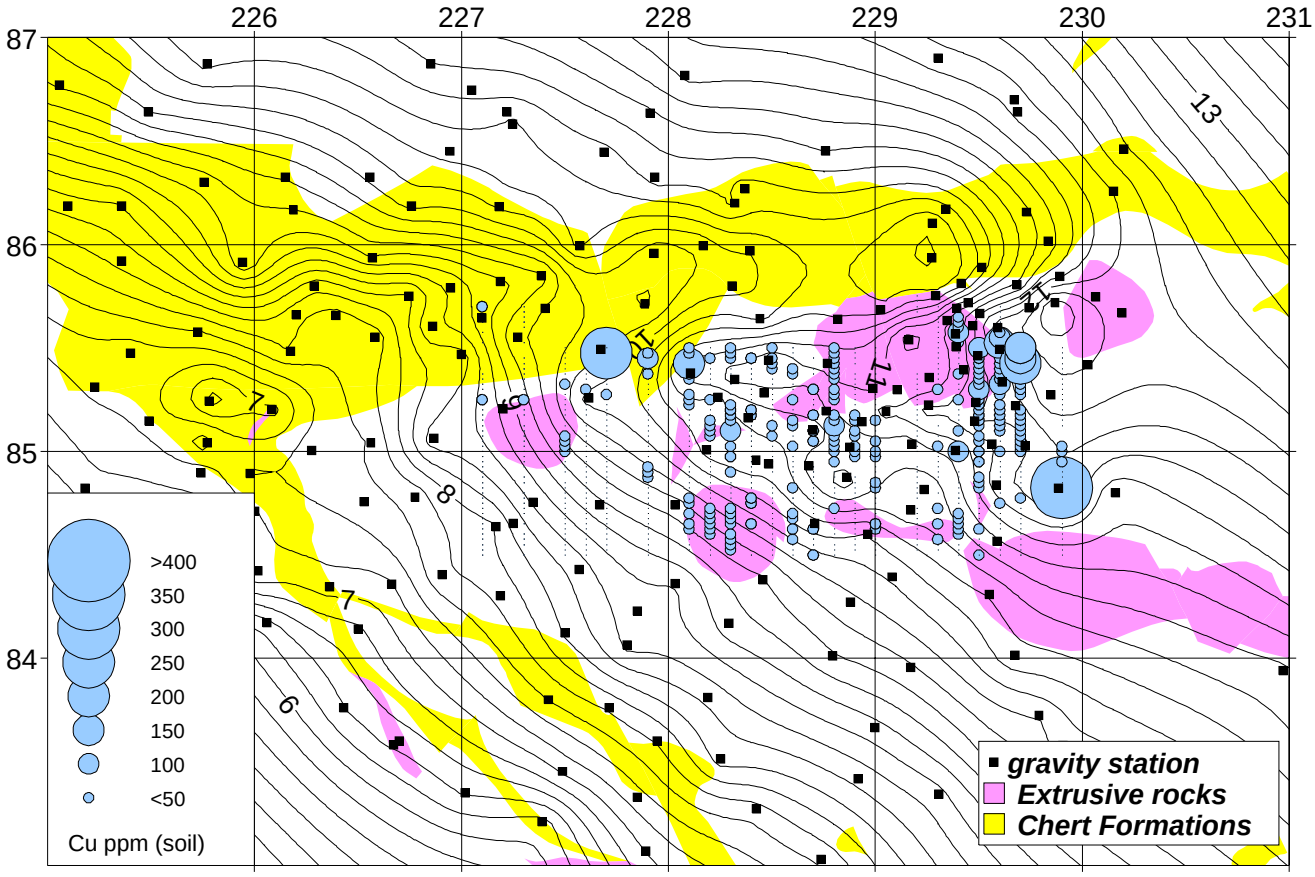

Figure 3 Bouguer gravity anomaly (mGal) for the Egloskerry area with Cu values in soils

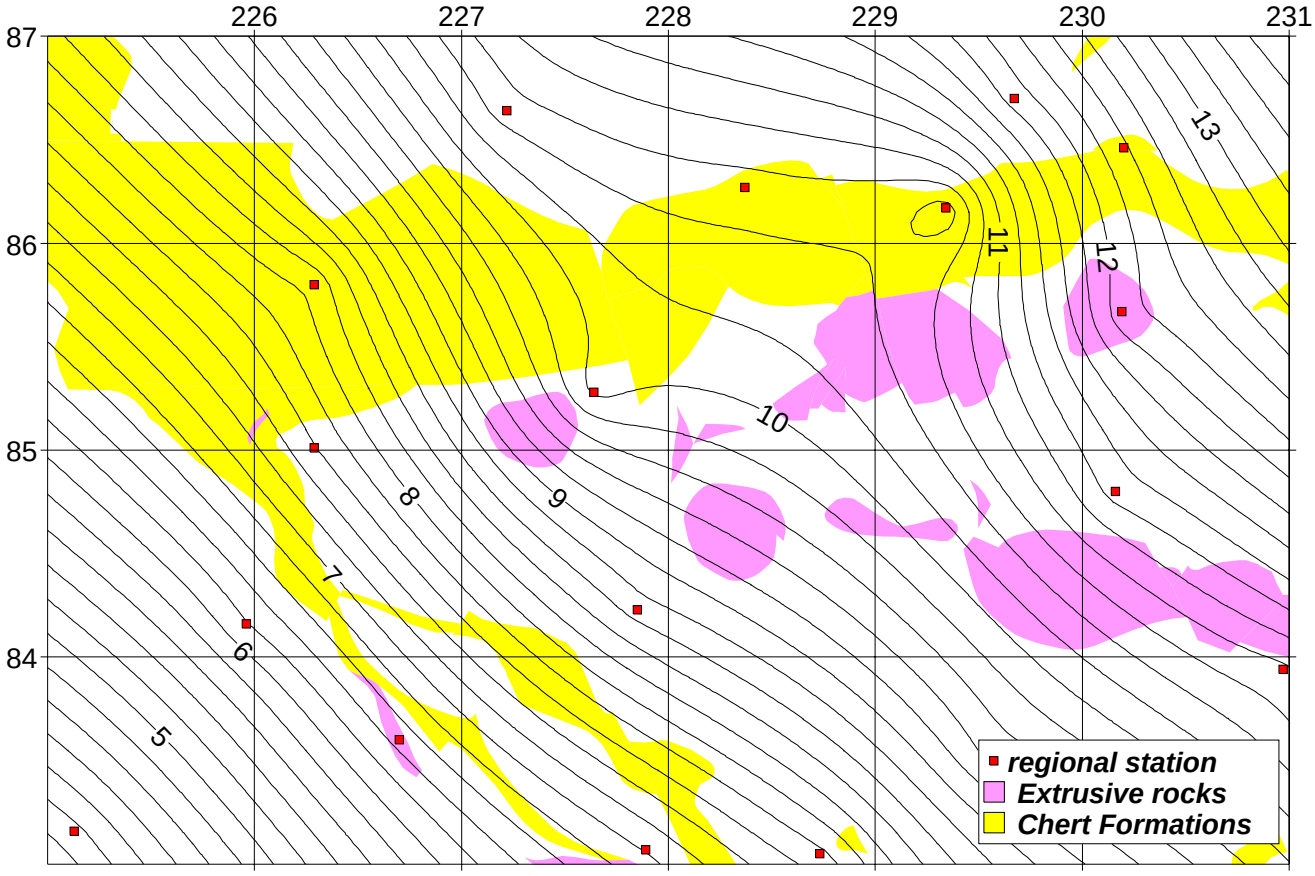

Figure 4 Regional Bouguer gravity anomaly (mGal) for the Egloskerry area

4.1.5 Anomaly interpretation

The residual gravity anomaly map (Figure 5) shows a strong correlation with solid geology and with anomalous levels of base metals in deep roadside soil samples. Residual anomalies are mostly in the range -0.6 mGal to 1.0 mGal. Negative anomalies are closely identified with the outcrop of the Fire Beacon Chert formation on Red Down, while positive anomalies to the south are associated with the Liddaton Shale formation and parts of the Crackington Formation with shales and slate.

The residual gravity anomaly also shows a good correlation with anomalous Pb and Zn values observed in shallow soils (Figure 6). Maximum positive residual gravity anomalies of about 1 mGal are associated with the zone of highest Pb in soil with values above 1600 ppm. Zinc values exceeding 200 ppm in soil are also correlated with the zone of positive residual gravity anomaly.

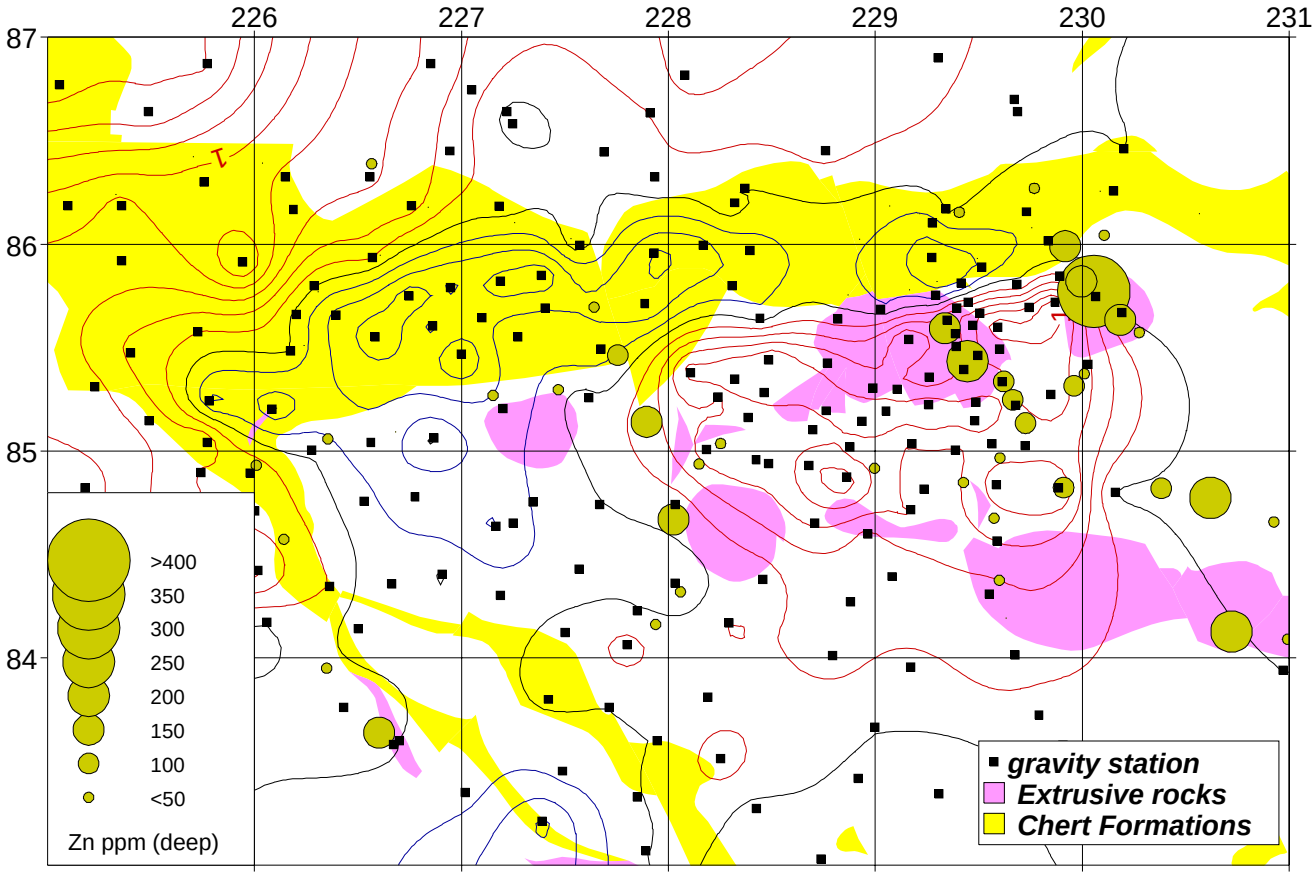

Figure 5 Residual gravity anomaly for the Egloskerry area, with Zn values in deep soil samples

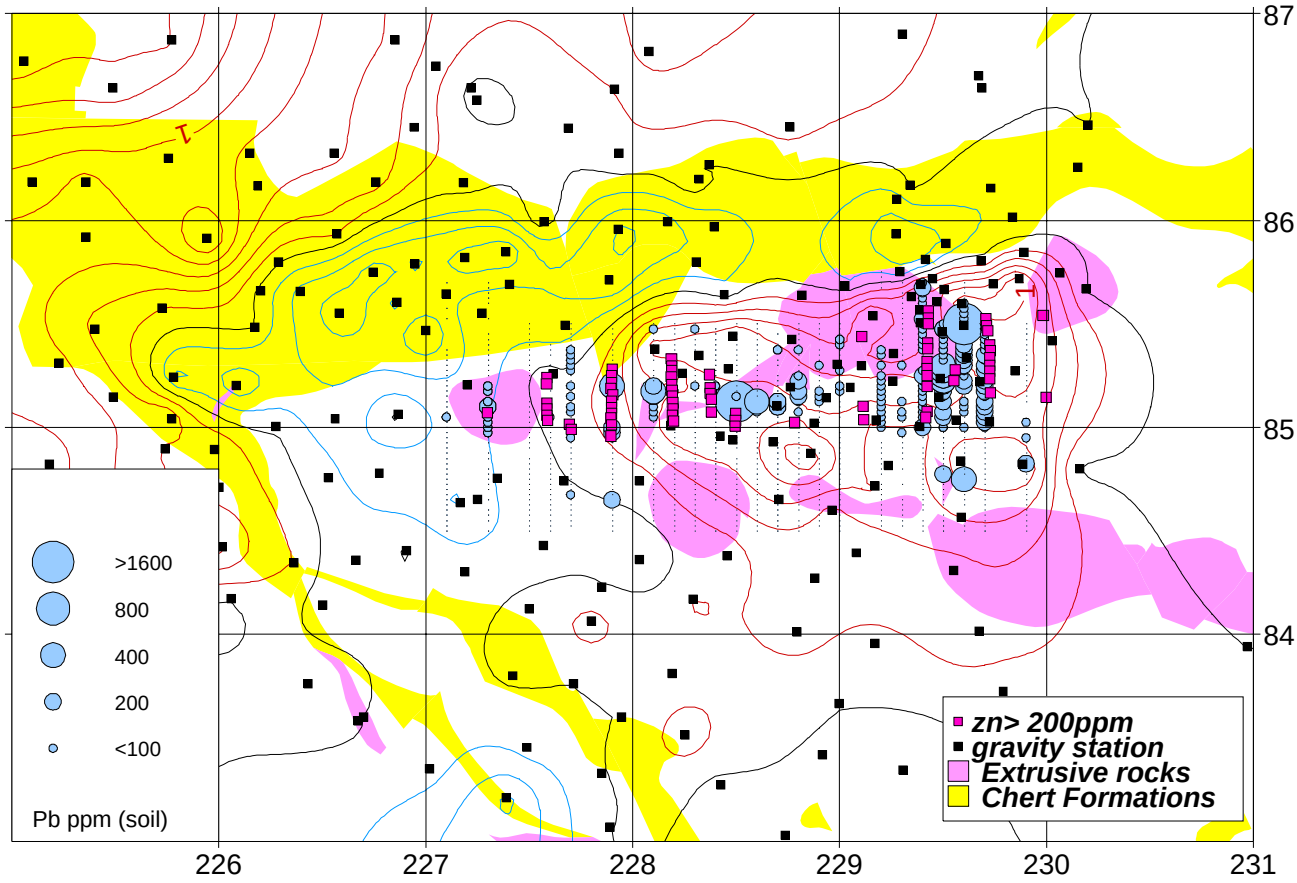

Figure 6 Residual gravity anomaly for the Egloskerry area, showing anomalous Pb and Zn in shallow soil samples

4.2 COMBE MARTIN SURVEY

4.2.1 Data collection

Survey procedure followed the practice described for Egloskerry. A base station was established at Horsewell Farm [SS 584 291] and linked to the NGRN73 base at Great Torrington. Table 6 shows the results of the base links.

Table 6 Base link information for Combe Martin

FBM	Gravity	Meter	Difference	Base gravity
Torrington FBM	1165.91	280	-3.49	1162.42
Torrington FBM	1165.91	456	-3.54	1162.37
Torrington FBM	1165.91	280	-3.57	1162.34
Horsewell Farm				1162.38

The terrain in North Devon is more incised than the central region and deep valleys run north to the sea. This makes radio communication and access generally more difficult. A total of 7 local control points were established in the survey block although only 4 of these were used for data collection. The nearest Ordnance Survey passive station is at Bratton Down, about 15 km from the survey region. This was used as a reference point and a GPS receiver was established here while short period static observations were made in sequence at the control points. Again no closure of the control network was made. Post-processing of the data provided WGS84 coordinates for all control points.

GPS survey procedure used the RTK mode to establish immediate positional (xyz) information at each gravity station with the GPS antenna pole sited in the gravity meter dish. Station positions were marked approximately on a 1:10,000 scale map at the time of observation to provide a review of data distribution and a field observation sheet was filled in for each station. There were some problems with radio link between reference GPS and rover but generally control point site selection was good.

A total of 167 gravity stations were observed in a region of about 40 km^2. Previously there were only 25 gravity stations in this block. Survey progress was somewhat limited by numerous access visits, extremely narrow lanes and tracks in the Combe Martin village area and the nature of the terrain. During the survey a long period oscillation of the gravity meter was observed on Wednesday 9 October 2002, with an amplitude of less than 1 scale division and data collection was suspended for a short time. This was apparently not related to tree roots or wind. On the next day 10 October, very large amplitude oscillations (±5 scale divisions) occurred between about 1200 hours and 1400 hours indicative of Rayleigh waves from a large earthquake. This was subsequently identified as a 7.6 magnitude earthquake in Irian Jaya, Indonesia. Data collection was suspended during the Rayleigh waves disturbance. Subsequent days showed no such interference.

The survey region and location of control points is shown in Figure 7.

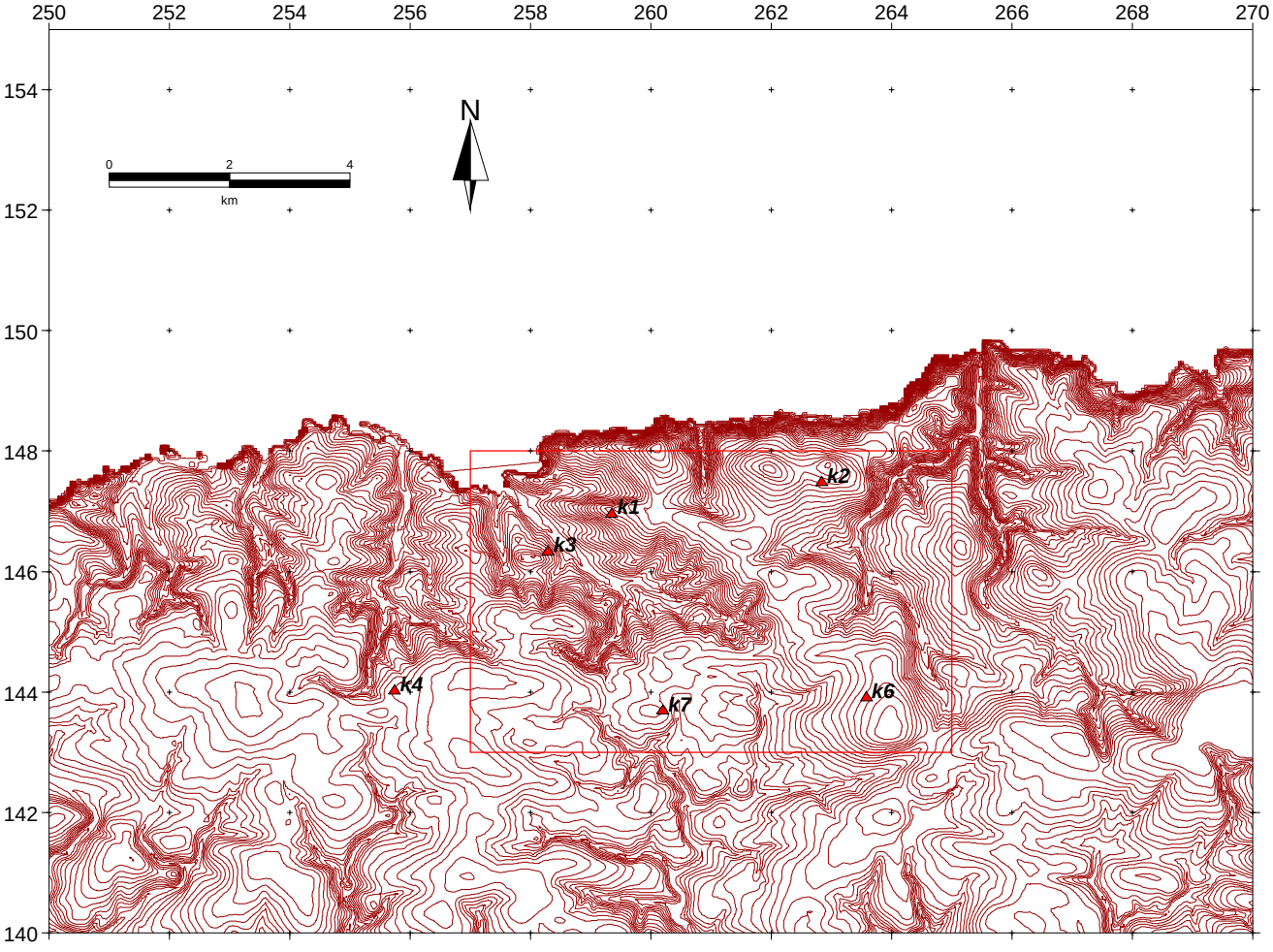

Figure 7 Digital Terrain Model (DTM) for the Combe Martin area

4.2.2 Terrain correction

Terrain correction procedure followed that indicated for Egloskerry. Inner zone terrain corrections out to + 3 km from each station (i.e. within a 7x7 km square) were made using a high-resolution (50 m) DTM extracted from the UK 50m DTM available based on OS contours.

Outer zone terrain corrections to 48 km from each station were made using a mean elevation DTM based on the British National Grid one kilometre squares.

The CEH DTM covers only the onshore region of the UK. Some gravity stations at Combe Martin are within 3 km of the mean high water mark (MHWM) and require submarine topography. Inspection of Admiralty Chart 1165 (Bristol Channel) indicates that despite the high cliffs along the north Devon coast, the seabed shows only low relief with water depths increasing rapidly to about 10 m offshore and then gradually to about 40 metres depth at about 5 km offshore. A simplified seabed topography was inserted into the high resolution DTM for the Combe Martin area to make the DTM complete.

Appendix 2 lists the new gravity data for the Combe Martin survey.

Appendix 3 lists the SQLPLUS script to access the UK 50 m DTM data on the ORACLE server and the control scripts to run the inner and outer zone terrain corrections using xdtmtc.

4.2.3 Data validation and gridding

At Combe Martin there are only 4 stations of the original regional survey that were at, or very close to, new gravity stations so data validation is less certain. However the results show that the values of observed gravity, terrain correction and Bouguer gravity anomaly are reasonable (Table 7).

Table 7 Comparison of regional and new data Combe Martin

Station	Type	Height	Observed	Terrain	Bouguer
SS54NE06	SH	36.3	1182.72	1.09	14.34
P75	GPS	36.41	1182.74	1.00	14.29
SS54NE07	SH	226.5	1143.56	1.47	12.69
P84	GPS	224.88	1143.87	1.50	12.69
SS64NW02	SH	259.4	1136.07	1.19	11.49
P30	GPS	261.03	1136.49	1.13	12.19
SS64NW09	SH	271.6	1135.45	1.51	14.41
P38	GPS	271.98	1135.36	1.23	14.07

The new gravity data for Combe Martin were combined with the existing regional data and edited to remove the duplicate regional points indicated in the Table 7. These data were then gridded at an interval of 50 m using a minimum tension algorithm with a tension factor of 0.3. The Bouguer gravity anomaly map is shown in Figure 8.

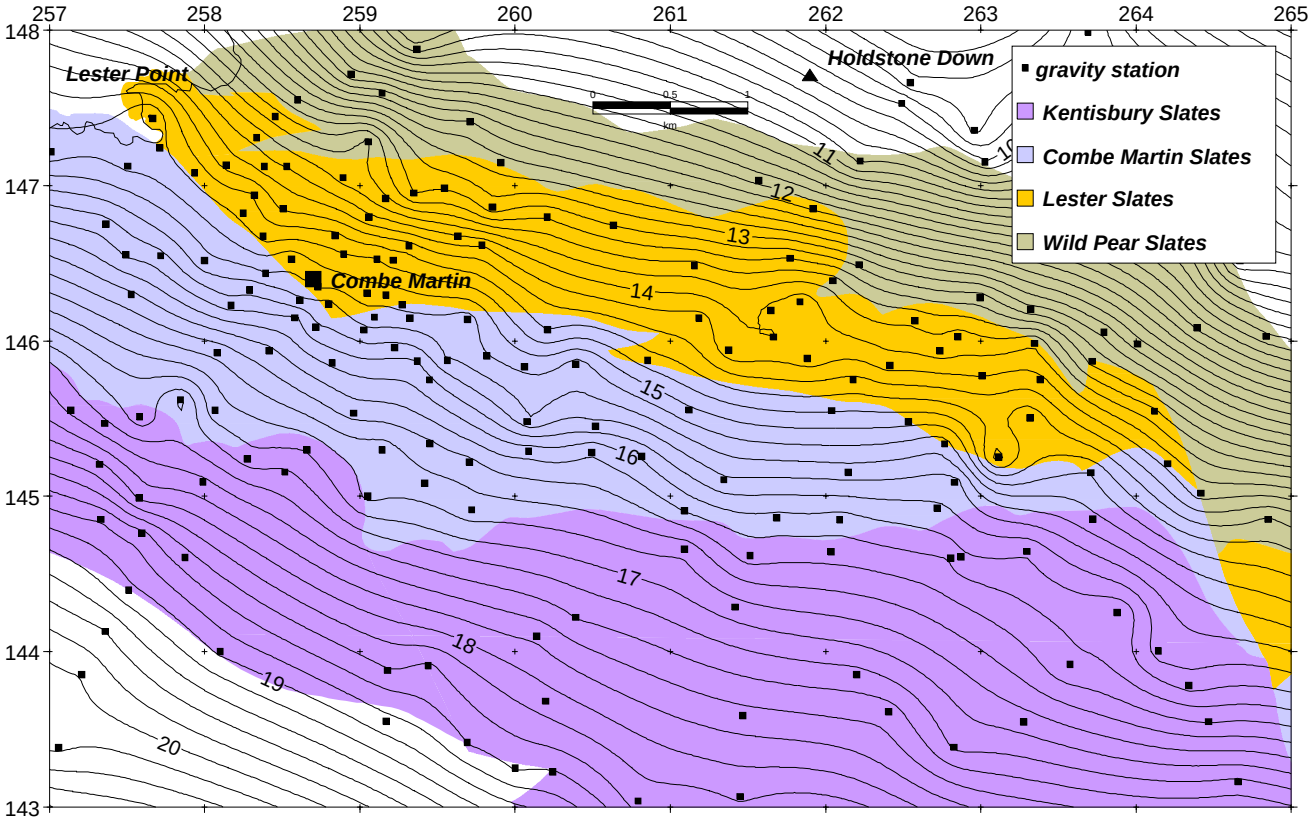

Figure 8 Bouguer gravity anomaly for the Combe Martin area

4.2.4 Regional residual separation

The regional gravity data for Combe Martin were gridded at a mesh size of 50 m and used to define the regional anomaly. The regional gravity anomaly shows (Figure 9) a very strong horizontal gravity gradient positive to the south. This gradient intersects the north Devon coast through Combe Martin suggesting that the zone of lead-silver mineralisation lies above a major structure at depth. This may be related to ESE faults identified on the 1:50,000 geological map. The strong horizontal gradient in the gravity field makes direct observation of small features in the Bouguer gravity anomaly field difficult.

The residual anomaly at Combe Martin (Figure 10) was derived by subtraction of the regional field from the new Bouguer gravity anomaly field.

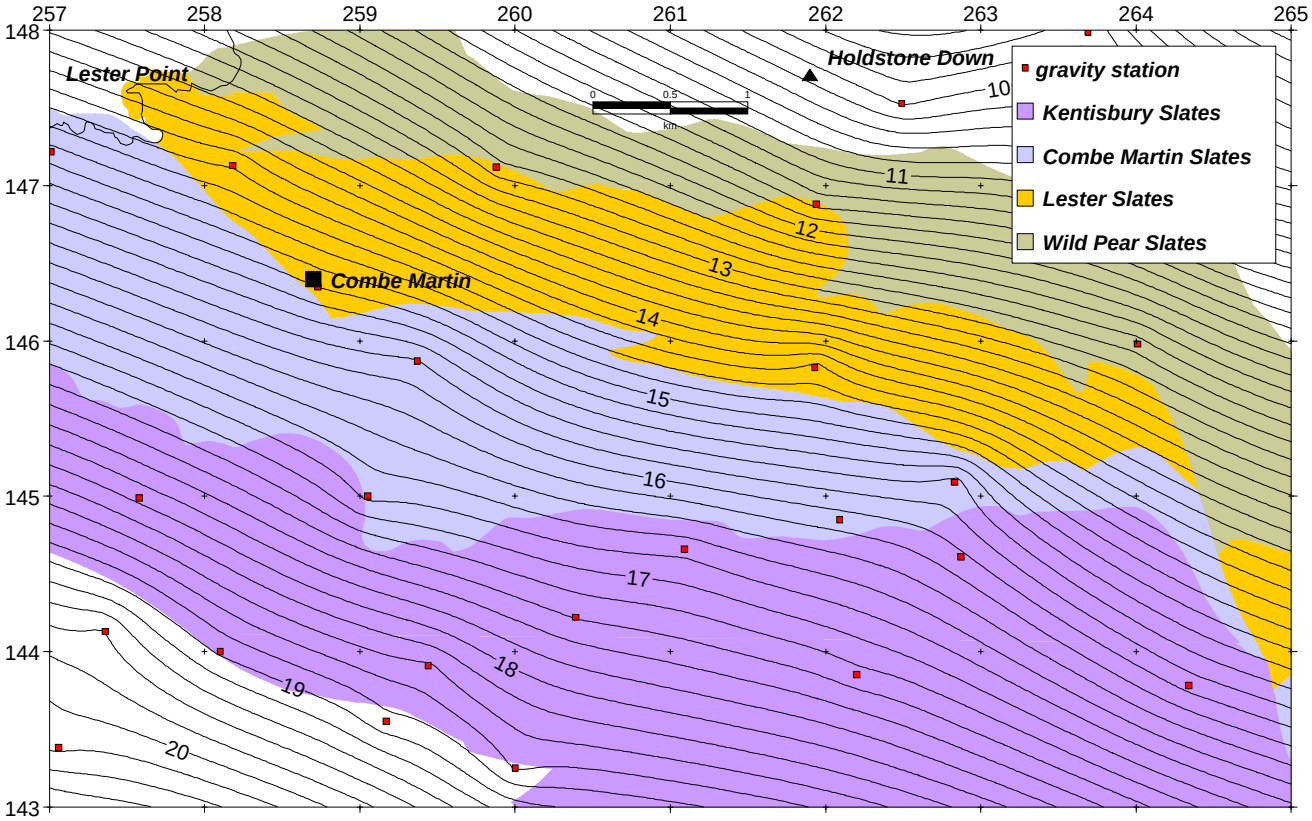

Figure 9 Regional Bouguer gravity anomaly for the Combe Martin area

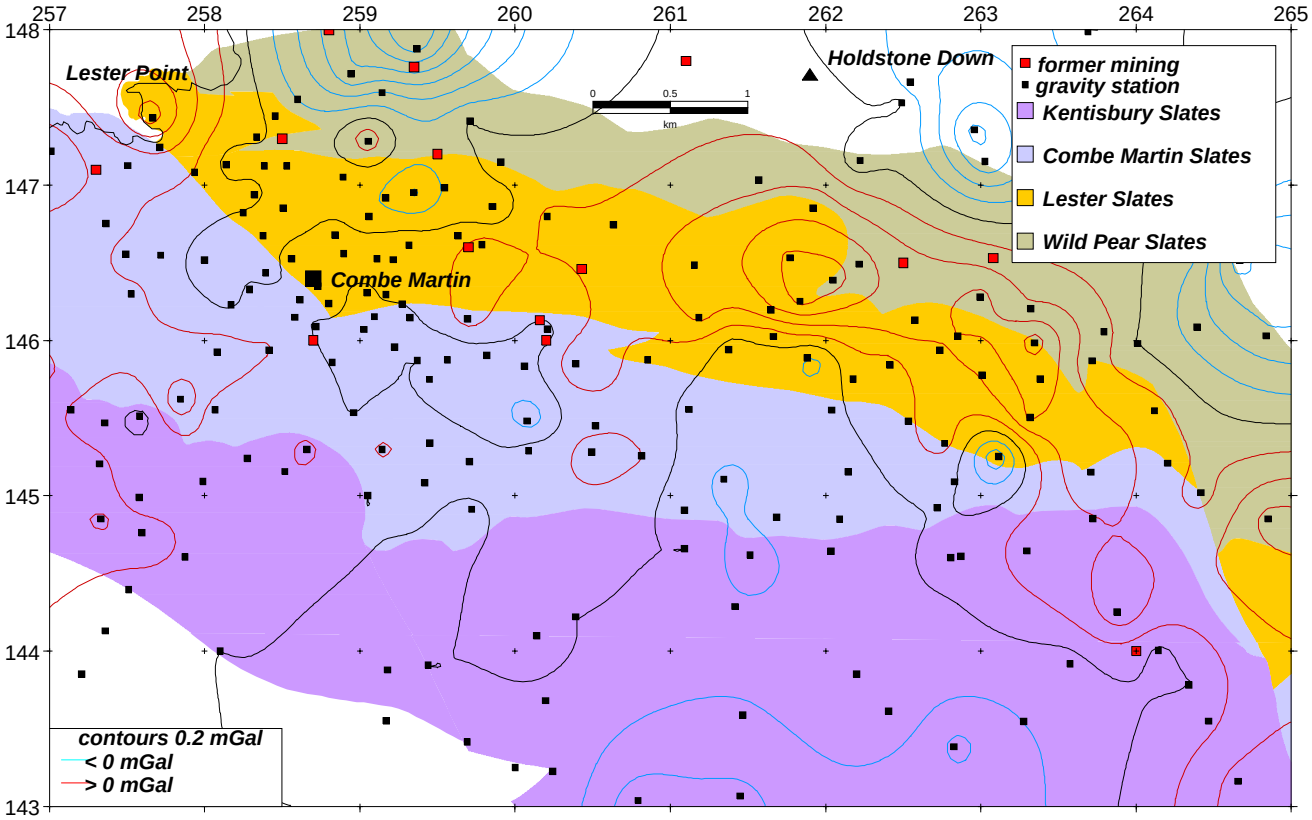

Figure 10 Residual gravity anomaly for the Combe Martin area

4.2.5 Anomaly interpretation

There is no clear positive residual gravity anomaly over the Combe Martin lead-silver mining area. This may reflect removal of most of the excess mass, a lack of significant buried massive sulphide deposit or a different model for the mineralisation. Vein or replacement style of mineralisation is not generally amenable to exploration using the gravity method. However, there does appear to be a zone of positive gravity residual anomaly of up to 0.8 mGal further east over the lower section of the Ilfracombe Slate Formation, approximately along the outcrop of the Lester Slates inland. This may reflect enhanced density of this formation, possibly due to sulphide mineralisation.

5 Conclusions

1. Real-Time-Kinematic (RTK) GPS provides accurate immediate positional and elevation data and has made collection of high-resolution and detailed gravity data much quicker. GPS also enables the surveyor to select the exact location of the gravity station making survey much safer.
2. High-resolution digital terrain models (DTM) have made automatic terrain correction of gravity data a rapid and simple procedure allowing high-resolution surveys to provide near real time corrected data for analysis and interpretation.
3. A residual positive gravity anomaly at Egloskerry of about 1 mGal shows strong correlation with geology and also with soil and overburden geochemistry.
4. At Combe Martin there is no clear positive gravity anomaly over the former lead mining area although a small positive anomaly of about 0.8 mGal is associated with the Lester Slates outcrop inland.

Inspection of the exiting regional data in relation to previous exploration work indicates that the region of north Cornwall and Devon is relatively poorly explored. Several minor residual gravity anomalies occur in this region and some are associated with stream-sediment geochemical anomalies (Table 8)

Table 8 Small positive residual gravity anomalies in north Cornwall and Devon

BNG E (km)	BNG N (km)	Geochemistry	Locality
254	099		2km W Inwardleigh
239	083		2km SSE Lifton
266	093		1km E South Zeal
281	135		Brightworthy Barrow
270	137	Zn	Muxworthy
254	141	Zn	Bittadon
263	139		Tidicombe

The Exmoor region is especially poorly explored in terms of contact geophysical surveys in particular electrical and gravity methods. Much of the previous geophysical work was focused towards the linear magnetic anomalies identified in the 1958 regional survey and primarily utilised the magnetic exploration method with minor gravity and EM surveys. Figure 11 indicates that the positive gravity anomalies associated with the minor southern magnetic anomaly and the geochemical Zn anomalies near the top part of the Morte Slates have not been explored. New ground geophysical surveys should be carried out over selected formations thought to be potential hosts for stratiform mineralisation especially the Lester Slate formation east of Combe Martin, the upper part of the Ilfracombe Beds and the upper part of the Morte Slates.

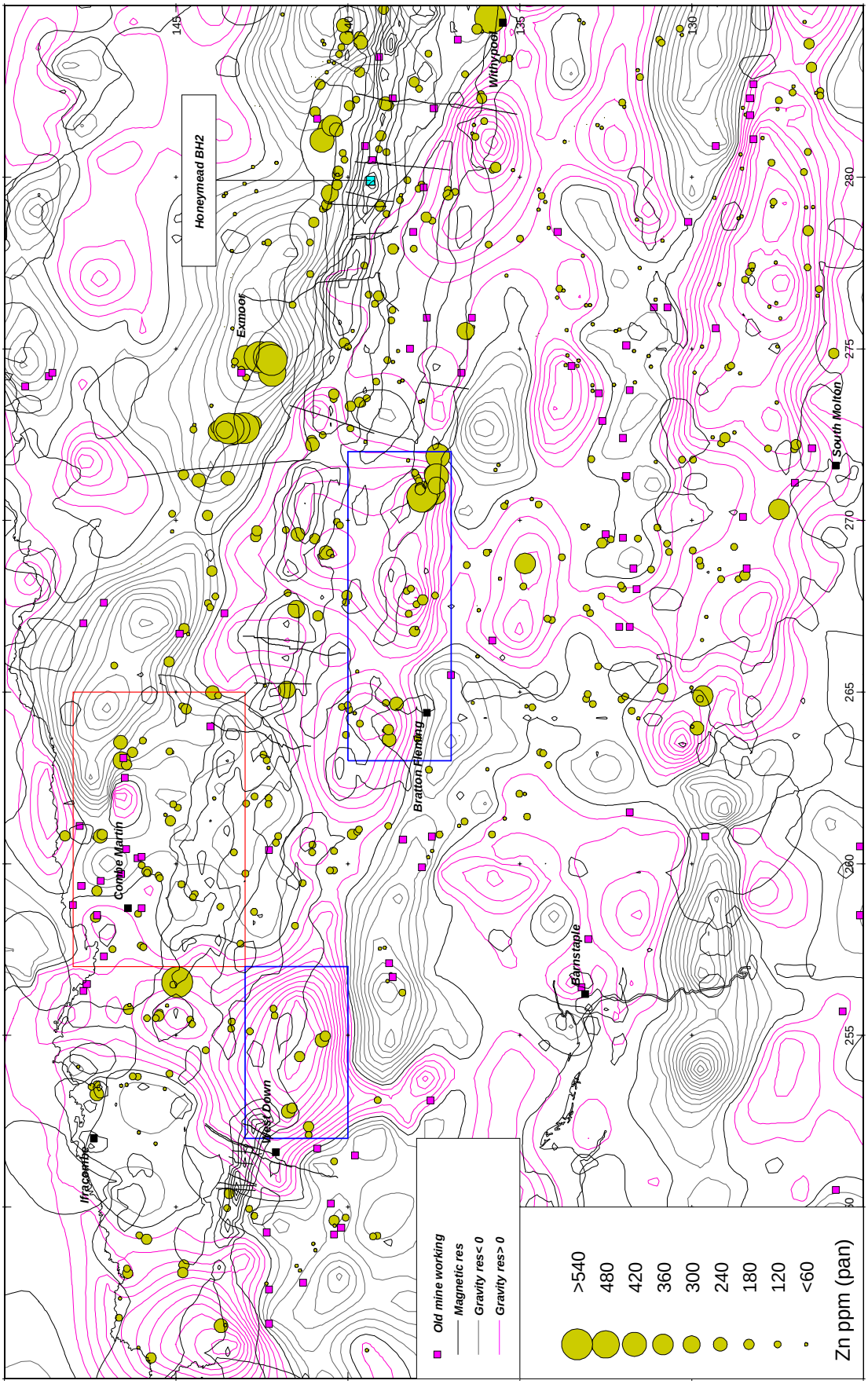

Figure 11 Residual gravity and magnetic anomalies over the Exmoor area

Notes: The positive gravity anomaly at about [263 147] region is caused by an error in the UK regional gravity data. The blue boxes are potential target areas for new work.

6 Recommendations

1. High resolution (HR) gravity surveys using RTK GPS and a high resolution (50 m) DTM for terrain correction should be carried out over other regions in the SW England mining district based on new regional geochemical data and new assessment of deposit models.
2. Significant small low-amplitude positive residual gravity anomalies on Exmoor, associated with geochemical anomalies and linear magnetic features, have not been explored as part of this survey but remain strong targets. The most favoured is the Bittadon area (east of West Down) where a strong positive gravity feature is associated with Zn geochemical anomalies and historic exploration. Anomalies east of Bratton Fleming are also potential targets.
3. The Leica GPS equipment at Keyworth should be upgraded to 530 level to provide the option of one reference GPS station and two roving receivers. Alternatively new GPS equipment suitable for rapid static or RTK operation should be purchased. This would significantly improve productivity for HR gravity surveys.
4. Records of mines and exploration in the Exmoor region are less accessible that those of the main lode workings in the central belt. The existing 1:10,560 and 1:10,000 gravity maps contain many indications of quarries and mine workings. These locations should be digitised and related to new mineral occurrence and geochemical data. Alternative sources of mine record data may also be available and these should also be explored.
5. Existing traverse geophysical data over west Exmoor should be digitised and the magnetic data re-interpreted for depth to source using modern profile deconvolution methods.

Appendix 1 Gravity data for Egloskerry

Station, LongD, LongM, LatD, LatM, BNGmE, BNGmN, height, accuracy, Gobserved, Gfree-air, density, Terrain1, Terrain2, Gboug, Date, source

k1, -4, 26.171, 50, 37.650, 227715.0, 83763.3, 185.10, cm, 1096.75, 28.53, 2.70, 0.133, 0.23X, 7.80, 30/09/02, 01,

p1, -4, 26.354, 50, 37.479, 227488.7, 83454.4, 198.68, cm, 1093.06, 29.28, 2.70, 0.143, 0.25X, 7.04, 30/09/02, 01,

p2, -4, 26.432, 50, 37.346, 227389.5, 83211.5, 207.21, cm, 1090.20, 29.25, 2.70, 0.203, 0.32X, 6.11, 30/09/02, 01,

p3, -4, 25.284, 50, 37.272, 228737.5, 83028.5, 178.84, cm, 1097.38, 27.78, 2.70, 0.063, 0.15X, 7.69, 30/09/02, 01,

p4, -4, 24.811, 50, 37.452, 229306.4, 83344.7, 190.99, cm, 1096.24, 30.12, 2.70, 0.123, 0.23X, 8.73, 30/09/02, 01,

p5, -4, 24.412, 50, 37.665, 229789.8, 83723.5, 181.71, cm, 1099.46, 30.18, 2.70, 0.103, 0.20X, 9.80, 30/09/02, 01,

p6, -4, 24.518, 50, 37.820, 229673.2, 84015.5, 172.13, cm, 1101.99, 29.52, 2.70, 0.193, 0.27X, 10.30, 30/09/02, 01,

p7, -4, 24.632, 50, 37.977, 229549.0, 84310.5, 163.58, cm, 1103.84, 28.49, 2.70, 0.373, 0.44X, 10.41, 30/09/02, 01,

p8, -4, 24.607, 50, 38.116, 229587.1, 84566.8, 143.12, cm, 1108.34, 26.47, 2.70, 0.633, 0.69X, 10.96, 30/09/02, 01,

p9, -4, 24.361, 50, 38.259, 229884.7, 84822.3, 97.43, cm, 1117.80, 21.62, 2.70, 1.213, 1.28X, 11.87, 30/09/02, 01,

p10, -4, 24.617, 50, 38.261, 229584.1, 84836.4, 93.29, cm, 1118.64, 21.18, 2.70, 0.853, 0.92X, 11.54, 30/09/02, 01,

p11, -4, 24.965, 50, 38.189, 229169.2, 84716.5, 122.69, cm, 1112.24, 23.96, 2.70, 0.553, 0.61X, 10.68, 30/09/02, 01,

p12, -4, 25.387, 50, 38.296, 228678.8, 84929.4, 96.58, cm, 1117.64, 21.15, 2.70, 0.623, 0.70X, 10.91, 30/09/02, 01,

p13, -4, 25.809, 50, 38.329, 228183.1, 85008.2, 110.07, cm, 1114.57, 22.19, 2.70, 0.693, 0.76X, 10.49, 30/09/02, 01,

p14, -4, 25.930, 50, 38.184, 228032.2, 84743.1, 131.32, cm, 1109.34, 23.73, 2.70, 0.613, 0.68X, 9.55, 30/09/02, 01,

p15, -4, 25.918, 50, 37.979, 228033.7, 84362.9, 161.17, cm, 1102.98, 26.89, 2.70, 0.103, 0.17X, 8.81, 30/09/02, 01,

p16, -4, 26.108, 50, 37.814, 227800.1, 84065.2, 161.21, cm, 1102.50, 26.66, 2.70, 0.153, 0.22X, 8.63, 30/09/02, 01,

p17, -4, 24.944, 50, 37.780, 229168.7, 83957.2, 173.99, cm, 1100.84, 28.99, 2.70, 0.153, 0.24X, 9.54, 30/09/02, 01,

p18, -4, 25.032, 50, 38.014, 229079.9, 84394.1, 159.26, cm, 1104.58, 27.85, 2.70, 0.173, 0.24X, 10.06, 30/09/02, 01,

p19, -4, 25.137, 50, 38.122, 228962.0, 84598.5, 152.10, cm, 1106.21, 27.11, 2.70, 0.243, 0.31X, 10.20, 30/09/02, 01,

p20, -4, 25.357, 50, 38.147, 228705.3, 84652.7, 121.48, cm, 1112.05, 23.46, 2.70, 0.573, 0.63X, 10.33, 30/09/02, 01,

p21, -4, 25.197, 50, 37.944, 228880.6, 84271.5, 137.90, cm, 1108.24, 25.01, 2.70, 0.283, 0.34X, 9.74, 30/09/02, 01,

p22, -4, 25.266, 50, 37.804, 228791.7, 84013.5, 160.64, cm, 1103.33, 27.33, 2.70, 0.163, 0.23X, 9.37, 30/09/02, 01,

p23, -4, 25.083, 50, 37.621, 228995.6, 83667.3, 177.87, cm, 1099.20, 28.79, 2.70, 0.163, 0.25X, 8.90, 30/09/02, 01,

p24, -4, 25.144, 50, 37.486, 228915.7, 83419.5, 177.90, cm, 1098.55, 28.35, 2.70, 0.123, 0.21X, 8.42, 30/09/02, 01,

p25, -4, 24.310, 50, 37.590, 229905.6, 83580.9, 182.07, cm, 1099.37, 30.30, 2.70, 0.113, 0.21X, 9.90, 30/09/02, 01,

p26, -4, 25.556, 50, 37.398, 228424.5, 83273.2, 182.31, cm, 1096.82, 28.11, 2.70, 0.103, 0.19X, 7.66, 30/09/02, 01,

p27, -4, 25.971, 50, 37.567, 227946.3, 83602.1, 188.03, cm, 1096.10, 28.91, 2.70, 0.113, 0.21X, 7.83, 30/09/02, 01,

p28, -4, 26.046, 50, 37.418, 227849.0, 83328.4, 187.22, cm, 1095.55, 28.33, 2.70, 0.123, 0.22X, 7.35, 30/09/02, 01,

p29, -4, 26.364, 50, 37.840, 227499.7, 84123.1, 165.86, cm, 1101.20, 26.76, 2.70, 0.133, 0.21X, 8.20, 30/09/02, 01,

p30, -4, 26.313, 50, 38.007, 227569.5, 84430.9, 154.07, cm, 1104.09, 25.77, 2.70, 0.093, 0.16X, 8.49, 30/09/02, 01,

p31, -4, 26.239, 50, 38.176, 227667.9, 84741.1, 153.53, cm, 1105.08, 26.34, 2.70, 0.113, 0.18X, 9.14, 30/09/02, 01,

p32, -4, 26.510, 50, 38.177, 227347.5, 84753.5, 166.73, cm, 1101.97, 27.30, 2.70, 0.133, 0.21X, 8.63, 30/09/02, 01,

p33, -4, 26.590, 50, 38.120, 227250.5, 84651.0, 168.19, cm, 1101.23, 27.09, 2.70, 0.143, 0.22X, 8.27, 30/09/02, 01,

p34, -4, 25.560, 50, 37.996, 228456.1, 84380.3, 155.97, cm, 1104.45, 26.72, 2.70, 0.263, 0.33X, 9.40, 30/09/02, 01,

p35, -4, 25.692, 50, 37.879, 228293.5, 84169.6, 146.23, cm, 1105.93, 25.37, 2.70, 0.213, 0.28X, 9.10, 30/09/02, 01,

p36, -4, 25.769, 50, 37.684, 228190.8, 83810.5, 177.55, cm, 1098.93, 28.33, 2.70, 0.133, 0.22X, 8.45, 30/09/02, 01,

p37, -4, 25.710, 50, 37.524, 228250.8, 83513.4, 175.64, cm, 1098.73, 27.78, 2.70, 0.263, 0.35X, 8.25, 30/09/02, 01,

k2, -4, 27.344, 50, 38.647, 226394.4, 85656.3, 189.54, cm, 1096.91, 28.58, 2.70, 0.483, 0.58X, 7.71, 01/10/02, 01,

p38, -4, 27.048, 50, 38.703, 226746.0, 85749.7, 179.11, cm, 1099.58, 27.95, 2.70, 0.413, 0.50X, 8.18, 01/10/02, 01,

p39, -4, 26.879, 50, 38.729, 226947.5, 85789.6, 173.91, cm, 1101.16, 27.89, 2.70, 0.373, 0.45X, 8.65, 01/10/02, 01,
p40, -4, 26.675, 50, 38.750, 227189.1, 85821.9, 169.16, cm, 1102.42, 27.65, 2.70, 0.373, 0.45X, 8.95, 01/10/02, 01,
p41, -4, 26.509, 50, 38.768, 227385.7, 85847.5, 163.58, cm, 1103.71, 27.19, 2.70, 0.433, 0.50X, 9.17, 01/10/02, 01,
p42, -4, 26.489, 50, 38.683, 227403.9, 85690.4, 159.69, cm, 1104.24, 26.64, 2.70, 0.763, 0.83X, 9.40, 01/10/02, 01,
p43, -4, 26.746, 50, 38.653, 227099.5, 85643.4, 169.61, cm, 1101.70, 27.21, 2.70, 0.823, 0.90X, 8.91, 01/10/02, 01,
p44, -4, 26.947, 50, 38.628, 226861.0, 85605.4, 179.57, cm, 1099.29, 27.91, 2.70, 0.903, 0.99X, 8.57, 01/10/02, 01,
p45, -4, 27.182, 50, 38.593, 226581.5, 85550.7, 184.12, cm, 1097.84, 27.92, 2.70, 0.573, 0.66X, 7.74, 01/10/02, 01,
p46, -4, 27.507, 50, 38.645, 226202.5, 85659.8, 183.15, cm, 1098.45, 28.15, 2.70, 0.343, 0.43X, 7.85, 01/10/02, 01,
p47, -4, 27.908, 50, 38.591, 225726.9, 85575.3, 192.37, cm, 1096.35, 28.98, 2.70, 0.363, 0.46X, 7.66, 01/10/02, 01,
p48, -4, 28.181, 50, 38.532, 225401.6, 85475.6, 181.31, cm, 1098.21, 27.51, 2.70, 0.253, 0.34X, 7.33, 01/10/02, 01,
p49, -4, 28.323, 50, 38.439, 225228.2, 85309.9, 158.43, cm, 1102.55, 24.93, 2.70, 0.183, 0.26X, 7.25, 01/10/02, 01,
p50, -4, 28.096, 50, 38.356, 225490.3, 85147.5, 163.82, cm, 1101.41, 25.57, 2.70, 0.133, 0.21X, 7.24, 01/10/02, 01,
p51, -4, 27.853, 50, 38.305, 225773.5, 85042.2, 178.92, cm, 1098.63, 27.53, 2.70, 0.123, 0.21X, 7.48, 01/10/02, 01,
p52, -4, 27.853, 50, 38.412, 225780.6, 85241.9, 168.25, cm, 1100.13, 25.58, 2.70, 0.113, 0.19X, 6.73, 01/10/02, 01,
p53, -4, 28.457, 50, 38.909, 225099.2, 86186.4, 195.27, cm, 1096.97, 30.02, 2.70, 0.313, 0.41X, 8.32, 01/10/02, 01,
p54, -4, 28.237, 50, 38.913, 225359.0, 86184.4, 193.91, cm, 1097.39, 30.02, 2.70, 0.243, 0.34X, 8.41, 01/10/02, 01,
p55, -4, 28.229, 50, 38.771, 225359.6, 85921.1, 180.27, cm, 1099.36, 27.99, 2.70, 0.363, 0.45X, 8.03, 01/10/02, 01,
p56, -4, 27.901, 50, 38.983, 225758.7, 86300.6, 173.34, cm, 1102.26, 28.43, 2.70, 0.203, 0.28X, 9.09, 01/10/02, 01,
p57, -4, 27.570, 50, 39.002, 226149.9, 86323.5, 149.50, cm, 1107.25, 26.04, 2.70, 0.193, 0.26X, 9.38, 01/10/02, 01,
p58, -4, 27.224, 50, 39.009, 226557.9, 86323.2, 121.05, cm, 1113.24, 23.24, 2.70, 0.203, 0.27X, 9.80, 01/10/02, 01,
p59, -4, 27.050, 50, 38.939, 226758.0, 86185.9, 113.28, cm, 1114.45, 22.16, 2.70, 0.463, 0.54X, 9.88, 01/10/02, 01,
p60, -4, 27.202, 50, 38.799, 226571.5, 85933.7, 138.35, cm, 1108.43, 24.08, 2.70, 0.533, 0.60X, 9.02, 01/10/02, 01,
p61, -4, 27.525, 50, 38.551, 226174.6, 85484.7, 184.07, cm, 1098.07, 28.20, 2.70, 0.363, 0.45X, 7.81, 01/10/02, 01,
p62, -4, 27.593, 50, 38.396, 226085.4, 85201.3, 152.12, cm, 1103.31, 23.81, 2.70, 0.303, 0.37X, 6.96, 01/10/02, 01,
p63, -4, 27.426, 50, 38.293, 226276.0, 85004.7, 168.57, cm, 1100.66, 26.38, 2.70, 0.173, 0.25X, 7.55, 01/10/02, 01,
p64, -4, 27.184, 50, 38.318, 226562.6, 85040.4, 148.54, cm, 1104.67, 24.18, 2.70, 0.183, 0.25X, 7.61, 01/10/02, 01,
p65, -4, 26.927, 50, 38.336, 226866.1, 85064.2, 118.62, cm, 1111.20, 21.45, 2.70, 0.363, 0.44X, 8.46, 01/10/02, 01,
p66, -4, 26.646, 50, 38.418, 227202.0, 85205.0, 128.35, cm, 1109.68, 22.81, 2.70, 0.493, 0.56X, 8.84, 01/10/02, 01,
p67, -4, 26.298, 50, 38.453, 227615.2, 85257.2, 125.48, cm, 1111.70, 23.89, 2.70, 0.283, 0.35X, 10.04, 01/10/02, 01,
p68, -4, 26.596, 50, 38.607, 227273.3, 85552.7, 141.22, cm, 1107.46, 24.29, 2.70, 0.963, 1.02X, 9.32, 01/10/02, 01,
p69, -4, 26.690, 50, 38.944, 227182.8, 86182.1, 106.40, cm, 1115.93, 21.50, 2.70, 0.573, 0.65X, 10.10, 01/10/02, 01,
p70, -4, 26.900, 50, 39.084, 226943.8, 86449.8, 113.03, cm, 1115.41, 22.82, 2.70, 0.173, 0.24X, 10.27, 01/10/02, 01,
p71, -4, 26.991, 50, 39.310, 226850.2, 86871.9, 132.98, cm, 1112.43, 25.66, 2.70, 0.103, 0.16X, 10.77, 01/10/02, 01,
p72, -4, 26.820, 50, 39.245, 227048.4, 86745.0, 129.22, cm, 1112.98, 25.15, 2.70, 0.093, 0.15X, 10.67, 01/10/02, 01,
p73, -4, 26.646, 50, 39.160, 227247.4, 86580.6, 127.74, cm, 1112.85, 24.69, 2.70, 0.103, 0.16X, 10.39, 01/10/02, 01,
p74, -4, 26.085, 50, 39.201, 227910.6, 86633.0, 106.80, cm, 1117.51, 22.83, 2.70, 0.173, 0.24X, 10.98, 01/10/02, 01,
p75, -4, 25.948, 50, 39.302, 228078.5, 86815.6, 97.57, cm, 1119.94, 22.26, 2.70, 0.143, 0.22X, 11.43, 01/10/02, 01,
p76, -4, 26.268, 50, 39.095, 227689.0, 86445.3, 121.78, cm, 1114.07, 24.17, 2.70, 0.113, 0.17X, 10.56, 01/10/02, 01,
p77, -4, 25.657, 50, 38.851, 228394.3, 85968.5, 183.42, cm, 1100.56, 30.04, 2.70, 0.633, 0.72X, 10.00, 01/10/02, 01,
p78, -4, 25.850, 50, 38.860, 228167.6, 85994.1, 161.68, cm, 1104.99, 27.75, 2.70, 0.363, 0.43X, 9.87, 01/10/02, 01,
p79, -4, 26.254, 50, 38.582, 227674.1, 85493.7, 103.95, cm, 1115.55, 20.90, 2.70, 0.483, 0.56X, 9.70, 002/10/02, 01,
p80, -4, 26.356, 50, 38.851, 227571.2, 85995.3, 106.62, cm, 1115.47, 21.25, 2.70, 0.973, 1.04X, 10.22, 002/10/02, 01,
p81, -4, 26.058, 50, 39.034, 227933.4, 86323.6, 118.78, cm, 1114.58, 23.84, 2.70, 0.193, 0.25X, 10.64, 002/10/02, 01,
p82, -4, 25.727, 50, 38.974, 228319.1, 86199.4, 137.49, cm, 1110.28, 25.41, 2.70, 0.723, 0.78X, 10.62, 002/10/02, 01,
p83, -4, 26.051, 50, 38.836, 227929.3, 85957.0, 150.61, cm, 1106.99, 26.36, 2.70, 0.273, 0.33X, 9.64, 002/10/02, 01,

p84, -4, 26.081, 50, 38.704, 227885.6, 85713.2, 133.67, cm, 1110.01, 24.35, 2.70, 0.313, 0.37X, 9.59, 002/10/02, 01,
p85, -4, 25.725, 50, 38.757, 228308.0, 85797.9, 145.15, cm, 1108.08, 25.89, 2.70, 0.423, 0.48X, 9.94, 002/10/02, 01,
p86, -4, 25.607, 50, 38.676, 228442.1, 85642.2, 138.99, cm, 1109.40, 25.43, 2.70, 0.373, 0.43X, 10.13, 002/10/02, 01,
p87, -4, 25.565, 50, 38.568, 228484.8, 85441.0, 153.29, cm, 1107.46, 28.06, 2.70, 0.373, 0.43X, 11.13, 002/10/02, 01,
p88, -4, 25.702, 50, 38.515, 228321.1, 85348.3, 131.16, cm, 1111.45, 25.30, 2.70, 0.553, 0.61X, 11.06, 002/10/02, 01,
p89, -4, 25.885, 50, 38.528, 228105.7, 85379.9, 103.54, cm, 1116.79, 22.10, 2.70, 0.463, 0.54X, 10.92, 002/10/02, 01,
p90, -4, 25.770, 50, 38.467, 228238.2, 85261.6, 103.16, cm, 1116.42, 21.70, 2.70, 0.463, 0.54X, 10.57, 002/10/02, 01,
p91, -4, 25.643, 50, 38.416, 228384.7, 85163.1, 99.88, cm, 1116.98, 21.33, 2.70, 0.533, 0.61X, 10.63, 002/10/02, 01,
p92, -4, 25.580, 50, 38.482, 228462.3, 85281.5, 128.72, cm, 1111.95, 25.09, 2.70, 0.403, 0.46X, 10.98, 002/10/02, 01,
p93, -4, 24.437, 50, 38.901, 229834.7, 86014.9, 178.30, cm, 1103.30, 31.13, 2.70, 0.323, 0.41X, 11.35, 002/10/02, 01,
p94, -4, 24.705, 50, 38.828, 229513.9, 85889.3, 174.35, cm, 1103.06, 29.77, 2.70, 0.303, 0.39X, 10.42, 002/10/02, 01,
p95, -4, 24.892, 50, 38.751, 229289.2, 85753.3, 173.07, cm, 1103.12, 29.56, 2.70, 0.273, 0.35X, 10.31, 002/10/02, 01,
p96, -4, 25.114, 50, 38.709, 229025.6, 85685.9, 170.60, cm, 1103.48, 29.22, 2.70, 0.263, 0.34X, 10.24, 002/10/02, 01,
p97, -4, 25.325, 50, 38.565, 228768.4, 85425.6, 158.95, cm, 1106.24, 28.60, 2.70, 0.283, 0.35X, 10.95, 002/10/02, 01,
p98, -4, 25.323, 50, 38.440, 228763.0, 85194.8, 137.54, cm, 1109.98, 25.91, 2.70, 0.593, 0.65X, 10.99, 002/10/02, 01,
p99, -4, 25.377, 50, 38.390, 228696.1, 85104.1, 107.58, cm, 1115.45, 22.21, 2.70, 0.583, 0.65X, 10.68, 002/10/02, 01,
p100, -4, 25.221, 50, 38.348, 228877.7, 85020.4, 103.06, cm, 1116.45, 21.87, 2.70, 0.533, 0.60X, 10.81, 002/10/02, 01,
p101, -4, 25.136, 50, 38.504, 228986.7, 85305.2, 156.55, cm, 1106.51, 28.21, 2.70, 0.433, 0.49X, 10.98, 002/10/02, 01,
p102, -4, 25.288, 50, 38.680, 228817.8, 85637.7, 167.26, cm, 1104.27, 29.01, 2.70, 0.243, 0.32X, 10.40, 002/10/02, 01,
p103, -4, 24.801, 50, 38.619, 229388.8, 85506.1, 169.37, cm, 1104.53, 30.02, 2.70, 0.343, 0.42X, 11.27, 002/10/02, 01,
p104, -4, 24.606, 50, 38.531, 229613.2, 85335.8, 136.93, cm, 1111.14, 26.74, 2.70, 0.393, 0.45X, 11.69, 002/10/02, 01,
p105, -4, 27.258, 50, 37.626, 226432.3, 83761.3, 193.91, cm, 1093.55, 28.08, 2.70, 0.183, 0.28X, 6.41, 002/10/02, 01,
p106, -4, 27.586, 50, 37.841, 226059.4, 84172.2, 190.66, cm, 1094.39, 27.60, 2.70, 0.143, 0.24X, 6.26, 002/10/02, 01,
p107, -4, 27.630, 50, 37.976, 226016.2, 84423.6, 183.48, cm, 1096.85, 27.64, 2.70, 0.153, 0.24X, 7.11, 002/10/02, 01,
p108, -4, 27.651, 50, 38.130, 226001.3, 84711.8, 183.61, cm, 1097.11, 27.72, 2.70, 0.163, 0.25X, 7.18, 002/10/02, 01,
p109, -4, 27.841, 50, 38.072, 225772.8, 84610.4, 199.08, cm, 1093.63, 29.10, 2.70, 0.173, 0.28X, 6.84, 002/10/02, 01,
p110, -4, 27.993, 50, 38.013, 225591.0, 84507.5, 194.32, cm, 1094.37, 28.46, 2.70, 0.203, 0.30X, 6.76, 002/10/02, 01,
p111, -4, 28.032, 50, 38.149, 225553.5, 84760.1, 187.29, cm, 1096.13, 27.84, 2.70, 0.163, 0.26X, 6.90, 002/10/02, 01,
p112, -4, 27.877, 50, 38.225, 225740.4, 84895.3, 178.12, cm, 1098.22, 26.99, 2.70, 0.203, 0.29X, 7.11, 002/10/02, 01,
p113, -4, 27.674, 50, 38.229, 225979.5, 84894.4, 185.40, cm, 1097.14, 28.15, 2.70, 0.163, 0.25X, 7.41, 002/10/02, 01,
p114, -4, 27.204, 50, 38.165, 226530.2, 84758.7, 147.91, cm, 1104.43, 23.97, 2.70, 0.213, 0.28X, 7.50, 002/10/02, 01,
p115, -4, 26.996, 50, 38.180, 226775.9, 84777.8, 129.20, cm, 1108.32, 22.06, 2.70, 0.253, 0.32X, 7.75, 002/10/02, 01,
p144, -4, 24.804, 50, 38.652, 229387.2, 85566.9, 169.79, cm, 1104.55, 30.13, 2.70, 0.313, 0.39X, 11.29, 04/10/2002, 01,
p145, -4, 24.839, 50, 38.687, 229347.7, 85633.4, 169.40, cm, 1104.61, 30.01, 2.70, 0.253, 0.33X, 11.16, 04/10/2002, 01,
p146, -4, 24.803, 50, 38.718, 229391.6, 85690.9, 166.50, cm, 1105.20, 29.65, 2.70, 0.243, 0.32X, 11.12, 04/10/2002, 01,
p147, -4, 24.787, 50, 38.784, 229415.0, 85812.0, 169.78, cm, 1103.83, 29.20, 2.70, 0.273, 0.35X, 10.33, 04/10/2002, 01,
p148, -4, 24.756, 50, 38.735, 229449.0, 85719.4, 162.63, cm, 1106.07, 29.31, 2.70, 0.243, 0.31X, 11.21, 04/10/2002, 01,
p149, -4, 24.708, 50, 38.707, 229503.2, 85665.1, 156.79, cm, 1107.58, 29.06, 2.70, 0.273, 0.34X, 11.65, 04/10/2002, 01,
p150, -4, 24.735, 50, 38.676, 229469.5, 85608.7, 161.34, cm, 1106.45, 29.37, 2.70, 0.293, 0.36X, 11.47, 04/10/2002, 01,
p151, -4, 24.633, 50, 38.672, 229589.7, 85597.9, 143.65, cm, 1110.56, 28.04, 2.70, 0.303, 0.36X, 12.13, 04/10/2002, 01,
p152, -4, 24.621, 50, 38.616, 229600.6, 85493.2, 136.71, cm, 1111.51, 26.93, 2.70, 0.343, 0.40X, 11.85, 04/10/2002, 01,
p153, -4, 24.709, 50, 38.598, 229495.9, 85463.0, 158.99, cm, 1106.80, 29.12, 2.70, 0.433, 0.50X, 11.62, 04/10/2002, 01,
p154, -4, 24.711, 50, 38.476, 229485.6, 85237.7, 145.40, cm, 1109.20, 27.50, 2.70, 0.463, 0.52X, 11.56, 04/10/2002, 01,
p155, -4, 24.765, 50, 38.559, 229427.0, 85393.7, 160.85, cm, 1106.18, 29.13, 2.70, 0.403, 0.47X, 11.39, 04/10/2002, 01,
p156, -4, 24.905, 50, 38.536, 229260.4, 85356.1, 165.97, cm, 1104.74, 29.31, 2.70, 0.413, 0.48X, 11.00, 04/10/2002, 01,

p157, -4, 25.037, 50, 38.501, 229103.7, 85297.4, 161.78, cm, 1105.44, 28.76, 2.70, 0.533, 0.60X, 11.04, 04/10/2002, 01,
p158, -4, 25.078, 50, 38.444, 229051.1, 85193.2, 144.73, cm, 1108.72, 26.86, 2.70, 0.703, 0.76X, 11.24, 04/10/2002, 01,
p159, -4, 25.175, 50, 38.416, 228935.6, 85144.2, 128.83, cm, 1111.86, 25.14, 2.70, 0.543, 0.60X, 11.15, 04/10/2002, 01,
p160, -4, 24.905, 50, 38.464, 229256.3, 85223.5, 152.53, cm, 1107.33, 27.85, 2.70, 0.813, 0.87X, 11.45, 04/10/2002, 01,
p161, -4, 24.715, 50, 38.427, 229478.3, 85147.3, 135.46, cm, 1110.79, 26.10, 2.70, 0.793, 0.85X, 11.61, 04/10/2002, 01,
p162, -4, 24.550, 50, 38.471, 229675.7, 85221.4, 120.48, cm, 1114.17, 24.79, 2.70, 0.533, 0.59X, 11.74, 04/10/2002, 01,
p163, -4, 24.969, 50, 38.361, 229174.9, 85035.7, 99.98, cm, 1117.07, 21.52, 2.70, 0.663, 0.73X, 10.93, 04/10/2002, 01,
p164, -4, 24.788, 50, 38.349, 229387.1, 85005.2, 95.20, cm, 1118.12, 21.12, 2.70, 0.663, 0.74X, 11.08, 04/10/2002, 01,
p165, -4, 24.641, 50, 38.368, 229561.3, 85034.3, 104.46, cm, 1116.69, 22.52, 2.70, 0.643, 0.71X, 11.40, 04/10/2002, 01,
p166, -4, 24.504, 50, 38.366, 229723.7, 85026.3, 92.06, cm, 1119.29, 21.29, 2.70, 0.593, 0.67X, 11.54, 04/10/2002, 01,
p167, -4, 25.604, 50, 38.307, 228423.5, 84959.4, 106.97, cm, 1115.12, 21.82, 2.70, 0.753, 0.82X, 10.53, 04/10/2002, 01,
p116, -4, 27.334, 50, 37.940, 226362.6, 84345.4, 172.82, cm, 1098.82, 26.38, 2.70, 0.203, 0.28X, 7.10, 03/10/2002, 01,
p117, -4, 26.875, 50, 37.981, 226905.9, 84403.7, 133.93, cm, 1106.98, 22.47, 2.70, 0.373, 0.44X, 7.75, 03/10/2002, 01,
p118, -4, 27.080, 50, 37.952, 226662.2, 84357.6, 155.40, cm, 1102.29, 24.45, 2.70, 0.223, 0.29X, 7.15, 03/10/2002, 01,
p119, -4, 27.210, 50, 37.833, 226501.8, 84142.2, 188.01, cm, 1095.25, 27.65, 2.70, 0.323, 0.41X, 6.78, 03/10/2002, 01,
p120, -4, 28.019, 50, 37.843, 225549.7, 84193.1, 209.61, cm, 1090.04, 29.10, 2.70, 0.193, 0.31X, 5.68, 03/10/2002, 01,
p121, -4, 28.271, 50, 37.992, 225261.3, 84479.4, 201.00, cm, 1092.46, 28.63, 2.70, 0.183, 0.29X, 6.17, 03/10/2002, 01,
p122, -4, 28.347, 50, 38.176, 225183.3, 84823.0, 177.73, cm, 1098.01, 26.74, 2.70, 0.203, 0.29X, 6.90, 03/10/2002, 01,
p123, -4, 27.860, 50, 37.834, 225736.7, 84170.1, 201.15, cm, 1091.96, 28.42, 2.70, 0.173, 0.28X, 5.93, 03/10/2002, 01,
p124, -4, 27.050, 50, 37.534, 226672.4, 83582.6, 196.12, cm, 1093.05, 28.40, 2.70, 0.153, 0.26X, 6.45, 03/10/2002, 01,
p125, -4, 26.660, 50, 38.112, 227167.6, 84638.1, 165.61, cm, 1101.45, 26.53, 2.70, 0.133, 0.21X, 7.99, 03/10/2002, 01,
p126, -4, 26.423, 50, 37.665, 227419.6, 83800.5, 178.56, cm, 1097.81, 27.55, 2.70, 0.153, 0.24X, 7.58, 03/10/2002, 01,
p127, -4, 26.633, 50, 37.930, 227188.0, 84301.6, 162.00, cm, 1101.80, 26.03, 2.70, 0.113, 0.18X, 7.87, 03/10/2002, 01,
p128, -4, 26.751, 50, 37.415, 227017.6, 83351.7, 204.02, cm, 1091.22, 29.19, 2.70, 0.213, 0.32X, 6.41, 03/10/2002, 01,
p129, -4, 27.734, 50, 38.778, 225942.8, 85914.6, 123.17, cm, 1110.88, 21.88, 2.70, 1.113, 1.18X, 9.11, 03/10/2002, 01,
p130, -4, 27.533, 50, 38.918, 226188.5, 86165.9, 141.59, cm, 1108.42, 24.89, 2.70, 0.243, 0.31X, 9.17, 03/10/2002, 01,
p131, -4, 27.905, 50, 39.291, 225773.4, 86872.4, 148.32, cm, 1108.88, 26.88, 2.70, 0.243, 0.31X, 10.40, 03/10/2002, 01,
p132, -4, 28.140, 50, 39.160, 225487.7, 86638.7, 174.63, cm, 1102.96, 29.27, 2.70, 0.253, 0.33X, 9.83, 03/10/2002, 01,
p133, -4, 25.361, 50, 39.117, 228759.2, 86451.0, 117.97, cm, 1115.11, 24.00, 2.70, 0.293, 0.35X, 11.00, 03/10/2002, 01,
p134, -4, 24.915, 50, 38.939, 229274.0, 86103.5, 173.59, cm, 1102.75, 29.07, 2.70, 0.543, 0.62X, 10.04, 03/10/2002, 01,
p135, -4, 24.911, 50, 38.848, 229272.7, 85935.0, 190.03, cm, 1099.38, 30.90, 2.70, 0.473, 0.58X, 9.97, 03/10/2002, 01,
p136, -4, 24.529, 50, 38.975, 229730.2, 86156.1, 183.76, cm, 1102.08, 31.48, 2.70, 0.423, 0.52X, 11.20, 03/10/2002, 01,
p137, -4, 24.175, 50, 39.037, 230151.2, 86256.0, 179.06, cm, 1103.96, 31.82, 2.70, 0.363, 0.45X, 12.00, 03/10/2002, 01,
p138, -4, 24.581, 50, 39.235, 229685.0, 86639.8, 128.86, cm, 1114.00, 26.07, 2.70, 0.363, 0.41X, 11.90, 03/10/2002, 01,
p139, -4, 24.911, 50, 39.368, 229304.4, 86898.2, 96.29, cm, 1120.65, 22.48, 2.70, 0.263, 0.33X, 11.91, 03/10/2002, 01,
p140, -4, 24.235, 50, 38.760, 230063.9, 85745.4, 167.88, cm, 1105.98, 30.80, 2.70, 0.273, 0.35X, 12.14, 03/10/2002, 01,
p141, -4, 24.912, 50, 38.244, 229235.0, 84815.4, 113.17, cm, 1114.20, 22.90, 2.70, 0.523, 0.58X, 10.67, 03/10/2002, 01,
p142, -4, 25.230, 50, 38.269, 228862.0, 84874.0, 95.83, cm, 1117.30, 20.61, 2.70, 1.243, 1.32X, 11.08, 03/10/2002, 01,
p143, -4, 25.553, 50, 38.298, 228482.9, 84939.9, 104.20, cm, 1115.60, 21.46, 2.70, 0.743, 0.81X, 10.47, 03/10/2002, 01,
p168, -4, 24.406, 50, 38.501, 229846.4, 85272.7, 125.07, cm, 1113.69, 25.68, 2.70, 0.553, 0.61X, 12.13, 04/10/2002, 01,
p169, -4, 24.258, 50, 38.584, 230025.7, 85420.1, 156.49, cm, 1107.75, 29.32, 2.70, 0.513, 0.58X, 12.18, 04/10/2002, 01,
p170, -4, 24.385, 50, 38.811, 229890.2, 85846.0, 165.52, cm, 1106.19, 30.21, 2.70, 0.233, 0.31X, 11.78, 04/10/2002, 01,
p171, -4, 24.558, 50, 38.785, 229684.5, 85805.4, 169.62, cm, 1104.82, 30.14, 2.70, 0.273, 0.35X, 11.29, 04/10/2002, 01,
p172, -4, 24.507, 50, 38.726, 229741.6, 85693.5, 163.26, cm, 1106.55, 29.99, 2.70, 0.503, 0.57X, 12.08, 04/10/2002, 01,
p173, -4, 24.401, 50, 38.742, 229867.2, 85718.1, 157.97, cm, 1108.26, 30.05, 2.70, 0.343, 0.41X, 12.58, 04/10/2002, 01,

p174, -4, 24.994, 50, 38.633, 229162.2, 85539.6, 172.55, cm, 1104.00, 30.45, 2.70, 0.273, 0.35X, 11.26, 04/10/2002, 01,

p175, -4, 26.825, 50, 38.555, 227000.1, 85466.9, 128.91, cm, 1109.26, 22.36, 2.70, 0.453, 0.52X, 8.29, 04/10/2002, 01,

p500, -4, 28.270, 50, 37.455, 225230.0, 83485.0, 169.75, cm, 1096.62, 23.95, 2.70, 0.343, 0.43X, 5.16, 04/10/2002, 01,

p501, -4, 28.306, 50, 37.495, 225190.0, 83560.0, 171.02, cm, 1096.14, 23.80, 2.70, 0.243, 0.33X, 4.77, 04/10/2002, 01,

p502, -4, 28.269, 50, 37.274, 225220.0, 83150.0, 133.50, cm, 1102.22, 18.63, 2.70, 0.303, 0.40X, 3.91, 04/10/2002, 01,

p503, -4, 28.507, 50, 39.223, 225060.0, 86770.0, 218.99, cm, 1093.78, 33.69, 2.70, 0.553, 0.69X, 9.59, 04/10/2002, 01,

Appendix 2 Gravity data for Combe Martin

Station, LongD, LongM, LatD, LatM, BNGmE, BNGmN, height, accuracy, Gobserved, Gfree-air, density, Terrain1, Terrain2, Gboug, Date, source

k3, -4, 1.709, 51, 11.883, 258289.4, 146327.6, 85.82, cm, 1173.48, 24.03, 2.70, 1.083, 1.23X, 15.55, 07/10/02, 01,

p28, -3, 58.087, 51, 12.666, 262545.2, 147664.8, 300.98, cm, 1125.31, 41.10, 2.70, 1.773, 2.46X, 9.49, 08/10/02, 01,

p29, -3, 58.352, 51, 12.389, 262222.0, 147159.5, 276.79, cm, 1131.85, 40.59, 2.70, 1.033, 1.56X, 10.81, 08/10/02, 01,

p30, -3, 58.606, 51, 12.219, 261917.9, 146851.6, 261.03, cm, 1136.49, 40.61, 2.70, 0.653, 1.13X, 12.19, 08/10/02, 01,

p31, -3, 58.910, 51, 12.312, 261569.1, 147034.0, 239.98, cm, 1140.48, 37.97, 2.70, 0.723, 1.10X, 11.90, 08/10/02, 01,

p32, -3, 58.725, 51, 12.045, 261770.7, 146532.7, 265.55, cm, 1136.58, 42.36, 2.70, 0.593, 1.06X, 13.36, 08/10/02, 01,

p33, -3, 58.824, 51, 11.862, 261646.1, 146197.4, 256.92, cm, 1138.82, 42.20, 2.70, 0.533, 0.94X, 14.05, 08/10/02, 01,

p34, -3, 58.664, 51, 11.895, 261834.1, 146252.8, 233.65, cm, 1143.36, 39.51, 2.70, 0.723, 1.06X, 14.12, 08/10/02, 01,

p35, -3, 58.484, 51, 11.971, 262047.5, 146388.4, 211.40, cm, 1147.24, 36.42, 2.70, 0.873, 1.17X, 13.66, 08/10/02, 01,

p36, -3, 58.343, 51, 12.029, 262215.2, 146491.8, 200.52, cm, 1149.09, 34.82, 2.70, 0.753, 1.03X, 13.15, 08/10/02, 01,

p37, -3, 58.805, 51, 11.770, 261663.8, 146025.7, 266.70, cm, 1136.52, 43.06, 2.70, 0.683, 1.12X, 13.99, 08/10/02, 01,

p38, -3, 58.616, 51, 11.698, 261880.7, 145886.5, 271.98, cm, 1135.36, 43.63, 2.70, 0.733, 1.23X, 14.07, 08/10/02, 01,

p39, -3, 58.359, 51, 11.629, 262176.6, 145751.1, 280.27, cm, 1134.12, 45.05, 2.70, 0.593, 1.13X, 14.45, 08/10/02, 01,

p40, -3, 58.046, 51, 11.487, 262533.7, 145478.0, 253.43, cm, 1140.03, 42.89, 2.70, 0.303, 0.70X, 14.90, 08/10/02, 01,

p41, -3, 57.844, 51, 11.414, 262765.6, 145336.8, 232.29, cm, 1144.46, 40.91, 2.70, 0.353, 0.68X, 15.29, 08/10/02, 01,

p42, -3, 57.544, 51, 11.374, 263113.2, 145252.7, 213.11, cm, 1147.11, 37.69, 2.70, 0.493, 0.77X, 14.34, 08/10/02, 01,

p43, -3, 58.157, 51, 11.682, 262414.6, 145842.6, 276.29, cm, 1134.69, 44.31, 2.70, 0.563, 1.08X, 14.11, 08/10/02, 01,

p44, -3, 57.884, 51, 11.738, 262735.1, 145937.5, 268.70, cm, 1135.84, 43.04, 2.70, 0.773, 1.26X, 13.88, 08/10/02, 01,

p45, -3, 58.026, 51, 11.839, 262574.6, 146130.1, 251.45, cm, 1138.91, 40.64, 2.70, 1.173, 1.56X, 13.73, 08/10/02, 01,

p46, -3, 57.786, 51, 11.788, 262851.7, 146027.1, 252.94, cm, 1138.78, 41.05, 2.70, 1.053, 1.44X, 13.85, 08/10/02, 01,

p47, -3, 57.646, 51, 11.654, 263007.5, 145775.3, 259.68, cm, 1137.93, 42.47, 2.70, 0.633, 1.08X, 14.15, 08/10/02, 01,

p48, -3, 57.324, 51, 11.647, 263382.5, 145751.1, 228.18, cm, 1143.76, 38.59, 2.70, 1.143, 1.48X, 14.24, 08/10/02, 01,

p49, -3, 57.360, 51, 11.772, 263346.4, 145983.9, 193.93, cm, 1150.57, 34.65, 2.70, 0.963, 1.24X, 13.93, 08/10/02, 01,

p50, -3, 57.388, 51, 11.890, 263319.6, 146203.6, 157.50, cm, 1157.15, 29.81, 2.70, 0.903, 1.12X, 13.10, 08/10/02, 01,

p51, -3, 57.669, 51, 11.925, 262994.9, 146278.1, 168.36, cm, 1155.07, 31.03, 2.70, 1.043, 1.26X, 13.23, 08/10/02, 01,

p52, -3, 57.375, 51, 11.513, 263316.7, 145505.2, 224.96, cm, 1145.27, 39.30, 2.70, 0.603, 0.92X, 14.75, 08/10/02, 01,

p61, -4, 1.268, 51, 11.842, 258799.8, 146238.1, 31.02, cm, 1183.67, 17.37, 2.70, 1.323, 1.57X, 15.43, 09/10/02, 01,

p62, -4, 1.058, 51, 11.884, 259047.0, 146308.5, 53.37, cm, 1179.10, 19.64, 2.70, 1.293, 1.48X, 15.08, 09/10/02, 01,

p63, -4, 0.954, 51, 11.878, 259168.0, 146295.0, 65.14, cm, 1176.94, 21.12, 2.70, 1.203, 1.37X, 15.12, 09/10/02, 01,

p64, -4, 0.861, 51, 11.846, 259274.0, 146232.6, 69.80, cm, 1175.98, 21.64, 2.70, 1.223, 1.39X, 15.13, 09/10/02, 01,

p65, -4, 1.069, 51, 11.755, 259027.0, 146070.5, 38.27, cm, 1182.12, 18.18, 2.70, 1.383, 1.61X, 15.46, 09/10/02, 01,

p66, -4, 0.604, 51, 11.658, 259564.1, 145876.0, 49.79, cm, 1179.56, 19.32, 2.70, 1.523, 1.72X, 15.40, 09/10/02, 01,

p67, -4, 0.387, 51, 11.677, 259818.1, 145903.4, 59.06, cm, 1177.70, 20.30, 2.70, 1.433, 1.62X, 15.23, 09/10/02, 01,

p68, -4, 0.178, 51, 11.643, 260059.5, 145834.3, 70.79, cm, 1175.48, 21.74, 2.70, 1.233, 1.40X, 15.13, 09/10/02, 01,

p69, -3, 59.895, 51, 11.657, 260388.9, 145851.0, 88.61, cm, 1171.75, 23.50, 2.70, 1.653, 1.82X, 15.29, 09/10/02, 01,

p70, -4, 1.193, 51, 12.016, 258896.4, 146558.3, 89.15, cm, 1172.31, 23.69, 2.70, 1.063, 1.22X, 14.82, 09/10/02, 01,

p71, -4, 1.244, 51, 12.080, 258840.1, 146678.8, 65.80, cm, 1176.67, 20.75, 2.70, 1.133, 1.30X, 14.60, 09/10/02, 01,

p72, -4, 1.482, 51, 11.994, 258558.5, 146526.8, 24.28, cm, 1184.84, 16.24, 2.70, 1.353, 1.59X, 15.08, 09/10/02, 01,

p73, -4, 1.536, 51, 12.169, 258505.1, 146852.7, 56.21, cm, 1178.59, 19.58, 2.70, 1.003, 1.17X, 14.38, 09/10/02, 01,

p74, -4, 1.646, 51, 12.314, 258384.7, 147124.9, 78.87, cm, 1174.13, 21.90, 2.70, 1.003, 1.16X, 14.13, 09/10/02, 01,

p75, -4, 1.857, 51, 12.315, 258138.7, 147133.1, 36.41, cm, 1182.74, 17.41, 2.70, 0.793, 1.00X, 14.29, 09/10/02, 01,
p76, -4, 1.692, 51, 12.413, 258335.4, 147308.7, 41.00, cm, 1181.31, 17.25, 2.70, 1.113, 1.31X, 13.92, 09/10/02, 01,
p77, -4, 1.593, 51, 12.488, 258455.1, 147445.7, 69.30, cm, 1175.56, 20.11, 2.70, 1.073, 1.23X, 13.50, 09/10/02, 01,
p78, -4, 1.471, 51, 12.548, 258599.5, 147553.2, 83.05, cm, 1172.46, 21.18, 2.70, 1.113, 1.26X, 13.04, 09/10/02, 01,
p79, -4, 1.522, 51, 12.315, 258529.2, 147123.0, 95.94, cm, 1170.72, 23.75, 2.70, 0.973, 1.12X, 14.01, 09/10/02, 01,
p80, -4, 1.006, 51, 12.579, 259142.7, 147595.5, 116.80, cm, 1164.88, 23.97, 2.70, 1.373, 1.52X, 12.27, 09/10/02, 01,
p81, -4, 0.818, 51, 12.735, 259369.1, 147878.4, 195.24, cm, 1147.14, 30.20, 2.70, 2.253, 2.54X, 10.64, 09/10/02, 01,
p82, -4, 1.180, 51, 12.641, 258943.0, 147716.4, 147.69, cm, 1158.45, 26.97, 2.70, 1.493, 1.68X, 11.93, 09/10/02, 01,
p83, -4, 0.339, 51, 12.349, 259908.0, 147148.6, 224.88, cm, 1143.87, 36.65, 2.70, 1.173, 1.50X, 12.69, 09/10/02, 01,
p84, -4, 0.515, 51, 12.490, 259710.2, 147413.7, 187.85, cm, 1150.75, 31.89, 2.70, 1.573, 1.82X, 12.45, 09/10/02, 01,
p85, -4, 1.060, 51, 12.149, 259057.7, 146799.8, 117.73, cm, 1165.78, 25.78, 2.70, 1.443, 1.59X, 14.05, 09/10/02, 01,
p501, -4, 2.577, 51, 10.532, 257209.0, 143852.0, 245.06, cm, 1145.45, 47.14, 2.70, 0.223, 0.60X, 19.99, 09/10/02, 01,
p502, -4, 3.608, 51, 10.729, 256018.0, 144250.0, 225.86, cm, 1149.61, 45.08, 2.70, 0.453, 0.76X, 20.27, 09/10/02, 01,
p96, -3, 58.474, 51, 11.519, 262037.7, 145551.2, 268.70, cm, 1136.58, 44.10, 2.70, 0.643, 1.11X, 14.79, 10/10/02, 01,
p97, -3, 58.371, 51, 11.306, 262146.6, 145153.4, 245.02, cm, 1141.86, 42.39, 2.70, 0.503, 0.86X, 15.51, 10/10/02, 01,
p98, -3, 58.456, 51, 11.029, 262033.8, 144641.8, 229.01, cm, 1145.56, 41.56, 2.70, 0.343, 0.66X, 16.30, 10/10/02, 01,
p99, -3, 57.874, 51, 11.190, 262719.8, 144921.8, 261.02, cm, 1139.07, 44.71, 2.70, 0.273, 0.70X, 15.86, 10/10/02, 01,
p100, -3, 57.794, 51, 11.018, 262803.9, 144601.8, 281.22, cm, 1135.00, 47.12, 2.70, 0.423, 0.89X, 16.18, 10/10/02, 01,
p101, -3, 57.373, 51, 11.049, 263295.7, 144644.8, 285.82, cm, 1133.92, 47.42, 2.70, 0.413, 0.90X, 15.96, 10/10/02, 01,
p102, -3, 57.014, 51, 11.167, 263719.3, 144853.1, 267.38, cm, 1136.85, 44.49, 2.70, 0.633, 1.06X, 15.28, 10/10/02, 01,
p103, -3, 56.864, 51, 10.844, 263878.1, 144250.2, 308.24, cm, 1129.27, 49.99, 2.70, 0.533, 1.06X, 16.16, 10/10/02, 01,
p104, -3, 56.344, 51, 10.474, 264466.1, 143548.9, 292.43, cm, 1132.12, 48.51, 2.70, 0.553, 0.98X, 16.38, 10/10/02, 01,
p105, -3, 56.173, 51, 10.268, 264655.7, 143160.5, 275.27, cm, 1136.46, 47.86, 2.70, 0.223, 0.58X, 17.27, 10/10/02, 01,
p106, -3, 56.632, 51, 10.716, 264142.4, 144004.6, 309.74, cm, 1128.11, 49.48, 2.70, 0.763, 1.29X, 15.71, 10/10/02, 01,
p107, -3, 57.118, 51, 10.661, 263574.3, 143918.0, 302.59, cm, 1130.34, 49.59, 2.70, 0.433, 0.92X, 16.25, 10/10/02, 01,
p108, -3, 57.365, 51, 10.457, 263276.6, 143547.5, 290.22, cm, 1133.15, 48.88, 2.70, 0.443, 0.87X, 16.89, 10/10/02, 01,
p109, -3, 57.748, 51, 10.362, 262825.7, 143383.6, 255.84, cm, 1140.15, 45.42, 2.70, 0.363, 0.68X, 17.13, 10/10/02, 01,
p110, -3, 58.113, 51, 10.479, 262405.5, 143612.7, 215.35, cm, 1148.74, 41.33, 2.70, 0.333, 0.57X, 17.52, 10/10/02, 01,
p111, -3, 56.421, 51, 11.267, 264415.5, 145019.3, 173.00, cm, 1154.03, 32.39, 2.70, 1.113, 1.35X, 14.16, 10/10/02, 01,
p112, -3, 56.043, 51, 11.182, 264850.9, 144850.7, 194.32, cm, 1150.80, 35.87, 2.70, 0.493, 0.76X, 14.63, 10/10/02, 01,
p113, -3, 56.239, 51, 12.079, 264667.2, 146519.1, 250.45, cm, 1136.44, 37.51, 2.70, 0.553, 0.95X, 10.10, 10/10/02, 01,
p116, -3, 56.532, 51, 12.096, 264327.1, 146560.2, 223.96, cm, 1142.69, 35.55, 2.70, 0.473, 0.81X, 11.01, 10/10/02, 01,
p117, -3, 56.465, 51, 11.841, 264392.1, 146085.2, 214.33, cm, 1144.92, 35.19, 2.70, 0.493, 0.79X, 11.72, 10/10/02, 01,
p9r, -4, 0.379, 51, 12.195, 259853.0, 146862.6, 232.12, cm, 1142.57, 37.81, 2.70, 1.213, 1.59X, 13.12, 10/10/02, 01,
k4, -4, 3.842, 51, 10.598, 255739.2, 144016.5, 225.82, cm, 1149.06, 44.71, 2.70, 0.333, 0.64X, 19.78, 10/10/02, 01,
k1, -4, 0.815, 51, 12.236, 259347.2, 146952.9, 210.24, cm, 1146.35, 34.78, 2.70, 1.903, 2.22X, 13.20, 11/10/02, 01,
p1, -4, 1.014, 51, 11.801, 259093.9, 146153.7, 55.66, cm, 1178.96, 20.32, 2.70, 1.093, 1.28X, 15.30, 07/10/02, 01,
p2, -4, 0.898, 51, 11.698, 259223.5, 145958.2, 45.75, cm, 1180.88, 19.34, 2.70, 1.343, 1.53X, 15.69, 07/10/02, 01,
p3, -4, 0.817, 51, 11.801, 259323.2, 146147.0, 90.65, cm, 1172.16, 24.33, 2.70, 1.043, 1.20X, 15.26, 07/10/02, 01,
p4, -4, 0.500, 51, 11.802, 259692.2, 146138.5, 131.36, cm, 1164.06, 28.78, 2.70, 1.203, 1.36X, 15.27, 07/10/02, 01,
p5, -4, 0.647, 51, 12.256, 259544.3, 146984.7, 220.76, cm, 1144.66, 36.30, 2.70, 1.493, 1.84X, 13.15, 07/10/02, 01,
p6, -4, 0.970, 51, 12.215, 259166.5, 146918.3, 179.88, cm, 1152.72, 31.81, 2.70, 2.023, 2.26X, 13.70, 07/10/02, 01,
p7, -4, 1.209, 51, 12.282, 258891.4, 147051.4, 149.27, cm, 1159.21, 28.75, 2.70, 1.683, 1.86X, 13.72, 07/10/02, 01,
p8, -4, 1.074, 51, 12.409, 259054.4, 147283.0, 95.93, cm, 1169.63, 22.52, 2.70, 1.803, 1.95X, 13.61, 07/10/02, 01,
p9, -4, 0.379, 51, 12.195, 259853.0, 146862.6, 232.12, cm, 1145.64, 40.87, 2.70, 1.213, 1.59X, 16.19, 07/10/02, 01,

p10, -4, 0.564, 51, 12.090, 259632.3, 146674.8, 191.29, cm, 1151.51, 34.30, 2.70, 1.203, 1.45X, 14.09, 07/10/02, 01,
p11, -4, 0.834, 51, 12.053, 259316.7, 146614.2, 133.62, cm, 1163.28, 28.33, 2.70, 1.173, 1.33X, 14.54, 07/10/02, 01,
p12, -4, 0.918, 51, 12.001, 259216.0, 146520.6, 119.09, cm, 1166.31, 26.95, 2.70, 1.133, 1.28X, 14.75, 07/10/02, 01,
p13, -4, 1.009, 51, 12.003, 259110.5, 146527.6, 109.22, cm, 1168.34, 25.94, 2.70, 1.063, 1.21X, 14.78, 07/10/02, 01,
p14, -4, 0.431, 51, 12.062, 259785.6, 146618.0, 203.02, cm, 1149.23, 35.69, 2.70, 1.253, 1.53X, 14.23, 07/10/02, 01,
p15, -4, 0.074, 51, 12.164, 260206.9, 146796.9, 236.89, cm, 1141.95, 38.70, 2.70, 1.093, 1.49X, 13.38, 07/10/02, 01,
p16, -3, 59.707, 51, 12.142, 260632.3, 146743.5, 255.84, cm, 1137.95, 40.59, 2.70, 1.093, 1.55X, 13.18, 07/10/02, 01,
p17, -3, 59.253, 51, 12.009, 261155.0, 146483.8, 262.48, cm, 1137.17, 42.05, 2.70, 0.833, 1.30X, 13.64, 07/10/02, 01,
p18, -3, 59.220, 51, 11.828, 261183.8, 146146.7, 227.35, cm, 1144.53, 38.84, 2.70, 0.833, 1.16X, 14.26, 07/10/02, 01,
p19, -3, 59.051, 51, 11.720, 261375.8, 145941.2, 234.87, cm, 1142.57, 39.36, 2.70, 0.893, 1.27X, 14.04, 07/10/02, 01,
p20, -3, 59.498, 51, 11.677, 260853.1, 145876.3, 163.48, cm, 1157.24, 32.06, 2.70, 0.903, 1.10X, 14.66, 07/10/02, 01,
p21, -4, 1.430, 51, 11.853, 258612.1, 146263.7, 31.60, cm, 1183.65, 17.51, 2.70, 1.313, 1.55X, 15.48, 07/10/02, 01,
p22, -4, 1.642, 51, 12.071, 258376.7, 146674.2, 22.17, cm, 1185.24, 15.87, 2.70, 1.183, 1.41X, 14.77, 07/10/02, 01,
p23, -4, 1.755, 51, 12.150, 258248.4, 146823.7, 20.46, cm, 1185.75, 15.74, 2.70, 1.113, 1.33X, 14.76, 07/10/02, 01,
p24, -4, 2.030, 51, 12.285, 257935.5, 147082.8, 14.20, cm, 1187.19, 15.04, 2.70, 0.983, 1.25X, 14.69, 07/10/02, 01,
p25, -4, 2.228, 51, 12.368, 257709.8, 147242.9, 5.55, cm, 1188.98, 14.04, 2.70, 1.173, 1.44X, 14.86, 07/10/02, 01,
p26, -4, 2.270, 51, 12.470, 257666.3, 147433.8, 28.31, cm, 1184.23, 16.16, 2.70, 1.843, 2.05X, 15.01, 07/10/02, 01,
p27, -4, 1.697, 51, 12.213, 258319.9, 146938.4, 45.13, cm, 1181.11, 18.61, 2.70, 0.913, 1.09X, 14.60, 07/10/02, 01,
p53, -3, 57.662, 51, 12.398, 263026.0, 147154.2, 247.92, cm, 1136.81, 36.62, 2.70, 1.053, 1.47X, 10.03, 08/10/02, 01,
p54, -3, 57.724, 51, 12.506, 262958.9, 147356.4, 278.15, cm, 1130.17, 39.16, 2.70, 1.363, 1.90X, 9.57, 08/10/02, 01,
p55, -3, 57.031, 51, 11.328, 263707.4, 145151.2, 211.62, cm, 1147.77, 37.96, 2.70, 0.723, 1.00X, 15.00, 08/10/02, 01,
p56, -3, 56.608, 51, 11.366, 264202.2, 145209.5, 225.50, cm, 1143.92, 38.34, 2.70, 1.043, 1.35X, 14.16, 08/10/02, 01,
p57, -3, 56.689, 51, 11.547, 264117.5, 145546.8, 181.66, cm, 1152.35, 32.97, 2.70, 1.013, 1.26X, 13.67, 08/10/02, 01,
p58, -3, 57.041, 51, 11.715, 263715.0, 145868.3, 147.43, cm, 1159.14, 28.95, 2.70, 0.913, 1.14X, 13.40, 08/10/02, 01,
p59, -3, 56.081, 51, 11.817, 264837.7, 146029.1, 249.05, cm, 1137.50, 38.52, 2.70, 0.493, 0.86X, 11.19, 08/10/02, 01,
p60, -3, 56.979, 51, 11.816, 263792.1, 146055.2, 153.59, cm, 1157.73, 29.30, 2.70, 0.803, 1.03X, 12.94, 08/10/02, 01,
p86, -4, 1.592, 51, 11.675, 258414.7, 145938.0, 60.22, cm, 1178.45, 21.41, 2.70, 1.483, 1.65X, 16.24, 09/10/02, 01,
p87, -4, 1.240, 51, 11.639, 258822.1, 145859.7, 89.94, cm, 1172.45, 24.63, 2.70, 1.383, 1.54X, 15.99, 09/10/02, 01,
p88, -4, 1.114, 51, 11.465, 258959.9, 145534.5, 116.93, cm, 1167.05, 27.81, 2.70, 1.563, 1.72X, 16.30, 09/10/02, 01,
p89, -4, 0.951, 51, 11.340, 259143.3, 145297.2, 137.69, cm, 1163.38, 30.74, 2.70, 1.403, 1.55X, 16.70, 09/10/02, 01,
p90, -4, 1.876, 51, 11.663, 258082.8, 145925.6, 101.91, cm, 1171.13, 26.97, 2.70, 0.913, 1.05X, 16.48, 09/10/02, 01,
p91, -4, 0.700, 51, 11.588, 259448.3, 145749.4, 40.70, cm, 1181.62, 18.69, 2.70, 1.553, 1.76X, 15.84, 09/10/02, 01,
p92, -4, 0.688, 51, 11.368, 259451.0, 145340.4, 55.34, cm, 1178.63, 20.54, 2.70, 1.953, 2.15X, 16.42, 09/10/02, 01,
p93, -4, 0.466, 51, 11.307, 259706.5, 145220.5, 101.89, cm, 1170.56, 26.92, 2.70, 0.953, 1.11X, 16.49, 09/10/02, 01,
p94, -4, 0.711, 51, 11.229, 259418.0, 145084.3, 70.93, cm, 1175.61, 22.53, 2.70, 1.973, 2.16X, 16.66, 09/10/02, 01,
p95, -4, 0.447, 51, 11.141, 259720.2, 144912.2, 150.34, cm, 1160.97, 32.52, 2.70, 1.033, 1.21X, 16.71, 09/10/02, 01,
p118, -3, 58.902, 51, 11.009, 261513.6, 144619.1, 213.81, cm, 1148.51, 39.85, 2.70, 0.423, 0.70X, 16.34, 10/10/02, 01,
p119, -4, 2.400, 51, 12.302, 257506.1, 147125.6, 23.53, cm, 1185.73, 16.44, 2.70, 0.923, 1.15X, 14.93, 11/10/02, 01,
p120, -4, 2.512, 51, 12.098, 257365.5, 146752.7, 39.13, cm, 1182.66, 18.49, 2.70, 1.463, 1.64X, 15.70, 11/10/02, 01,
p121, -4, 2.397, 51, 11.993, 257493.2, 146554.1, 41.01, cm, 1182.37, 18.93, 2.70, 1.303, 1.49X, 15.78, 11/10/02, 01,
p122, -4, 2.362, 51, 11.857, 257527.0, 146300.5, 49.14, cm, 1180.66, 19.93, 2.70, 1.673, 1.85X, 16.22, 11/10/02, 01,
p123, -4, 1.623, 51, 11.942, 258392.5, 146434.9, 39.03, cm, 1181.95, 17.97, 2.70, 1.423, 1.63X, 15.18, 11/10/02, 01,
p124, -4, 1.962, 51, 11.982, 257999.4, 146518.3, 77.19, cm, 1175.27, 23.01, 2.70, 0.863, 1.02X, 15.29, 11/10/02, 01,
p125, -4, 2.205, 51, 11.994, 257717.4, 146549.2, 95.66, cm, 1172.13, 25.55, 2.70, 0.823, 0.96X, 15.68, 11/10/02, 01,
p126, -4, 1.709, 51, 11.883, 258289.4, 146327.6, 85.86, cm, 1173.42, 23.98, 2.70, 1.083, 1.23X, 15.50, 11/10/02, 01,

p127, -4, 1.809, 51, 11.828, 258169.9, 146229.9, 130.55, cm, 1164.55, 28.98, 2.70, 1.323, 1.47X, 15.67, 11/10/02, 01,
p128, -4, 1.456, 51, 11.791, 258579.2, 146149.4, 39.19, cm, 1182.25, 18.54, 2.70, 1.473, 1.70X, 15.81, 11/10/02, 01,
p129, -4, 1.336, 51, 11.760, 258717.0, 146088.7, 53.43, cm, 1179.51, 20.24, 2.70, 1.233, 1.44X, 15.63, 11/10/02, 01,
p130, -4, 2.073, 51, 11.496, 257844.7, 145622.0, 131.24, cm, 1164.98, 30.12, 2.70, 2.023, 2.17X, 17.43, 11/10/02, 01,
p131, -4, 1.881, 51, 11.462, 258067.6, 145552.8, 181.68, cm, 1155.35, 36.10, 2.70, 1.183, 1.39X, 16.92, 11/10/02, 01,
p132, -4, 1.937, 51, 11.213, 257988.9, 145093.0, 229.82, cm, 1146.70, 42.67, 2.70, 0.663, 0.97X, 17.63, 11/10/02, 01,
p133, -4, 1.694, 51, 11.297, 258276.2, 145241.1, 231.72, cm, 1145.35, 41.79, 2.70, 1.203, 1.52X, 17.07, 11/10/02, 01,
p134, -4, 1.368, 51, 11.334, 258658.0, 145298.7, 224.36, cm, 1146.53, 40.64, 2.70, 1.453, 1.75X, 16.99, 11/10/02, 01,
p135, -4, 1.486, 51, 11.254, 258516.5, 145155.9, 245.34, cm, 1142.53, 43.24, 2.70, 1.423, 1.78X, 17.24, 11/10/02, 01,
p136, -4, 2.331, 51, 10.829, 257510.7, 144395.3, 249.86, cm, 1143.73, 46.45, 2.70, 0.503, 0.89X, 19.06, 11/10/02, 01,
p137, -4, 2.266, 51, 11.029, 257596.0, 144763.0, 221.26, cm, 1149.46, 43.07, 2.70, 0.343, 0.66X, 18.68, 11/10/02, 01,
p138, -4, 2.495, 51, 11.072, 257331.7, 144851.1, 214.04, cm, 1150.88, 42.20, 2.70, 0.493, 0.79X, 18.76, 11/10/02, 01,
p139, -4, 2.678, 51, 11.449, 257138.1, 145554.9, 182.79, cm, 1156.37, 37.49, 2.70, 0.533, 0.75X, 17.55, 11/10/02, 01,
p140, -4, 2.821, 51, 11.566, 256977.8, 145776.2, 181.56, cm, 1156.65, 37.21, 2.70, 0.633, 0.85X, 17.51, 11/10/02, 01,
p141, -4, 2.297, 51, 11.433, 257581.4, 145512.5, 189.51, cm, 1154.13, 37.34, 2.70, 0.983, 1.21X, 17.10, 11/10/02, 01,
p142, -4, 2.488, 51, 11.406, 257357.3, 145469.2, 195.72, cm, 1153.44, 38.61, 2.70, 0.793, 1.03X, 17.48, 11/10/02, 01,
p143, -4, 2.510, 51, 11.263, 257324.2, 145205.1, 213.68, cm, 1150.49, 41.42, 2.70, 0.583, 0.86X, 18.09, 11/10/02, 01,
p144, -4, 2.025, 51, 10.948, 257873.3, 144604.5, 218.87, cm, 1149.68, 42.67, 2.70, 0.333, 0.63X, 18.52, 11/10/02, 01,
p145, -3, 59.058, 51, 11.269, 261344.3, 145105.9, 128.45, cm, 1164.19, 28.80, 2.70, 1.203, 1.38X, 15.64, 11/10/02, 01,
p146, -3, 58.761, 51, 11.143, 261684.2, 144862.1, 194.24, cm, 1152.08, 37.18, 2.70, 0.643, 0.89X, 16.08, 11/10/02, 01,
p147, -3, 59.272, 51, 11.157, 261090.1, 144905.1, 186.71, cm, 1153.49, 36.25, 2.70, 0.843, 1.08X, 16.19, 11/10/02, 01,
p148, -4, 0.155, 51, 11.453, 260076.8, 145481.2, 88.22, cm, 1172.38, 24.31, 2.70, 0.923, 1.09X, 15.41, 11/10/02, 01,
p149, -3, 59.793, 51, 11.352, 260492.5, 145281.7, 88.51, cm, 1171.95, 24.11, 2.70, 1.873, 2.05X, 16.14, 11/10/02, 01,
p150, -3, 59.515, 51, 11.342, 260815.6, 145255.8, 132.00, cm, 1164.38, 29.98, 2.70, 0.793, 0.96X, 16.00, 11/10/02, 01,
p151, -3, 59.775, 51, 11.442, 260517.9, 145449.9, 76.65, cm, 1174.22, 22.59, 2.70, 1.573, 1.76X, 15.68, 11/10/02, 01,
p152, -4, 0.142, 51, 11.350, 260086.7, 145290.5, 109.99, cm, 1168.72, 27.52, 2.70, 0.853, 1.01X, 16.08, 11/10/02, 01,
p153, -4, 0.055, 51, 11.774, 260209.5, 146073.7, 115.47, cm, 1166.54, 26.40, 2.70, 1.143, 1.30X, 14.63, 11/10/02, 01,
p154, -3, 59.262, 51, 11.508, 261118.7, 145555.5, 152.44, cm, 1159.26, 30.92, 2.70, 1.213, 1.40X, 15.07, 11/10/02, 01,
p155, -4, 0.010, 51, 10.484, 260196.9, 143680.7, 218.22, cm, 1148.79, 42.26, 2.70, 0.273, 0.53X, 18.08, 11/10/02, 01,
p156, -4, 0.069, 51, 10.708, 260139.4, 144098.4, 214.70, cm, 1149.51, 41.57, 2.70, 0.223, 0.48X, 17.75, 11/10/02, 01,
p157, -3, 58.979, 51, 10.828, 261415.0, 144286.5, 192.55, cm, 1153.18, 38.22, 2.70, 0.213, 0.44X, 16.87, 11/10/02, 01,
p158, -3, 58.918, 51, 10.452, 261466.6, 143588.2, 228.88, cm, 1146.16, 42.97, 2.70, 0.333, 0.60X, 17.66, 11/10/02, 01,
p159, -3, 58.921, 51, 10.171, 261449.1, 143066.3, 188.16, cm, 1154.47, 39.13, 2.70, 0.163, 0.35X, 18.18, 11/10/02, 01,
p160, -3, 59.484, 51, 10.145, 260791.7, 143036.9, 188.31, cm, 1154.56, 39.31, 2.70, 0.113, 0.30X, 18.29, 11/10/02, 01,
p161, -3, 59.960, 51, 10.238, 260242.0, 143223.7, 165.43, cm, 1159.24, 36.79, 2.70, 0.423, 0.59X, 18.65, 11/10/02, 01,
p162, -4, 0.437, 51, 10.333, 259691.0, 143415.3, 202.44, cm, 1152.29, 41.11, 2.70, 0.183, 0.40X, 18.60, 11/10/02, 01,
p163, -4, 0.888, 51, 10.575, 259178.7, 143878.0, 207.79, cm, 1151.29, 41.41, 2.70, 0.253, 0.50X, 18.38, 11/10/02, 01,

Appendix 3 Scripts to perform terrain corrections

1. SQL to extract DTM data from ORACLE database

```
/*  Extract DTM   */
set pagesize 0
set linesize 200
set feedback off
set termout off
set trimspool on
spool dtm50.dat
/* Get DTM  for UK   Combe Martin region */

select easting, northing, elevation
from DTM
where easting   between  249000 and 271000
and   northing  between  139000 and 156000;
/
spool off
```

2. Script to run xdtmtc for Inner-zone terrain corrections

```
#!/bin/csh -f
/users/k_ker/exec/xdtmtc     << ENDV
eg-total.out
eg-total.tc
2                              enter input data option [1]:
0.000                         enter radial limit R1 km    [0.0]:
-3.000                         enter radial limit R2 km [48.620]:
N                             Do you want to RECALCULATE TC   y/n [n]
2.700                          enter DENSITY for TC [2.70]:
4                              enter DTM INPUT option [4]:
dtm-eg.sg
Y                                Do you want to AVERAGE SG [y]:
Y                              Convert input DTM to km  y/n [Y]:
N                                List DTM gradient WARNINGS [N]:
Y                                Continue processing ?y/n [Y]:
N                             LIST  Analysis of Adjacent/Near terrain
2                              enter MODE for ADJACENT DTM:
ENDV
```

3. Script to run xdtmtc for Outer-zone terrain corrections

```
#!/bin/csh -f
/users/k_ker/exec/xdtmtc     << ENDV
eg-total.tc
eg-total.tc2
2                              enter input data option [1]:
0.000                         enter radial limit R1 km    [0.0]:
48.620                         enter radial limit R2 km [48.620]:
N                             Do you want to RECALCULATE TC   y/n [n]
2.700                          enter DENSITY for TC [2.70]:
4                              enter DTM INPUT option [4]:
/rgtmp/users/k_ker/wsw/SW-hyts1.sg
N                                Do you want to AVERAGE SG [y]:
Y                              Convert input DTM to km  y/n [Y]:
N                                List DTM gradient WARNINGS [N]:
Y                                Continue processing ?y/n [Y]:
N                             LIST  Analysis of Adjacent/Near terrain
ENDV
```

Appendix 4 List of mines in the Combe Martin area

Site	Easting	Northing	Name of mine/ trial	Mineral worked (if known)	Other information
40	24926	14237	Un-named	Unknown	Depression in field immediately north of Spreacombe Lodge, identified as site of shaft by BGS.
36	25010	14050	South Dene Iron Mine	Iron	Adits in Pines Dean Copse, with open working(s) and possibly an adit on hillside below adjacent to road. Iron working 1860.
42	25150	13980	Fullabrook Mine	Manganese	Also known as Huel Comfort, Little Comfort or West Down. Adits shafts and open workings in valley 500 yards south-east of Fullabrook Mill. Sett also included Bakers Tenement lands, actually in West Down parish, north of the Fullabrook site. Manganese mine at work 1698, 1859-61 and 1872-84. Remains of dressing floor with water powered crushing mill.
39	21570	14090	Un-named	Manganese	Adit and shafts on Snowball Hill. Worked for manganese mid 19th century.
44	25310	13760	Bere Charter Mine	Copper	Short adit and shafts in Pippacott Wood. Copper mine at work 1858-62.
86	25730	14710	Watermouth Mine	Lead-Silver	Also known as Great Watermouth (see also Wheal Basset, Wheal Harmony and Berry Mine). Shaft and adit at Newberry (573471); shaft at 56364773 north of Napps Quarry and adit at 56544764 Golden Cove. Worked for silver-lead 1859 to about 1866, although Newberry workings are considerably earlier.
48	25670	13870	Plaistow Mine	Iron	Also known as Shirwell Mine. Adits and shafts to north and east of West Plaistow Farm. Iron working 1861-69 and 1873-75; sett sometimes worked with Viveham Mine.
46	25710	13880	Viveham Mine	Iron	Open workings on northeast side of valley; shafts in area yet to be positively identified. At work for iron in 1861 and 1868; probably worked again in 1873 with Plaistow Mine

89	25850	14730	West Challacombe Mine	Lead-Silver	Also known as New Combmartin and West Combmartin. Shafts and adit 2-300 yds south of West Challacombe Farm; shaft below Lester Cliff; adits in cliff at Lester Point and at Wild Pear Beach. Site of ancient working for silver-lead; trials made by Gullet 1790-92; and Combmartin and North Devon Mining Co. in 1843, abandoned in 1845. Further trials for silver-lead 1853-54. Promoted as New Combmartin Silver-lead Mine 1864-66; further working 1873-74 and 1876-78, as West Combmartin.
88	25870	14600	South Combmartin Mine	Lead-Silver	That section of the Old Combmartin Mine on Gorwell's Lode, adjacent to Coneypark Lane. Attempted reworking 1879-80.
93	25950	14720	Girt Vale Mine	Lead-Silver	Part of Knap Down sett. Shaft and adit in valley 300yds southwest of Girt Farm. Worked for silver-lead around 1859-60 by North Devon Silver-lead Mining Co. Ltd. Trials also carried out in 1875. (Claughton, 1992a)
92	25970	14660	Knap Down Mine	Lead-Silver	Shafts and adit 200 yds ENE of 'Silver Mines Farm'. Ancient adit adjacent to Corner Lane to south west of farm. Site of ancient workings for silver-lead. Reopened 1836 by Combmartin and North Devon Mining Co. but abandoned 1846. Reopened again in 1848 as North Devon Wheal Rose; in Dec. 1850 as Nap Down Consols. In 1859 the North Devon Silver-lead Mining Co. Ltd was formed and worked the mine until 1873. Some prospecting in 1890s and again in 1927. Sett included Girt Vale workings. Remains of engine house for Sims combined cylinder pumping engine (1843-73). (Claughton,1992a)

98	25880	14800	Girt and Holdstone Downs Mine	Iron	On the coast north of the village. Girt Down section is located to the west of Sherrycombe and Holdstone Down section is to the east. On Girt Down there are adits at the Rawns, just above HWM, and workings on the cliff top just west of the Rawns at [588480], in addition there are adits on the north side of Great Hangman at [600482]. The workings on Holdstone Down consist of trial pits on the east side of Sherrycombe and across the south side of the down. A lease of both sections was granted in 1796 (as part of the manorial lands) but the extent of working is not known. The Girt Down section was worked for iron in 1867-8 by the West of England Iron Ore Co. In 1872 iron working recommenced on both sections and in 1875 the mine was taken over by the Girt and Holdstone Downs Mining Co. (wound up in 1876). In 1877 the mine was in the hands of the Combmartin Manganese and Haematite Iron Ore Co. who worked it for a short period only. Reputedly worked during the 1914-18 war. (Atkinson 1997, p. 32-3)
99	25935	14776	Un-named	Iron	Adit (?) driven northeast from point to northeast of East Challacombe Farm. Probably for iron; date not known.
49	25990	13785	Shirwell Ford Mine	Iron	Shaft and openwork adjacent to quarry. Worked for iron in 1874.
94	26020	14600	Buzzacott Mine	Lead-Silver	Adit and shaft east of Buzzacott House and west of track to Beara Farm; also trial crosscuts driven north from points south (60164613), and northeast (60434646), of Beara Farm. Trials for silver-lead 1874-76 but probably worked at an earlier date.
47	26040	14230	Un-named	Umber/Ochre ?	Adits and shafts in wood 700 yds northeast of church. Possibly for umber/ ochre 1785-88.
52	26079	13756	Un-named	Iron	Adit in Yeo valley 175 yds north of Blackpool Bridge; shaft in woods to north. Trial for iron; date not known.
50	26070	13840	Cott Quarry Mine	Manganese	Adits in small quarry 400 yds west of Loxhore Cott. Worked for manganese 1874-75.

100	26250	14650	Combmartin Consols	Iron	Also known as Wheal Vervale. Shafts and adit 500 yds west of Tattiscombe Farm. Working for silver-lead 1846-47 (as Wheal Vervale) and possibly earlier; again in 1853-55 (as Combmartin Consols). The northern part of the sett appears to have been worked for iron at a date not known.
101	26308	14653	Un-named	Unknown	Crosscut adit north of Tattiscombe Farm. Mineral/ date not known; although it appears to have been on the Combmartin Consols sett, it is not mentioned in reports.
57	26400	14400	Un-named	Iron	Trial pits on north side of Kentisbury Down adjacent to road. Iron trial probably dating from 1870s.

Appendix 5 Mineralisation at Combe Martin

Appendix 5.1 Fold closure at Lester Point, North Devon with mineralised strata. The mineralisation lies in the shadow beneath the overhanging strata in the centre right of the photo, but is not present in the same bed where the geologist is working.

Appendix 5.2 Details of the mineralisation at Lester point. Stringers of predominantly galena and quartz follow the bedding of the Lester Slates.

Appendix 5.3 Details of mineralisation in Harris shaft, Combe Martin.

Appendix 5.4 Details of mineralisation in Harris shaft, Combe Martin.

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