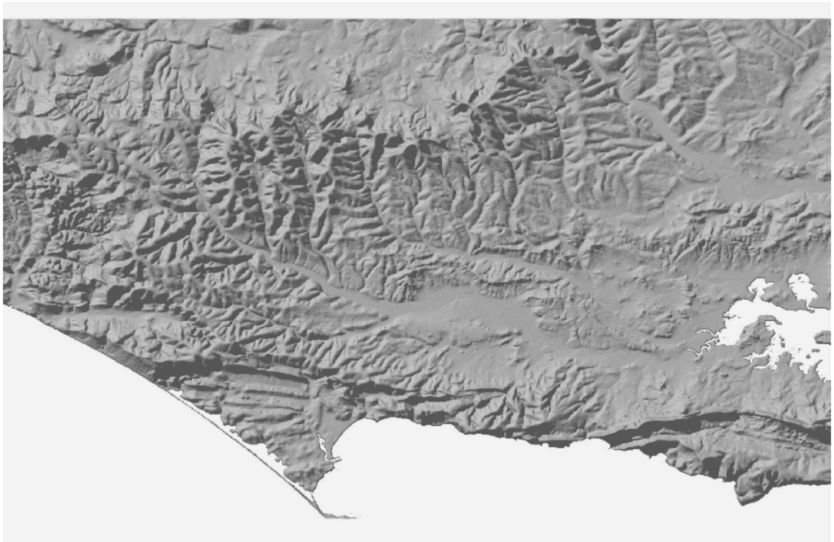
British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

The Geological Framework of the Frome-Piddle Catchment

Integrated Geoscience Surveys - Southern Britain

Commissioned Report CR/02/197 N



BRITISH GEOLOGICAL SURVEY

COMMISSIONED REPORT CR/02/197N

The Geological Framework of the Frome-Piddle Catchment

Newell, A J, Royse, K R, Barron, A J M and Woods, M A

Key words

Geology, Dorset, Chalk, Palaeogene, Structure

Front Cover

Shaded relief image of the Frome-Piddle Catchment

Bibliographical reference

Newell, A J, Royse, K R, Barron, A J M and Woods, M A. 2002. The Geological Framework of the Frome-Piddle Catchment. *British Geological Survey Commissioned Report*. CR/02/197

Keyworth, Nottingham British Geological Survey 2002

BRITISH GEOLOGICAL SURVEY

The full range of Survey publications is available from the BGS Sales Desks at Nottingham and Edinburgh; see contact details below or shop online at www.thebgs.co.uk

The London Information Office maintains a reference collection of BGS publications including maps for consultation.

The Survey publishes an annual catalogue of its maps and other publications; this catalogue is available from any of the BGS Sales Desks.

The British Geological Survey carries out the geological survey of Great Britain and Northern Ireland (the latter as an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as its basic research projects. It also undertakes programmes of British technical aid in geology in developing countries as arranged by the Department for International Development and other agencies.

The British Geological Survey is a component body of the Natural Environment Research Council.

Keyworth, Nottingham NG12 5GG

☎ 0115-936 3241 Fax 0115-936 3488
e-mail: sales@bgs.ac.uk
www.bgs.ac.uk
Shop online at: www.thebgs.co.uk

Murchison House, West Mains Road, Edinburgh EH9 3LA

☎ 0131-667 1000 Fax 0131-668 2683
e-mail: scotsales@bgs.ac.uk

London Information Office at the Natural History Museum (Earth Galleries), Exhibition Road, South Kensington, London SW7 2DE

☎ 020-7589 4090 Fax 020-7584 8270
☎ 020-7942 5344/45 email: bgslondon@bgs.ac.uk

Forde House, Park Five Business Centre, Harrier Way, Sowton, Exeter, Devon EX2 7HU

☎ 01392-445271 Fax 01392-445371

Geological Survey of Northern Ireland, 20 College Gardens, Belfast BT9 6BS

☎ 028-9066 6595 Fax 028-9066 2835

Maclean Building, Crowmarsh Gifford, Wallingford, Oxfordshire OX10 8BB

☎ 01491-838800 Fax 01491-692345

Parent Body

Natural Environment Research Council, Polaris House, North Star Avenue, Swindon, Wiltshire SN2 1EU

☎ 01793-411500 Fax 01793-411501
www.nerc.ac.uk

Contents

List of figures

1 Introduction

The purpose of this report is to describe the solid and drift geology of the catchment area of the rivers Frome and Piddle and a 5 km-wide buffer zone (together comprising the study area).

The Frome-Piddle Catchment is centred on Dorchester in South Dorset and is predominantly a chalkland drainage basin containing rivers that flow SE into Poole Harbour (Figure 1). The drainage basin is some 48 km in length and 22 km wide, with the Frome draining an area of 463.7 km^2 and the Piddle an area of 187.5 km^2.

The catchment has been recently geologically surveyed at 1:10 000-scale (1985-1997), and most is covered by published 1:50 000-scale maps (Figure 1). These have been compiled into a map covering the catchment and its 5 km buffer zone (Map 1). While the map is largely seamless within the catchment, there is one major misfit in the buffer zone resulting from the different lithostratigraphical subdivisions used on the modern Shaftesbury (313) and much older Yeovil (312) sheet. Some of the lithostratigraphical terms used on the 1:10 000-scale maps have been superseded, and a table showing the current terminology is included as Appendix 1. In addition, borehole, and surface outcrop data has been utilised to model important geological surfaces and produce a series of maps (Maps 2-5) and cross-sections (Sections 1-5).

1.1 REGIONAL GEOLOGICAL SETTING

In terms of regional geological setting, the catchment lies at the centre of the Wessex Basin, a post-Variscan sedimentary depocentre that extends across central southern England and adjacent offshore areas (Underhill and Stoneley, 1998). The geology of the catchment has been shaped by a history of Mesozoic extension and a phase of Cenozoic folding and structural inversion of basin-bounding and intra-basinal faults. The present day structure is dominated by the effects of this basin inversion that in turn have important influences on the form of the Frome-Piddle drainage basin.

1.2 ANALYSIS OF CATCHMENT AREA SURFACE GEOLOGY

The catchment is underlain by solid geological units ranging in age from the Middle Jurassic (Bathonian) Fuller's Earth Formation to the Palaeogene (Eocene) Bracklesham Group (Figure 2). Cretaceous Chalk and Palaeogene formations dominate the solid geology of the catchment (Table 1; Figure 3). In terms of gross lithology, chalk underlies around 65 percent of the catchment, sand and sandstone around 18 percent and argillaceous rocks 11 percent. The balance of 6 percent comprises predominantly Jurassic interbedded limestone, sandstone and clays (Table 2). Drift deposits cover about 268.2 km^2 (41 percent) of the catchment and include clay-with-flints, alluvium and river terrace deposits (Table 3). The general structural dip of strata within the catchment is to the ESE and the depth of present-day erosion increases toward the WNW. As a consequence, the surface geology of the Frome-Piddle Catchment comprises three distinct geological zones: the headwaters of the Frome and Piddle cut into Jurassic limestones and mudstones, the middle reaches flow across chalklands, and the lower reaches traverse the Palaeogene deposits of the Wareham Basin before discharging into Poole Harbour (Figure 4). The southern margin of the Frome-Piddle drainage basin broadly corresponds to the southernmost limit of the Chalk outcrop, which itself is controlled by major faults.

Geological Unit (Source BGS 1:250 000 DiGMap)	Area(km^2)	Area (%)
Thames and Bracklesham groups	173.88	26.71
Chalk Group	428.45	65.82
Upper Greensand, Gault and Lower Greensand formations	40.20	6.18
Wealden Group	1.46	0.22
Purbeck Group	0.18	0.03
Portland Group	0.58	0.09
Kimmeridge Clay Formation	0.50	0.08
Oxford Clay and Kellaways formations	0.95	0.15
Cornbrash Formation	0.20	0.03
Forest Marble Formation	1.38	0.21
Fuller’s Earth Formation	3.15	0.48

Table 1. Solid geological formations in the Frome-Piddle Catchment and their outcrop area

Rock description (Source BGS 1:250 000 DiGMap)	Area (km^2)	Area(%)
Chalk	428.45	65.90
Sandstone	118.90	18.27
Argillaceous rocks	24.00	3.69
Limestone	0.07	0.01
Argillaceous rocks interbedded with sandstone	77.10	11.85
Limestone interbedded with argillaceous rocks	1.90	0.29

Table 2. Rock types in the Frome-Piddle Catchment and their outcrop area

Drift type (Source 1:50 000 BGS DiGMap)	Area (km^2)	Area (%)
Alluvium	33.90	12.64
Blown Sand	0.10	0.04
Clay-With-Flints	96.28	35.91
Head	61.65	22.99
Marine or Estuarine Alluvium	0.42	0.16
Older Head	2.01	0.75
Peat	0.33	0.12
River Terrace Deposits	73.45	27.39

Table 3. Drift deposits in the Frome-Piddle Catchment and their outcrop area

2 Solid geology of the Frome-Piddle Catchment

The solid geology of the catchment area is shown in outline on Figure 4, which is based on the BGS 1:250 000-scale map, and for the entire study area in detail on the 1:50 000-scale map (Map 1), which depicts both solid (bedrock) and drift (superficial) deposits. The solid units are briefly described below, and are divided into three larger sequences (Jurassic-Early Cretaceous; 'Upper Cretaceous'; Palaeogene) by major unconformities in the mid Cretaceous (Aptian-Albian) (Figure 5) and early Tertiary (Figure 2).

2.1 JURASSIC-EARLY CRETACEOUS STRATA

Jurassic and Early Cretaceous strata represent only 1.2 percent of the solid geology at outcrop within the Frome-Piddle Catchment, although there are more extensive outcrops within the northern, western and southern parts of the buffer zone. They underlie the important Aptian-Albian unconformity which is marked by the progressive westerly truncation of Mesozoic and Permian strata. As a result much of the Jurassic to Early Cretaceous sequence is absent beneath the Gault across the central part of the study area. Differences in detail in the sequences to the north and south of the South-Dorset Platform (depicted on Figure 2) reflect earlier down-faulting along the margins of the Platform.

2.1.1 Lower Jurassic strata

Lower Jurassic strata crop out only in the valleys south and north-west of Beaminster, in the west of the study area. The oldest formation at outcrop is the Dyrham Formation, comprising up to 125 m of sandstone and siltstone, divided into three members. It is overlain by up to 2 m of the Beacon Limestone Formation, followed by the fine-grained sandstones of the Bridport Sand Formation – up to 90 m thick here, but thickening eastwards to 200 m at depth.

2.1.2 Inferior Oolite Formation

The Middle Jurassic Inferior Oolite Formation also crops out only in the west, where it comprises up to 6 m of ooidal and ferruginous limestone. It thickens east at depth to almost 50 m.

2.1.3 Fuller's Earth Formation

The Fuller's Earth comprises an interbedded series of pale to medium grey, variably calcareous, blocky to subfissile mudstones interbedded with carbonate siltstones and pale grey, hard, argillaceous limestones. The formation is the youngest unit thought to be present throughout the study area beneath the Aptian-Albian unconformity. It is as little as 74 m thick in the west of the catchment where overlain by the Gault, and thickens east to over 100 m in the South-Dorset Platform. To the south in the Portland-Wight Trough it exceeds 230 m.

2.1.4 Frome Clay Formation

The Frome Clay comprises interbedded argillaceous, bioclastic limestone and calcareous claystones overlain by grey mudstones, which are highly calcareous in parts. The Frome Clay is absent beneath the Aptian-Albian unconformity in the west, and thickens to over 70 m northwards and southwards from the South-Dorset Platform, where it is typically around 50 m thick.

2.1.5 Forest Marble Formation

The Forest Marble consists of a variable but dominantly argillaceous sequence of mudstones, sandstones and limestones. The limestones are hard, ooidal and bioclastic and with the sandstones generally occur in the middle of the formation. The Forest Marble is typically around 50 m thick, but is absent in the west of the catchment area.

2.1.6 Cornbrash Formation

The Combrash Formation comprises bioclastic limestones with interbeds of calcareous mudstone. It is typically around 10 m thick but is absent over the western part of the South-Dorset Platform.

2.1.7 Kellaways Formation

The Kellaways Formation comprises grey, slightly silty and micaceous, calcareous mudstones passing upwards into siltstones and fine-grained calcareous and argillaceous sandstones. The sandstones locally contain large calcareous concretions (doggers). The formation ranges up to 50 m thick but has been completely removed over the western part of the Platform by erosion beneath the Aptian-Albian unconformity.

2.1.8 Oxford Clay Formation

The Oxford Clay is a succession of grey to brown calcareous mudstones interbedded with thin calcareous siltstones and argillaceous limestones. Around 50 m thick across much of the South-Dorset Platform, it is absent in the west (Figure 5), but may attain about 120 m in thickness in the south.

2.1.9 Corallian Group

Strata belonging to the Corallian Group are present in the north and south of the study area, but are absent beneath the centre of the catchment area as a result of the Aptian-Albian unconformity (Figure 5). The sequences in the north and south differ in detail (Figure 2): in the north the succession is predominantly argillaceous, with minor amounts of sandstones and limestones, and is between 90 and 100 m in thickness. In the south, along the coast, the Corallian is dominated by sandstones and limestones, with lesser amounts of mudstones. In total, the group here ranges between 30 and 110 m in thickness.

2.1.10 Kimmeridge Clay Formation

The Kimmeridge Clay Formation comprises a sequence dominated by claystones and calcareous mudstones, with lesser amounts of bituminous shales and oil shales, and thin beds of bioclastic limestone and dolomite ('Stone Bands'). Absent beneath the centre of the catchment area (Figure 5), it ranges from about 300 m to more than 500 m thick in the north and south (Cox and Gallois, 1981).

2.1.11 Portland Group

The Portland Group is present only in the south (Figure 2) and is subdivided into a lower Portland Sand Formation (mainly dolomitic limestones, dolomites, siltstones and minor sandstones) and an upper Portland Stone Formation (mainly bioclastic limestones, significantly cherty in the lower part). The Portland Group ranges up to about 80 m thick.

2.1.12 Purbeck Group

The Purbeck Group is also only present in the south, and is divided into the Lulworth and Durlston formations. The Jurassic-Cretaceous boundary lies within the Lulworth Formation. Both formations are dominated by alternations of limestones, argillaceous limestones and calcareous mudstones (Westhead and Mather, 1996). The group is between 50 and 60 m thick.

2.1.13 Wealden Group

The Wealden Group is a succession of colour-variegated mudstones containing channel sand-bodies and thin beds of sand and conglomerate . The Group is in excess of 500 m thick in the south, but absent across the South-Dorset Platform and in the north.

2.2 'EARLY-UPPER CRETACEOUS' STRATA

The late-Early Cretaceous Lower Greensand, Gault and Upper Greensand formations and the late Cretaceous Chalk Group are separated from underlying strata by the Aptian-Albian unconformity (Figure 5), which is marked regionally by the progressive westerly truncation of Mesozoic and Permian strata. In general terms the Upper Cretaceous succession as a whole shows little thickness variation and is considered a post-rift sequence that drapes across previously active normal faults.

2.2.1 Lower Greensand Formation

The Lower Greensand comprises ferruginous sandstone and shale. It does not crop out within the Frome-Piddle Catchment, outcropping within the buffer only along the Purbeck Disturbance (Figure 10), where it may attain 60 m thick, and in the extreme north (up to 2 m thick). Within the catchment area it may be locally present at depth beneath the Gault.

2.2.2 Gault Formation

The Gault Formation consists of medium to dark grey, poorly fissile mudstones and shales. It is present throughout the catchment area, ranging from 4 to 40 m in thickness. The Gault together with Upper Greensand crop out across 18 km^2 of the catchment, mainly in the headwater valleys of the Frome and Piddle in the north and north-west part (Figure 4), with minor outcrops around the Compton Valence Dome, Winterbourne Abbas Dome and the Chaldon Pericline.

2.2.3 Upper Greensand Formation

The Upper Greensand consists largely of grey-green fossiliferous, glauconitic, fine-grained sands and sandstones (Cann Sand Member), that are highly susceptible to landslipping. At the top are harder cemented beds (Shaftesbury Sandstone, Boyne Hollow Chert and Eggardon Grit members). The Upper Greensand Formation is typically around 20 to 30 m thick. The junction between the Upper Greensand and Gault is transitional.

Following the deposition of the Upper Greensand, moderate differential uplift in the area of the South-Dorset Platform caused erosion of the upper beds of the formation through the centre of the study area.

2.2.4 Chalk Group

2.2.4.1 INTRODUCTION

A progressive rise in sea level across much of north-west Europe in the late Lower and Upper Cretaceous resulted in the very widespread deposition of the Chalk. While much of the Chalk was deposited as a relatively uniform blanket across the Wessex Basin, the earliest deposits were influenced by a series of shallow basins and highs. The South-Dorset Platform, which underlies much of the catchment, broadly corresponds to a positive area which accounts for the restricted distribution of the lowest formation of the Chalk.

Recent studies (Bristow et al., 1997) including feature mapping, lithology, macro- and micropalaeontology and aerial photography, have shown that the Chalk of southern England can be divided into nine laterally persistent formations (Figures 2 and 6). The terms Lower, Middle and Upper Chalk are now only used as informal names, but can be related to the new scheme (Appendix 1) and are used in Figure 4.

Each formation has a characteristic signature on geophysical logs, especially the sonic log, and can be recognized across the whole of the Wessex Basin. The principal subdivision into two subgroups is taken at the base of a prominent mudstone interval, the Plenus Marls (Figure 6). Below the Plenus Marls, the Grey Chalk Subgroup comprises thin argillaceous and marly grey and greyish white chalks, while the overlying White Chalk Subgroup comprises thick white chalks and nodular chalks with or without flints.

Chalk is a white to greyish white very fine-grained microporous limestone. It is composed predominantly of coccoliths (microscopic, calcareous skeletal remains of planktonic algae). Coarse-grained carbonate material is also present and includes foraminifera, ostracods, and entire or finely broken echinoderm, bryozoan, coral, inoceramid and other bivalve remains. Other lithological types within the Chalk Group include glauconitised chalkstone (hardgrounds), calcarenites and flint. Calcareous mudstone (marl) and argillaceous or muddy limestone occur in the basal part of the Chalk succession and in individual thin seams elsewhere. Mud-grade material forms 30 to 40 per cent of the basal strata but typically less than 5 per cent of the pure white chalks that dominate the upper part of the succession.

Chalk forms the solid geology of some 366 km^2 or 65% of the catchment, typically forming the higher ground which rises to over 265 m at Gore Hill [ST 637 038] on the northern crop and to almost 200 m on the Povington Hill [SY 880 811] in the south. The Chalk in the south of the study area is folded and faulted and, particularly along the Purbeck Disturbance, has been changed from a soft, highly porous material into a harder limestone. This has a significant impact on the aquifer properties of the Chalk and on its lithostratigraphical subdivision.

Oil company boreholes prove the full thickness of the Chalk Group in the eastern part of the Frome-Piddle Catchment to be in the range 400 to 425 m. In the centre and west it thins to between 360 and 380 m or possibly less.

2.2.4.2 GREY CHALK SUBGROUP

The Grey Chalk Subgroup includes the traditional Lower Chalk up to the base of the Plenus Marls Member. Where fully developed, the Grey Chalk Subgroup is divided into two formations, a lower, West Melbury Marly Chalk Formation and an upper, Zig Zag Chalk Formation. The **West Melbury Marly Chalk** is present at outcrop only in the extreme north of the study area, and within the catchment area is present only at depth in the north-east, in the Winterbourne-Kingston Trough (Figure 9), where it may be up to 10 m thick. As a result of restricted deposition on the South-Dorset Platform, it may be represented here by a phosphatic, ammonite-rich conglomerate at the base of the overlying Zig Zag Chalk.

The **Zig Zag Chalk** comprises blocky, greyish white chalk with common marl seams and has been proved in boreholes in the east of the study area ranging between 38 and 49 min thickness. The lower part of the Zig Zag Chalk was not deposited over the South-Dorset Platform and the formation rests unconformably on the pitted and phosphatised top of the Upper Greensand; its base is marked by the diachronous 'Chalk Basement Bed' (Figure 6).

2.2.4.3 WHITE CHALK SUBGROUP

The White Chalk Subgroup is up to 385 m thick and comprises white chalks and nodular chalks with or without flints divided into seven formations. At the base is the **Holywell Nodular Chalk Formation**, a hard nodular chalk, 21-23 m thick, with a basal marly unit (Plenus Marls) and common shell debris in the upper beds. This is overlain by the **New Pit Chalk Formation**, a firm blocky chalk, 10-11 m thick, with regularly developed marls and marly chalk horizons. South of the Purbeck Disturbance (Figure 10), strata coeval with the New Pit Chalk are hard and nodular, and have been mapped with the underlying Holywell Nodular Chalk. These formations together approximately correspond with the traditional 'Middle Chalk'.

The **Lewes Nodular Chalk Formation** is defined by the entry of hard nodular chalks with thin marl seams and mineralised hardgrounds and is mostly in the range 30 to 45 m thick. The Lewes Nodular Chalk is succeeded by the **Seaford Chalk Formation**, comprising firm, white, flinty chalk with common marl seams in the basal part only. Conspicuous, semi-continuous bands of large nodular flints are a feature of this formation. The overlying **Newhaven Chalk Formation** is characterized by firm, white chalk with common marl seams and widely spaced nodular flints. In parts of the Frome-Piddle Catchment, it has not been possible to map the Seaford and Newhaven chalks separately and the two are combined as 'Seaford and Newhaven Chalk undivided', which is around 100 m thick.

In contrast to the Newhaven Chalk, marls are rare in the overlying **Culver Chalk Formation** and flints are more conspicuously developed, particularly in the lower part. Two subdivisions are recognised on the basis of feature-mapping, named the **Tarrant Chalk Member** and **Spetisbury Chalk Member**. The Tarrant Chalk comprises firm white chalk with large, relatively widely spaced flint bands. The thickness of the Tarrant Chalk in south Dorset is generally between 30 and 35 m, but locally may be 20 m. The Spetisbury Chalk comprises firm, white chalk with large flints, including tabular forms in the lower part, and Zoophycos flints in the higher part. In south Dorset, the member is probably generally between 28 and 55 m thick.

The youngest formation of the White Chalk Subgroup, the **Portsdown Chalk Formation** underlies the unconformity at the base of the Palaeogene, and hence is highly variable in thickness – between 80 and 135

m. It comprises soft to firm, white, flinty chalk with common marl seams The upper part of the formation in Dorset comprises soft, white, marl-free chalk with very large flints, known as the **Studland Chalk Member** (Gale et al., 1987) (Figure 6).

2.3 PALAEOGENE STRATA

Palaeogene strata are mostly contained within the synclinal Wareham Basin at the eastern end of the Frome-Piddle Catchment (Figure 4), covering an area of about 174 km^2 (26% of the catchment) and reaching a maximum thickness of 122 m. Palaeogene deposits mostly comprise weakly consolidated sand and clays that overlie a major unconformity on the upper surface of the Chalk. Within the Wareham Basin, the Palaeogene succession is divided into two main units, the London Clay Formation (Thames Group) below, and Poole Formation above, which is overlain locally by the Branksome Sand and Creech Barrow Limestone formations, altogether belonging to the Bracklesham Group (Figure 2).

2.3.1 London Clay Formation

The London Clay has a fairly wide outcrop on the northern and western margins of the basin, but in the south, because of either steep dip or faulting, its outcrop is narrow or absent. The formation consists of an alternating sequence of sands and clays that include two named members, the West Park Farm Member (formerly mapped as the Reading Beds or Formation) and the Christchurch Member. The London Clay is typically 55-60 m thick in the deepest part of the Wareham Basin (around Wareham) thinning to 20 m toward its western and northern margins.

Bristow et al. (1991) introduced the term West Park Farm Member to describe red-mottled clays and sands (up to 25 m thick) that directly overlie the Chalk in the Wareham Basin and were previously mapped as 'Reading Beds'. The West Park Farm Member has an irregular crop along the northern and western margin of the Wareham Basin. Gamma-ray logs from wells in the centre of the Wareham Basin (e.g. Wareham 3; Figure 7) indicate that the West Park Farm Member comprises up to 20 m of sand at the base overlain by clay. The overlying Christchurch Member (generally indicated as 'London Clay Formation, undivided' on maps of the area) rests with a sharp erosive contact on the red clays of the West Park Farm Member and comprises up to 35 m of thinly interbedded sands and clays that have a characteristic serrated gamma-ray response (Figure 7).

2.3.2 Poole Formation

The Poole Formation is a succession of thick sand bodies and clays that rest sharply on the London Clay. Up to 70 m of Poole Formation are present in the Frome-Piddle Catchment and a greater thickness (perhaps 150 m) in the east of the study area. The formation crops out over a large part of the Wareham Basin where it was previously mapped as 'Bagshot Sands'. The basal sand of the Poole Formation, the Creekmoor Sand Member rests erosively on the London Clay and comprises cross-bedded, fine-medium grained sands. It has an extensive outcrop in the western part of the basin (shown as Poole Formation, undivided on maps) but dips below surface in the Wareham area (Figure 7). The Creekmoor Sand is overlain by the Creekmoor Clay, an argillaceous unit up to 30 m thick that includes commercial quantities of 'ball clay' used in the manufacture of ceramics (Henley et al., 1992). The Creekmoor Clay is erosively overlain by a succession of fine to coarse grained, locally pebbly, cross-bedded sands, including the Oakdale Sand Member, that have an extensive outcrop across the eastern part of the Wareham Basin. A number of clay units (Oakdale, Broadstone and Parkstone clay members) within the sands have been used to further subdivide the succession (Bristow et al., 1991).

2.3.3 Branksome Sand Formation

The Branksome Sand, 65 m thick, is well exposed in cliff sections at Bournemouth. The formation occurs as small outliers around Trigon Hill and Creech Hill in the Wareham Basin. The lower half of the formation comprises coarse grained, locally pebbly, trough cross-bedded sands which grade upwards into interbedded fine-grained sands and clays.

2.3.4 Creech Barrow Limestone Formation

The Creech Barrow Limestone forms a 3 m thick capping to Creechbarrow Hill [SY 921824]. It is a white to yellow, micritic and pisolitic sandy limestone.

3 Drift geology of the Frome-Piddle catchment

The drift geology of the catchment area is shown on Figure 8, and for the entire study area on the 1:50 000-scale map (Map 1). The drift deposits within the catchment area are briefly described below. Those lying within the 5-km buffer around the catchment are not included.

Figures for outcrop areas and stratigraphical thicknesses given below refer to the catchment area only (unless otherwise stated).

Drift deposits cover 268.1 km^2 (41%) of the catchment and include clay-with-flints, head, river terrace deposits and alluvium with minor amounts of peat and marine or estuarine alluvium (Figure 8).

3.1 CLAY-WITH-FLINTS

The clay-with-flints overlies much of the higher chalk ground of the Catchment. It typically comprises up to 2 m of structureless, dark brown, silty clay with angular flints; clast-supported flint gravel with no clay matrix occurs locally. Angular flint clasts are predominant, with minor amounts of well-rounded flint, quartzite, subangular chert, sandstone and nodular chalk. The base of the deposit is cryoturbated and comprises unstratified broken flints piped into highly fractured chalk. Downslope movement results in clay-with-flints material passing laterally into flinty head in valley bottoms.

Most outcrops of clay-with-flints dip south or south-east at about 2° or less, comparable though not usually concordant with the regional dip of the underlying solid strata. Extensive south-dipping deposits overlie dip slopes of Tarrant, Spetisbury and Portsdown chalk on the north side of the Wareham Basin, where much of the ground is above 120 m OD but falls to about 50 m in the Winterbourne valley. Elsewhere, north-dipping deposits occur on the chalk on the south side of the basin. Here, the clay-with-flints lies at 80 to 170 m OD.

3.2 HEAD

Head is an unstratified or poorly stratified mixture of clay, silt, sand and flinty gravel that has moved downslope by solifluction, soil creep and slopewash. Head deposits typically occupy valley bottoms, for example in coombes and dry valleys on the Chalk. In general, the minimum mapped thickness of Head is 1 m, and the deposit may range up to 4 m in thickness. Extensive Head deposits overlie the Palaeogene strata of the Wareham Basin.

3.3 RIVER TERRACE DEPOSITS

Fifteen levels of river terrace are developed along the Frome and Piddle valleys and their tributaries in east Dorset. They range in height from 0.5 to about 50 m above their respective floodplains and represent the eroded remnants of formerly more extensive, gravel rich deposits (Mathers, 1982). In general, low terrace deposits are the most extensive and occur near or adjacent to alluvium, particularly in the east. The deposits comprise sandy gravel with lenses of sand; the gravel fraction is dominated by angular flints (Mathers, 1982). Average terrace deposit thicknesses are 2 to 3 m, locally up to 6 m in the Frome valley near Dorchester.

3.4 ALLUVIUM

The principal alluvial spreads are associated with the rivers Frome and Piddle, and are typically 200 to 500 m wide. Minor alluvial spreads occur along their numerous small tributaries. Alluvium typically consists of up to 2.5 m of poorly stratified brown silt and clay, commonly organic or peaty, overlying gravel. The thickness of the basal gravel ranges from about 0.6 to 6 m, and generally increases downstream. In the extreme east, marine or estuarine alluvium, comprising silt and clay overlying sand and gravel, extends up the Frome valley from Poole Harbour.

3.5 SUBSIDENCE HOLLOWS AND SINK HOLES

Subsidence hollows (dolines) and stream sink holes have been known in Dorset for almost two centuries (Sperling et al., 1977). Most are located within a 3 to 5 km wide belt along the northern edge of the Wareham Basin between Dorchester in the west, to near Lytchett Minster in the east (Figure 1; Map 1). Culpeppers Dish is the largest single doline in the area. It is a conical depression, 21 m deep with a mean diameter of 86 m, slightly elliptical in plan with uniformly graded sides sloping at about 30° (Sperling et al., 1977). They occur mainly where the basal Palaeogene strata or river terrace deposits overlie the Portsdown Chalk, and where the solid strata are gently inclined southwards. Evidence for continuous and recent collapse of swallow holes is provided by Sperling et al. (1977, p.217), who concluded that they formed by intense and localised chemical weathering promoted by highly acidic conditions under heathland vegetation.

4 Structural Framework of the Frome-Piddle Catchment

4.1 INTRODUCTION

The Frome-Piddle Catchment study area lies within the Wessex Basin, a system of deep Permian-Cretaceous fault-bounded basins and highs. A high density of seismic data and deep boreholes related to oil exploration, together with outstanding coastal outcrop, has resulted in a detailed understanding of the stratigraphy and structure of the Wessex Basin, much of which has been extensively documented in BGS maps and memoirs and in numerous external publications.

In terms of deep structure, the catchment can be divided into three major component parts bounded by important exposed or buried tectonic elements (Figure 9).

- The South Dorset Platform is a Permian-Cretaceous intrabasinal high with a cover of <2.5 km of Permian-Cretaceous sediment. It lies across the centre of the study area and is bounded to the south by the Abbotsbury-Ridgeway and Purbeck faults which are by far the most important extensional structures in the area. The fault system forms a series of offset, en-echelon fault segments (Chadwick 1986).
- The northern part of the catchment area is partially underlain by the Winterborne Kingston Trough, a narrow basin bounded by WNW-ESE trending extensional faults, including the Bere Regis Fault.
- To the south of the Abbotsbury-Ridgeway and Purbeck faults, and south of the catchment area, the Portland-Wight Trough is a deep Permian-Cretaceous basin containing >3 km of strata.

This system of fault-bounded basins and highs primarily influenced deposition during the Jurassic and the Early Cretaceous. In the Late Cretaceous major structures such as the Purbeck Fault had little or no influence on the structure, sedimentary facies or stratigraphic thickness of the Lower Greensand, Gault, Upper Greensand and the Chalk Group. The Cenozoic (Tertiary-Quaternary) was dominated by contractional reactivation of basin-bounding faults with the development of major fold structures along the Purbeck Disturbance.

4.2 NOTES ON MAJOR STRUCTURES

4.2.1 Abbotsbury-Ridgeway Fault

The Abbotsbury-Ridgeway Fault (Figure 9) runs for some 25 km from Abbotsbury to Chaldon. The term Abbotsbury Fault is used to describe the western end of the fault where, at crop, the fault preserves its southerly sense of downthrow with Corallian and Kirnmeridge Clay brought against Fuller's Earth and Forest Marble (Wilson et al., 1958). It passes east into the Ridgeway Fault, which has a northerly sense of downthrow at crop juxtaposing Chalk against Jurassic strata to the south. The fault is a major, south-dipping listric structure that soles out at depth. The Abbotsbury Ridgeway Fault generally truncates the Chalk outcrop to the north and it forms the southern margin of the Frome-Piddle Catchment. Adjacent to the fault, the (usual) northward dip of the Chalk increases in steepness from less than 10° at the western end to 45° or more at Chaldon.

4.2.2 Purbeck Fault/Disturbance

The Purbeck Disturbance is a sharp northward facing monoclinal structure of Tertiary age. Along the structure, the Chalk is vertical and forms the elevated topography of the Purbeck Hills, which delineate the southern margin of the Frome-Piddle Catchment. The monoclinal fold is locally thrusted, with low angle reverse faults in the footwall (Underhill and Paterson, 1998).

4.2.3 Litton Cheney Fault

The Litton Cheney Fault at the surface trends NNE-SSW with a throw to the north in Jurassic strata. It continues at depth beneath the Upper Cretaceous cover (Figure 9).

4.2.4 Winterbourne Abbas Fault

The Winterbourne Abbas Disturbance is a low dome cut by the NW-SE trending Winterbourne Fault (Figure 10). The fault throws down to the north with a maximum throw of about 60 m decreasing rapidly to the east. In common with most other reactivated normal faults in the area, Chalk in the footwall block is heavily fractured (Wilson et al., 1958).

4.2.5 Watchet-Cothelstone Fault

The Watchet-Cothelstone Fault is a major NW-SE trending fault which has been primarily mapped in the subsurface using seismic data (Chadwick, 1986). At surface, it is represented by a number of separate fault strands that include the Hooke and Winterbourne faults (Figure 10). The similarly trending Frome Valley Fault broadly coincides with the course of the River Frome to the south-east of Maiden Newton.

4.2.6 Compton Valence Dome

The Compton Valence Dome is an almost circular uplift of Chalk and older beds about 1.5 km in diameter (Figure 10). It has been postulated that uplift of the dome was caused by halokinesis, or by movement of mobile clays in the Jurassic, and it is probable that it represents a transpressional feature related to strike-slip movement on the Watchet-Cothelstone Fault (Butler, 1998).

4.2.7 Wareham Basin

The Wareham Basin is an eastward-plunging syncline whose axis runs approximately along the Frome Valley and is the primary control on the orientation of the drainage system (Figures 1 and 4). The syncline is strongly asymmetrical; on the northern margin Chalk and Palaeogene strata dip gently (1-2°) SE, but along the southern margin, they are near vertical or locally overturned and thrusted along the Purbeck Disturbance. This belt of structural complexity generally extends no more than 500 m north of the Palaeogene/Chalk contact and results from Mid-Eocene ('Alpine') structural inversion (Figure 10).

5 Structure Contour Maps

Structure contour maps (plots) for the base of the Chalk, base of the Lewes Nodular Chalk (base of 'Upper Chalk') and the base of the Palaeogene sequences are shown in **Maps 2, 3 and 4**. The plots are derived from a combination of surface outcrop data and subsurface borehole data modelled with the grid-based graphics program and software package Earthvision. Each data set was gridded using a Kriging method and uses weighted average interpolation algorithms. The closer the data point to the grid node, the more weight it carries in determining the value at that node. The data sources and methodology are described in Appendices 3 and 4.

The principle features of the maps are as follows:

- The structure and thickness of the Chalk is controlled by roughly east-west-trending major faults, notably the Purbeck and Abbotsbury-Ridgeway faults in the south of the Frome-Piddle catchment area. The general structural dip of the chalk is east to southeast at between 1 and 2 degrees. In the south the dip increases to near vertical due to these major E-W faults.
- The chalk structural contour plots (Maps 2 and 3) indicate that the chalk deepens towards the east forming a synclinal structure with an axis along the Frome valley (the Wareham Basin). The syncline is asymmetrical, with gentle northern and steep southern limb.
- The contour plot of the base of the Palaeogene (Map 4) shows dips generally of 0.5 to 1.5 degrees, locally up to 3 degrees, with a slight decrease towards centre of the Wareham Basin and an increase in dip towards the southern limb of the basin. The structure contour plot shows a small anticlinal flexure in the centre of the Palaeogene basin.

Map 5 shows the changes in combined thickness of the 'Lower Chalk' and 'Middle Chalk' across the Frome-Piddle catchment area. The diagram shows that there is an increase in thickness adjacent to several of the faults suggesting growth (syndepositional) faulting. However the thickness changes are not all consistent with this hypothesis and could be introduced because of a lack of data in these areas. Further work is needed to properly determine the influence of the faults on the deposition of the Chalk.

Appendix 1 Table showing current solid lithostratigraphic terms (black) against equivalent obsolete terms (blue) used on some 1:10 000-scale maps.

Map Code	Current lithostratigraphy on 1:50 000 maps	Subgroup	Group	Former name(s)	Former grouping
CrBL	Creech Barrow Limestone Formation		Bracklesham Group		Bournemouth Formation
BrkS	Branksome Sand Formation			Bagshot Beds	
CrBr	Creech Brick Clay Member				
Pool	Poole Formation				Pipeclay Series
Pool	Undifferentiated sand in Poole Formation				
c	Undifferentiated clay in Poole Formation				
PkC	Parkstone Clay Member				
PkS	Parkstone Sand Member				
BrtC	Broadstone Clay Member				
BrtS	Broadstone Sand Member				
BrOS	Broadstone to Oakdale Sand members, undivided				
OakC	Oakdale Clay Member				
OakS	Oakdale Sand Member				
CmC	Creekmoor Clay Member				
CkmS	Creekmoor Sand Member				
LC	London Clay Formation		Thames Group		
P	Pebble Beds in London Clay Formation				
LyMs	Lytchett Matravers Sand Member				
WrmS	Warmwell Farm Sand Member				
WPF	West Park Farm Member			Reading Beds	
S(WPF)	Sand in West Park Farm Member				
PCk	Portsdown Chalk Formation	White Chalk	Chalk Group		Upper Chalk (Formation)
CCk	Culver Chalk Formation				
SpCk	Spetisbury Chalk Member				
TCk	Tarrant Chalk Member				
SNCk	Seaford Chalk Formation and Newhaven Chalk Formation [Undifferentiated]			Blandford Chalk	
NCk	Newhaven Chalk Formation				
SCk	Seaford Chalk Formation				
LeCk	Lewes Nodular Chalk Formation			Lewes Chalk	
NPCk	New Pit Chalk Formation				Middle Chalk (Formation)
HCk	Holywell Nodular Chalk Formation			Holywell Chalk	
ZCk	Zig Zag Chalk Formation	Grey Chalk			Lower Chalk (Formation)
WMCk	West Melbury Marly Chalk Formation				

Map Code	Current lithostratigraphy on 1:50 000 maps	Subgroup	Group	Former name(s)	Former grouping
UGS	Upper Greensand Formation				
ECG	Eggardon Grit Member				
BHC	Boyne Hollow Chert Member				
Shy	Shaftesbury Sandstone Member			Exogyra Rock	
CanS	Cann Sand Member			Malmstone	
G	Gault Formation			Gault Clay Formation	
LGS	Lower Greensand Formation				
BedS	Bedchester Sands Member				
W	Wealden Group		Wealden Group	Wealden Formation	
Durl	Durlston Formation		Purbeck Group		
PeP	Peveril Point Member				
Sho	Stair Hole Member				
Lulw	Lulworth Formation				
WoT	Worbarrow Tout Member				
Rid	Ridgeway Member				
Mup	Mupe Member				
PlSt	Portland Stone Formation		Portland Group		
PoFr	Portland Freestone Member				
PoCh	Portland Chert Member				
PoSa	Portland Sand Formation				
KC	Kimmeridge Clay Formation				
Abl	Abbotsbury Ironstone Formation		Corallian Group		
Sft	Sandsfoot Formation				
SfG	Sandsfoot Grit Member				
ClB	Clavellata Formation			(Trigonia) Clavellata Beds	
OsS	Osmington Oolite Formation				
Sto	Stour Formation				
StP	Sturminster Pisolite Member				
HSM	Hinton St Mary Clay Member				
CkO	Cucklington Oolite Member				
WwC	Woodrow Clay Member				
Hz	Hazelbury Bryan Formation				
LyGB	Lyon’s Gate Bed				
Nth	Nothe Formation				
Ngt	Nothe Grit Member				

Map Code	Current lithostratigraphy on 1:50 000 maps	Subgroup	Group	Former name(s)	Former grouping
OxC	Oxford Clay Formation				
StWe	Stewartby Member and Weymouth Member [Undifferentiated]			Middle and Upper Oxford Clay, undifferentiated	
Pet	Peterborough Member			Lower Oxford Clay	
Kys	Kellaways Formation				
Cb	Cornbrash Formation		Great Oolite Group		
FMb	Forest Marble Formation				
FC	Frome Clay Formation				
FE	Fuller's Earth Formation				
UFE	Upper Fuller's Earth Member				
FER	Fuller's Earth Rock Member				
LFE	Lower Fuller's Earth Member				
InO	Inferior Oolite Group				
BdS	Bridport Sand Formation		Lias Group	Bridport and Yeovil Sands	Upper Lias (Sands)
DCC	Down Cliff Clay Member				
BLF	Beacon Limestone Formation			Junction Bed	
DyS	Dyrham Formation				Middle Lias (Formation)
TS	Thorncombe Sand Member				
DCS	Down Cliff Sand Member				
EyCl	Eype Clay Member				

Table showing current drift lithostratigraphic terms (black) against equivalent obsolete terms (blue) used on some 1:10 000-scale maps.

Current lithostratigraphy on 1:50 000 maps	**Former name(s)**
Artificial Ground	
Made Ground	
Worked Ground	
Infilled Ground	
Mass movement deposits	
Landslip	
Superficial deposits	
Head [Undifferentiated]	Coombe Rock
Older Head	Plateau Gravel
Clay-with-flints	Angular Flint-gravel
Blown Sand	
Tufa	
Alluvium	
Peat	
River Terrace Deposits 1	Valley Gravel [lower terraces] /Plateau Gravel [higher terraces]
River Terrace Deposits 2	
River Terrace Deposits 3	
River Terrace Deposits 4	
River Terrace Deposits 5	
River Terrace Deposits 6	
River Terrace Deposits 7	
River Terrace Deposits 8	
River Terrace Deposits 9	
River Terrace Deposits 10	
River Terrace Deposits 11	
River Terrace Deposits 12	
River Terrace Deposits 13	
River Terrace Deposits 14	
River Terrace Deposits 15	
River Terrace Deposits [Undifferentiated]	
Storm Beach Gravel, flint	
Shoreface and Beach Deposits, undifferentiated	
Marine Or Estuarine Alluvium	
Tidal Flat Deposits	Marine Deposits, present day

Appendix 2 Table of boreholes used in modelling.

NUMBER	BOREHOLE NAME	Easting	Northing	Confi-dential	GL
ST50SE2	THE BARN KINGCOMBE CROSS, RAMPISHAM	355540	0100740	N	210.00
ST50SW1	ST 50/21	350550	0104200	N	245.00
ST50SW9	CORSCOMBE CROSS	350590	0104400	N	246.90
ST50SW17	PIPSFORD FARM MAPPERTON	351800	0100540	N	200.00
ST50SW18	PIPSFORD FARM MAPPERTON	351900	0100450	N	185.00
ST50SW19	TOLLER WHELME	351320	0102050	N	184.40
ST60SE13	BARTON MEADOWS FARM	366500	0100500	N	111.00
ST60SW1	BATCOMBE 1	361122	0103139	N	244.10
ST60SW2	CATTISTOCK FARM P.S. NO 3	360790	0100150	N	150.64
ST60SW3	CATTISTOCK FARM P.S. NO 4	360790	0100270	N	200.00
ST60SW15	WARDEN HILL HOSPITAL	361130	0102990	N	248.40
ST60SW17	CATTISTOCK FARM P.S. NO 2	361040	0100180	N	162.50
ST70SW1	ALTON PANCRAS	370210	0101740	N	118.00
ST70SW2	WATCOMBE BARN PLUSH	371540	0103000	N	158.50
ST70SW3	NETTLECOMB FARM NO.1	374370	0101770	N	210.00
ST70SW4	NETTLECOMB FARM NO.2	374590	0101540	N	200.00
ST70SW18	ALTON PANCRAS NO.2	370150	0101830	N	117.60
ST70SE21	DELCOMBE FARM, MILTON ABBAS	379360	0104390	N	141.00
ST70SE26	HIGHER ANSTY	377030	0103920	N	178.30
ST80NE2	QUARLESTON WATER WELL	385940	0105650	N	98.00
ST80SE1	SPETISBURY 1	388809	0102687	N	70.00
ST90SW1	SHAPWICK 1	394284	0101342	N	25.23
SY58NE1	WHITE HILL BARN LITTLE BREDY	359560	0089210	N	172.00
SY58NE8	BRIDEHEAD, LITTLE BREDY	358900	0088950	N	105.50
SY59NE8	UNITED DAIRIES, MAIDEN NEWTON	359870	0097860	N	97.50
SY59SE4	KINGSTON RUSSELL	358600	0090900	N	130.00
SY59SE7	POOR LOT, KINGSTON RUSSELL	359200	0090700	N	119.00
SY59SE15	COMPTON VALENCE	359190	0093120	N	139.00
SY59SE20	LITTON CHENEY, PILOT BOREHOLE	355330	0090790	N	88.00
SY59SE23	LITTON CHENEY, NO 3	355700	0091120	N	110.00
SY68NW3	MARTINSTOWN 1	364182	0086639	Y	153.28
SY68NW8	MARTINSTOWN SW 2	363700	0089400	N	88.00
SY68NW11	KIT HILL SW 16	363000	0089000	N	99.00
SY68NE81	ASHTON FARM	366200	0088100	N	80.00
SY69NW1	HUISH TROUT FM, SYDLING ST NICHOLAS	363230	0098870	N	105.00
SY69NW6	EAST STREET, SYDLING ST NICHOLAS	363380	0099530	N	112.20
SY69NW7	LOWER MAGISTON, NO 1	363470	0096440	N	90.52
SY69NW9	LOWER MAGISTON, NO 3	363550	0095970	N	85.03
SY69NW10	LOWER MAGISTON, OBSERVATION BOREHOLE	363570	0095870	N	84.12
SY69NE1	CERNE ABBAS	366310	0099750	N	116.00
SY69NE2	ROMAN ROAD FARM, PIDDLEHINTON	369100	0096300	N	139.00
SY69SE21	ELDRIDGE POPE BREWERY DORCHESTER BH1	369230	0090130	N	69.00
SY69SW11	ROMAN ROAD W OF HOGLEAZE FARM	360140	0091880	N	184.00
SY78NE1	MOIGNE COMBE FARM	377670	0087730	N	46.00
SY78NE2	WOODSFORD AERODROME	376170	0089130	N	50.30
SY78NE3	WARMWELL HEATH	375210	0087250	N	39.60
SY78NE4	MORETON GRAVEL PITS	378030	0088530	N	52.70
SY78NE5	HURST FARM	379190	0089940	N	31.10
SY78NE23	GRAVEL PITS MORETON	377940	0088930	N	48.80
SY78NE166	WARMWELL QUARRY WW003-87	376000	0088840	Y	60.00

NUMBER	BOREHOLE NAME	Easting	Northing	Confi-dential	GL
SY78NE167	WARMWELL QUARRY WW004-87	375640	0088510	Y	61.00
SY78NE168	WARMWELL QUARRY WW005-87	375220	0088600	Y	66.00
SY78NE286	WARMWELL PHASE 2A WW02-90	375180	0088200	Y	65.00
SY78NE287	WARMWELL PHASE 2A WW03-90	375580	0087950	Y	61.00
SY78NE395	WARMWELL MILL, NO 2	375210	0087250	N	39.60
SY78NE396	WARMWELL MILL, NO 1	375210	0087300	N	39.60
SY78NE399	WOODSFORD	376140	0089140	N	50.30
SY78NW8	WEST KNIGHTON SANDPIT	374420	0089100	N	61.60
SY78NW18	NO.8 WARMWELL WATER CRESS BEDS	374670	0087450	N	44.00
SY78NW19	EMPOOL PUMPING STATION	374180	0087840	N	50.00
SY78NW20	EMPOOL PUMPING STATION 4	373870	0088140	N	66.00
SY78NW30	WARMWELL OBH	374630	0087420	N	46.00
SY78NW33	WARMWELL	374930	0087400	N	46.00
SY78NW34	WATERGATES LANE 1	374050	0087080	N	47.00
SY78NW36	WARMWELL QUARRY WW006-87	374790	0089100	Y	65.00
SY78NW37	WARMWELL QUARRY WW007-87	374790	0088710	Y	65.00
SY78NW41	WARMWELL 2/4	374950	0088060	Y	51.00
SY78NW43	WARMWELL WW01-93	374790	0087890	Y	65.00
SY78NW46	WARMWELL WW05-93	374070	0088870	Y	66.84
SY78NW47	WARMWELL WW06-93	374420	0088820	Y	65.00
SY78NW50	WARMWELL WW01-92	374950	0088410	Y	65.00
SY78NW52	WARMWELL WW03-92	374790	0088300	Y	60.00
SY78NW53	WARMWELL WW05-92	374790	0088300	Y	51.00
SY78NW55	WATERCRESS BEDS W.KNIGHTON A	374020	0087070	N	42.70
SY78NW56	WATERCRESS BEDS W.KNIGHTON B	374040	0087060	N	47.00
SY78NW57	WATERCRESS BEDS W.KNIGHTON C	374050	0087050	N	42.70
SY78NW104	SANDPITS, WEST STAFFORD	374440	0089110	N	61.60
SY78SE7	WINFRITH DORSET	379440	0082230	N	94.00
SY78SE9	CHALDON HERRING	379890	0081110	N	132.00
SY78SE10	CHALDON HERRING	378670	0082070	N	122.00
SY78SW8	POXWELL HOUSE NR DORCHESTER	372470	0084550	N	112.80
SY79SE17	MORETON	379740	0090860	N	28.00
SY79SE135	TINCLETON DORSET	378200	0092200	N	66.00
SY79SE211	WADDOCK CROSS	378820	0090940	N	29.00
SY79SE217	WATERCRESS BEDS WADDOCK	379760	0090920	N	28.00
SY79SE359	CLYFFE HOUSE, TINCLETON	378160	0092160	N	62.00
SY79SW26	ILSINGTON ESTATE (DUCK DAIRY HO)	373960	0091360	N	49.70
SY79SW107	DUCK DAIRY HOUSE, ILSINGTON ESTATE	373850	0091280	N	54.90
SY79NE8	DEWLISH HILL	377860	0099440	Y	83.70
SY88NE13	WAREHAM D4	389760	0087620	N	18.30
SY88NE119	BUDDENS FARM 3	387100	0089300		19.00
SY88NW26	MORETON	380830	0089740	N	25.30
SY88NW27	KNIGHTON LANE	381540	0085830	N	30.00
SY88NW28	COLLIERS LANE WOOL	384470	0086520	N	21.30
SY88NW29	WINFRITH HEATH	381930	0086730	N	23.71
SY88NW30	BOVINGTON CAMP	382950	0089100	N	51.20
SY88NW44	CEGB PRELIMINARY BHS FOR POWER STN A	380022	0087254	Y	28.00
SY88NW47	CEGB WINFRITH HEATH BH.K	381040	0086870	Y	35.00
SY88NW127	WINFRITH POWER STN 110	381440	0087330	Y	28.35
SY88NW130	WINFRITH POWER STN 113	381320	0087120	Y	26.79
SY88NW131	WINFRITH POWER STN 114	381430	0087390	Y	29.16
SY88NW137	WINFRITH POWER STN 120	381250	0087100	Y	30.16

NUMBER	BOREHOLE NAME	Easting	Northing	Confi-dential	GL
SY88NW138	WINFRITH POWER STN 121	381290	0087040	Y	29.86
SY88NW140	WINFRITH POWER STN 123	381100	0087330	Y	36.02
SY88NW141	WINFRITH POWER STN 124	381090	0086820	Y	32.04
SY88NW148	WINFRITH POWER STN 131	381310	0087220	Y	28.55
SY88NW151	WINFRITH POWER STN 302	381390	0087240	Y	26.21
SY88NW196	LONGTHORNS FARM 4499	384790	0088860	N	45.66
SY88SW1	CHALDON DOWN G2	383230	0081300	N	111.25
SY88SW2	CHALDON DOWN G1	380660	0081960	N	128.00
SY88SW18	NEWLANDS FARM	381180	0080890	N	99.00
SY88SW21	BURNGATE WOODS, LULWORTH	383490	0082590	N	137.00
SY88SW24	LULWORTH	384790	0084240	N	72.00
SY88SW30	MARLEY BOTTOM	380820	0083740	N	62.00
SY88SW31	CHALDON BOTTOM, LULWORTH	380200	0082790	N	69.40
SY88SW32	LULWORTH	380310	0082450	N	90.00
SY88SW36	WESSEX WATER AUTHORITY OL30 EL.1	384440	0081880	N	99.00
SY88SW37	WESSEX WATER AUTHORITY OL15	384100	0081710	N	99.00
SY88SW48	COOMBE KEYNES 1	382400	0084120	Y	93.00
SY88SW56	WEST DOWN FARM OL19	381860	0081720	N	120.00
SY88SE1	LULWORTH CAMP E L P B 1 EAST	385350	0081840	N	65.00
SY88SE2	LULWORTH CAMP OL 20	385150	0081830	N	75.00
SY88SE5	PARK LODGE LULWORTH 9	385500	0083100	N	53.00
SY88SE6	EAST LULWORTH DORSET 10	385700	0081800	N	58.00
SY88SE8	COOMBE HEATH 42	385900	0084960	N	35.00
SY88SE9	EAST LULWORTH DORSET 44	386590	0082530	N	56.00
SY88SE1333	LUCKFORD LAKE 3412	387205	0084522	Y	17.22
SY88SE1334	LUCKFORD LAKE 3413	386507	0084642	Y	30.32
SY88SE1335	LUCKFORD LAKE 3414	386724	0084125	Y	21.69
SY89NW1	WINTERBORNE KINGSTON	384700	0097960	N	61.00
SY89NE1	BERE REGIS 1	386440	0095630	N	69.20
SY89SW1	SPYWAY BORE (AFFPUDDLE)	380800	0090800	N	33.65
SY89SW2	BRYANTS PUDDLE	381540	0092870	N	75.00
SY89SW16	WADDOCK CROSS 1	380350	0091250	N	36.60
SY89SW205	BOVINGDON CAMP	383000	0090400	N	59.40
SY89SE18	TANPITS COPPICE 3767	385920	0092130	Y	22.57
SY89SE19	TANPITS COPPICE 3768	386030	0092060	Y	30.30
SY89SE22	NORTH TRIGON 4010	389010	0091450	Y	16.33
SY89SE23	NORTH TRIGON 4011	389350	0091270	Y	14.56
SY89SE27	HYDE WOODS 4383	385720	0090880	Y	31.73
SY89SE29	MORDEN HEATH 4143	389960	0093180	Y	22.09
SY89SE96	HYDE FARM	387100	0090900	Y	22.92
SY98NE1	WYTCH FARM X1	398040	0085260	N	9.90
SY98NE2	WYTCH FARM A2	398950	0085540	N	12.50
SY98NE3	WYTCH FARM B3	397260	0085380	N	9.10
SY98NE4	WYTCH FARM D4	399470	0085650	N	9.80
SY98NE5	ARNE G1	395750	0087040	N	7.92
SY98NE7	WYTCH FARM B21	397260	0085380	N	12.20
SY98NE43	ECC BALL CLAYS 3725	398582	0085075	Y	6.01
SY98NW2	WAREHAM 1	390915	0087827	Y	7.87
SY98NW3	WAREHAM 2	390935	0088348	Y	28.10
SY98NW4	WAREHAM 3	390590	0087210	N	18.29
SY98NW20	STOBOROUGH 2	391260	0086610	N	17.70
SY98NW47	ECC BALL CLAYS 4396	390843	0089817	Y	13.99

NUMBER	BOREHOLE NAME	Easting	Northing	Confi-dential	GL
SY98NW298	STOBOROUGH	392670	0086360	N	10.00
SY98NW295	WAREHAM 5	392500	0088300	N	2.00
SY98SE4	BUSHEY FARM A1	396930	0083050	Y	40.20
SY98SW14	CREECH 1	390043	0082483	N	56.50
SY99NW17	WEST PARK FARM	392800	0096500	N	68.00
SY99NW48	NEW LANE, EAST MORDEN	391470	0095120	N	43.90
SY99SE215	ROYAL NAVAL CORDITE FACTORY 6	395570	0090870	Y	6.10
SY99SE226	BEACON HILL DORSET 3633	397610	0094460	N	48.23
SY99SE232	EAST HOLTON FARM 6	395900	0091400	N	12.00
SY99SW12	E.C.C. 4147	390582	0090962	Y	12.73
SY99SW81	LYCHETT 1	393390	0092860	Y	20.00

Appendix 3 Modelling Data Sources

The datasets and other information sources used as a basis for modelling are listed below:

DATA	COMMENT
Digital geological linework (1:50 000)	Based on the BGS 1:50 000 DiGMap
NGRC borehole records	165 boreholes (see Appendix 2)
BGS memoirs: Bridport and Yeovil Bournemouth Weymouth Swanage, Corfe and Lulworth Shaftesbury Ringwood Dorchester	Provided borehole descriptions summaries and regional overviews

Appendix 4 Modelling methodology

The flow chart below shows the main processes required to produce the 2-D gridded surfaces, cross-section, and 3D block models in Earthvision.

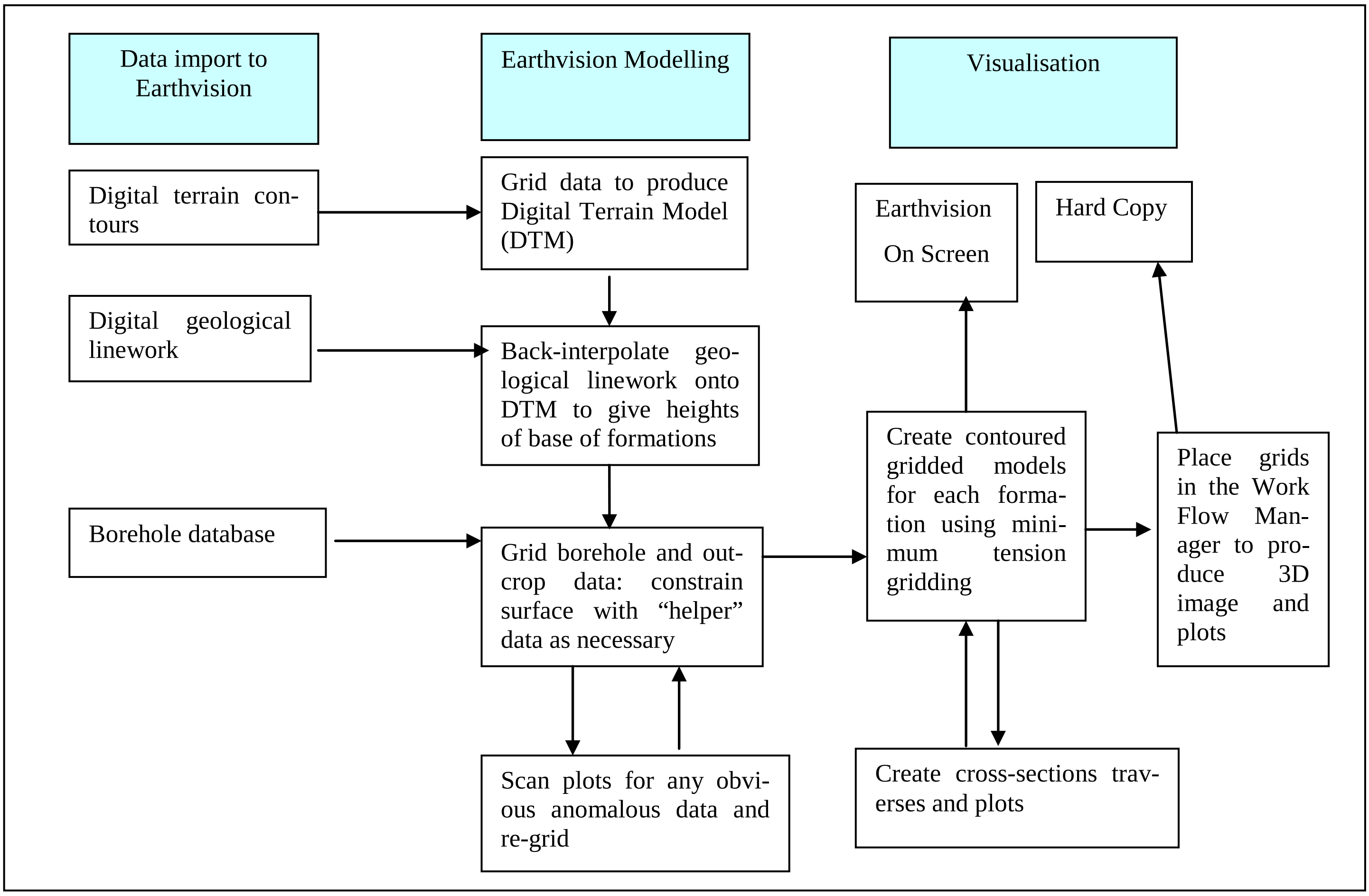
- A digital terrain model (DTM), borehole point data and geological linework were all input into the "Earthvision" modelling package.
- The "back-interpolation" calculation was used incorporating the geological linework and the DTM to provide additional point data for the elevations of the base of each Formation.
- Grids were calculated using "2D-minimum tension" and contour plots produced
- Grids were then "nulled" to clip the grid to the relevant outcrop of the Formation
- Cross-section traverses were plotted
- When all grids contained no anomalous areas, they were placed in the workflow manager to produce 3D block diagrams.

General remarks

- Borehole information was entered directly into an Excel spreadsheet.
- Geological linework was created in MapInfo from 1:50 000 scale map information and imported into Earthvision (as a *.MIF file).
- Gridded surfaces were constructed for the following horizons:
    1. Base of Chalk
    2. Base of Lewes Nodular Chalk
    3. Base of Palaeogene
- "First pass" contour plots were scanned for obviously anomalous data. Sources and calculations were cross-checked.
- Contour plots were processed with "helper data " (artificial data points to constrained contours to known boundaries) to improve surfaces in areas of sparse borehole coverage.

- Grid files were "stacked " within Earthvision and cross-section traverses generated at 5 km intervals across the whole area both horizontally and vertically.
- Then, following procedures outlined in Earthvision's Workflow manager, 3D block diagrams were produced.

Methodology work-flow chart



6 References

Bristow, C R, Freshney, E C, Penn, I E. 1991. *Geology of the country around Bournemouth.* Memoir of the British Geological Survey, Sheet 329 (England and Wales).

Bristow, R, Mortimore, R and Wood, C. 1997. Lithostratigraphy for mapping the Chalk of southern England. *Proceedings of the Geologists Association,* Vol. 108, 293-315.

Butler, M. 1998. The geological history of the southern Wessex Basin: a review of new information from oil exploration. 67-86 in *Development, Evolution and Petroleum Geology of the Wessex Basin*. UNDERHILL, J R. (editor). Geological Society, London, Special Publications, 133.

Chadwick, R A. 1986. Extension Tectonics in the Wessex Basin, Southern England. *Journal of the Geological Society,* Vol. 143, 465-488.

Cox, B M and Gallois, R W. 1981. The stratigraphy of the Kimmeridge Clay of the Dorset type area and its correlation with some other Kimmeridgian sequences. *of the Report of the Institute of Geological Sciences No. 80*.

Gale, A S, Wood, C J and and Bromley, R G. 1987. The lithostratigraphy and marker bed correlation of the White Chalk (late Cenomanian-Campanian) in southern England. *Mesozoic Research,* Vol. 1, 107-118.

Henley, S, Palmer, Q G and Tucker, D K, 1992. The use of integrated software techniques to evaluate a bedded clay deposit. 135-141 in *Case Histories and Methods in Mineral Resource Evaluation*. ANNELS, A E (Editor), Geological Society Special Publications, 63.

Mathers, S J. 1982. *The sand and gravel resources of the country between Dorchester and Wareham, Dorset: descriptions of parts of 1:25 000 sheets SY68, 69, 78, 79, 88, 89 and 99.* Mineral Assessment Report of the Institute of Geological Sciences, No. 103.

Sperling, C H B, Goudie, A S, Stoddart, D R and Poole, G G. 1977. Dolines of the Dorset Chalklands and other areas in southern Britain. *Transactions of the Institute British Geographers,* Vol. NS2, 205-223.

Underhill, J R and Paterson, S. 1998. Genesis of tectonic inversion structures: seismic evidence for the development of key structures along the Purbeck Isle of Wight Disturbance. *Journal of the Geological Society,* Vol. 155, 975-992.

Underhill, J R and Stoneley, R, 1998. Introduction to the development, evolution and petroleum geology of the Wessex Basin. 1-18 in *Development, Evolution and Petroleum Geology of the Wessex Basin*. UNDERHILL, J R. (editor) Geological Society, London, Special Publications, 133.

Westhead, R K and Mather, A E. 1996. An updated lithostratigraphy for the Purbeck Limestone Group of the Dorset type area. *Proceedings of the Geologist's Association,* Vol. 107, 117-128.

Wilson, V, Welch, F B A, Robbie, J A and Green, G W. 1958. Geology of the country around Bridport and Yeovil. Mem. Geol. Surv. GB., Memoir of the Geological Survey of Great Britain.

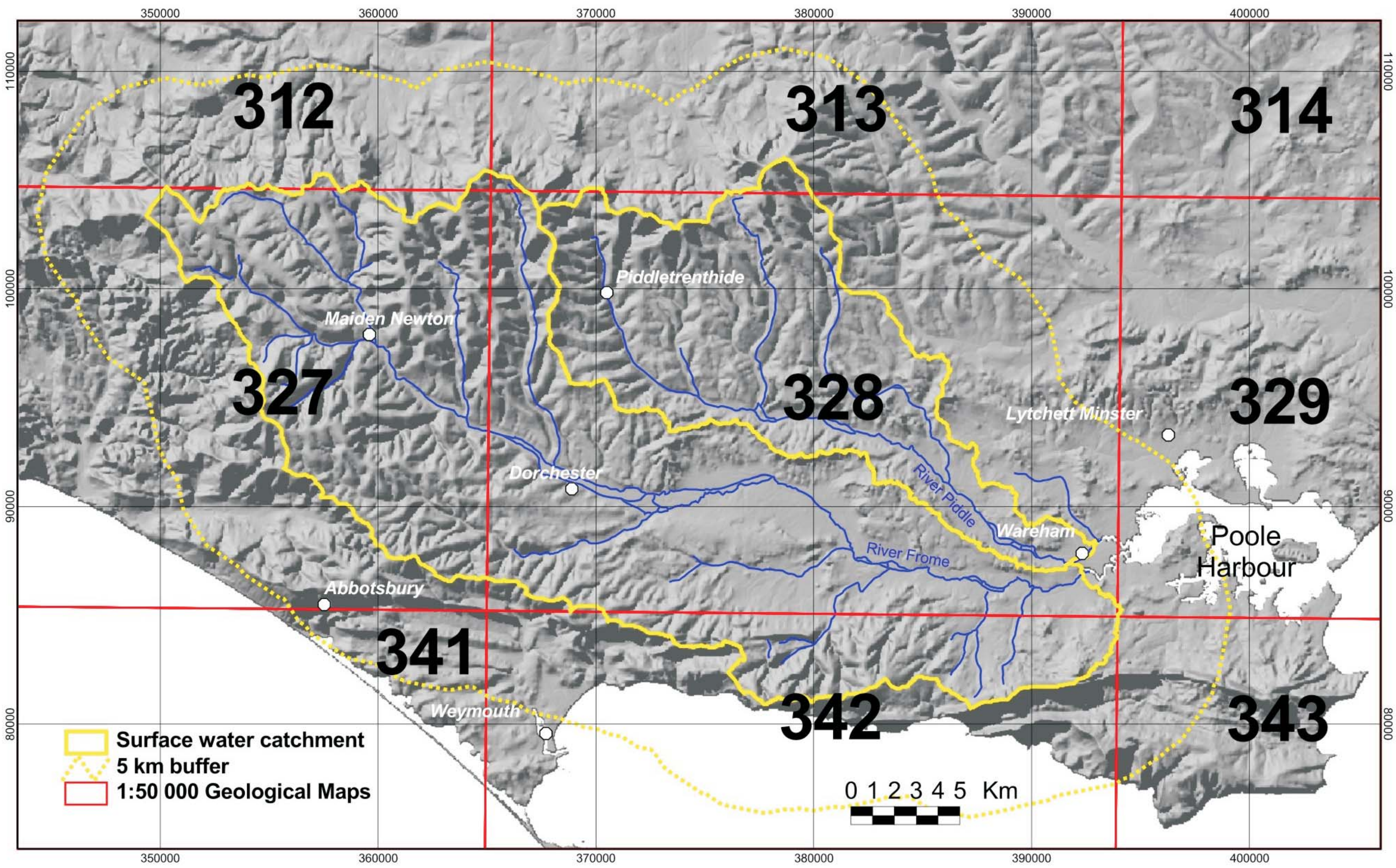


Figure 1. Location map

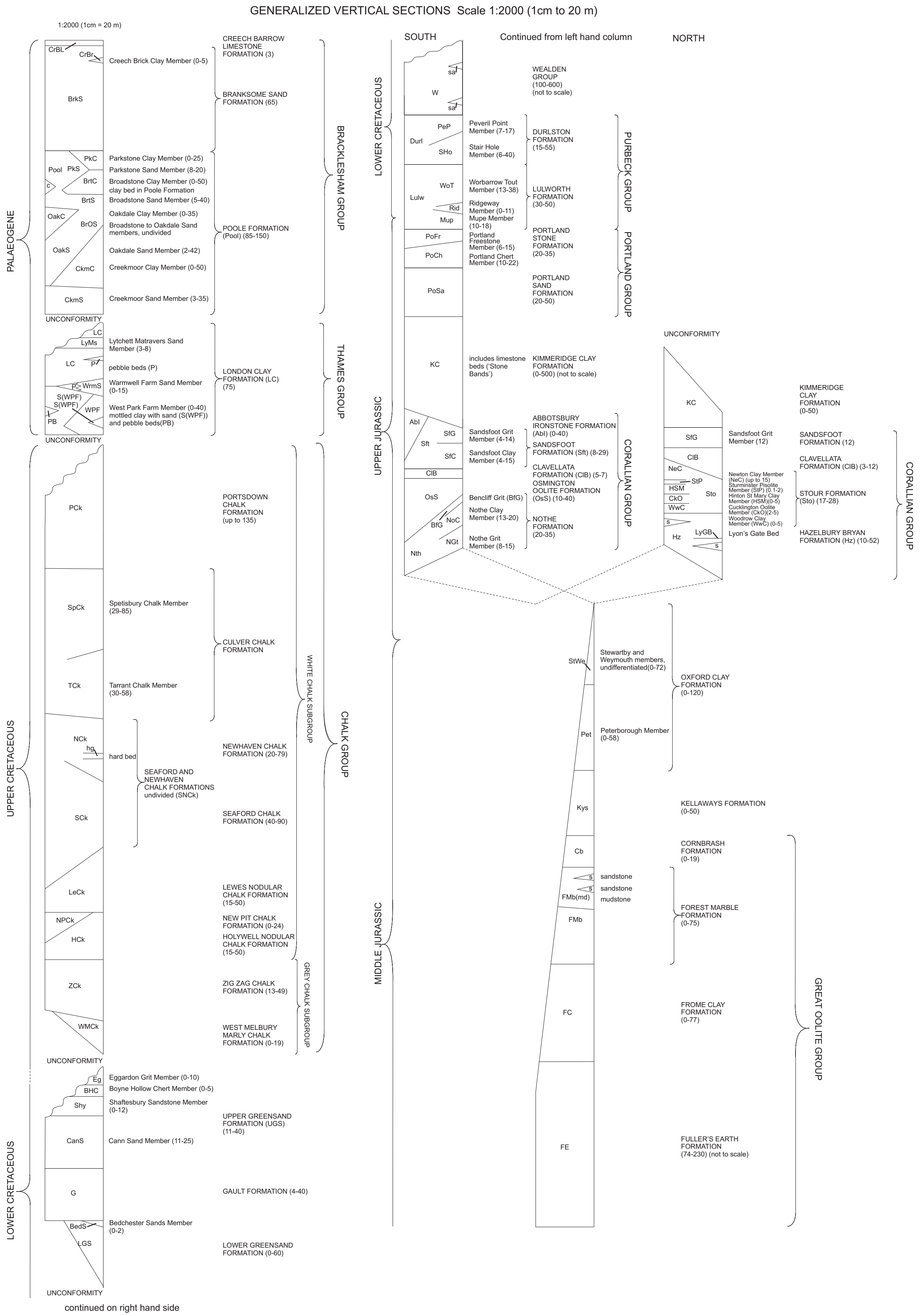


Figure 2. Generalized vertical section (lithostratigraphical units shown and thicknesses given are for the catchment plus 5 km buffer)

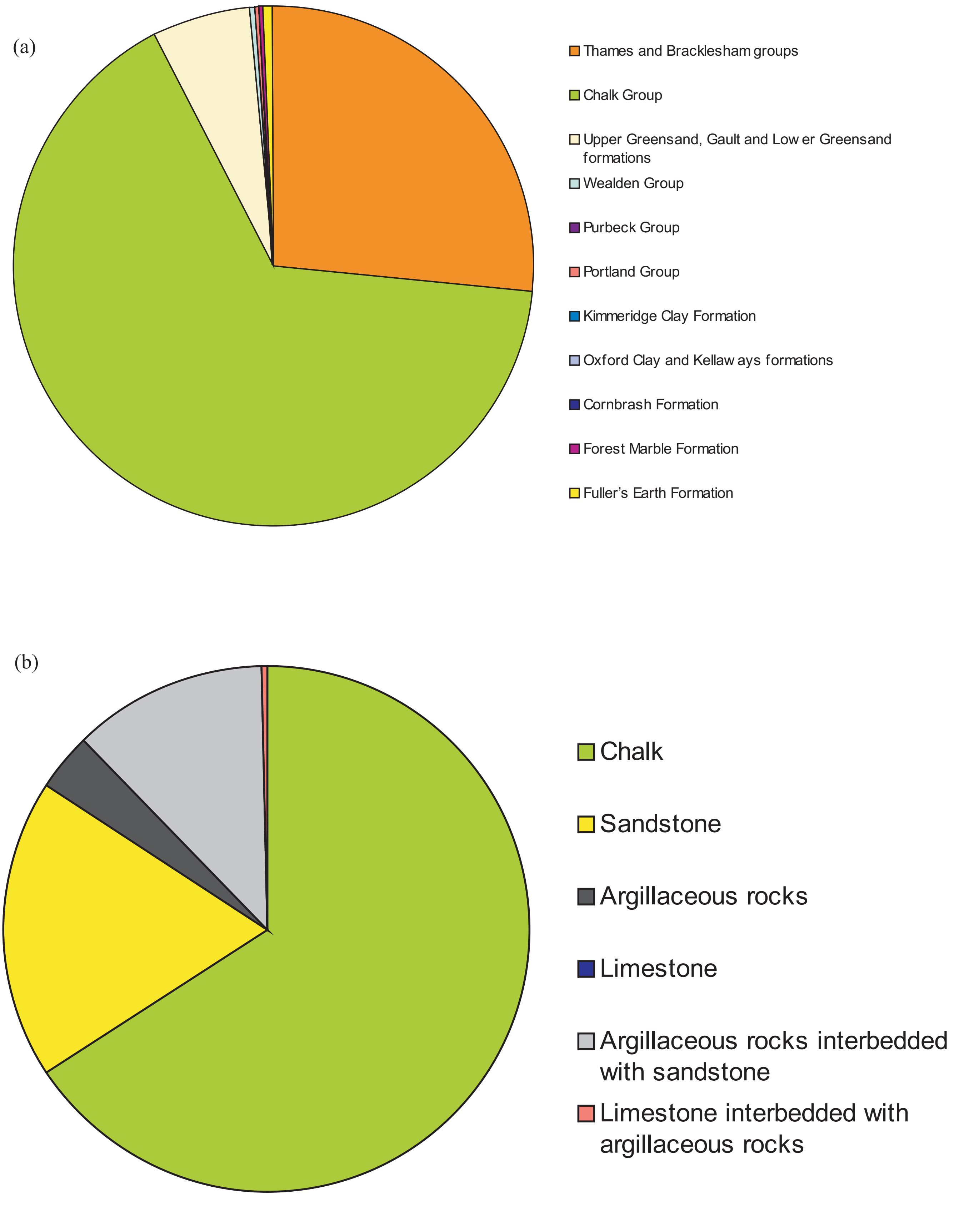


Figure 3. Pie charts showing: (a) area percent of geological units in the Frome-Piddle Catchment (b) reclassified according to rock type

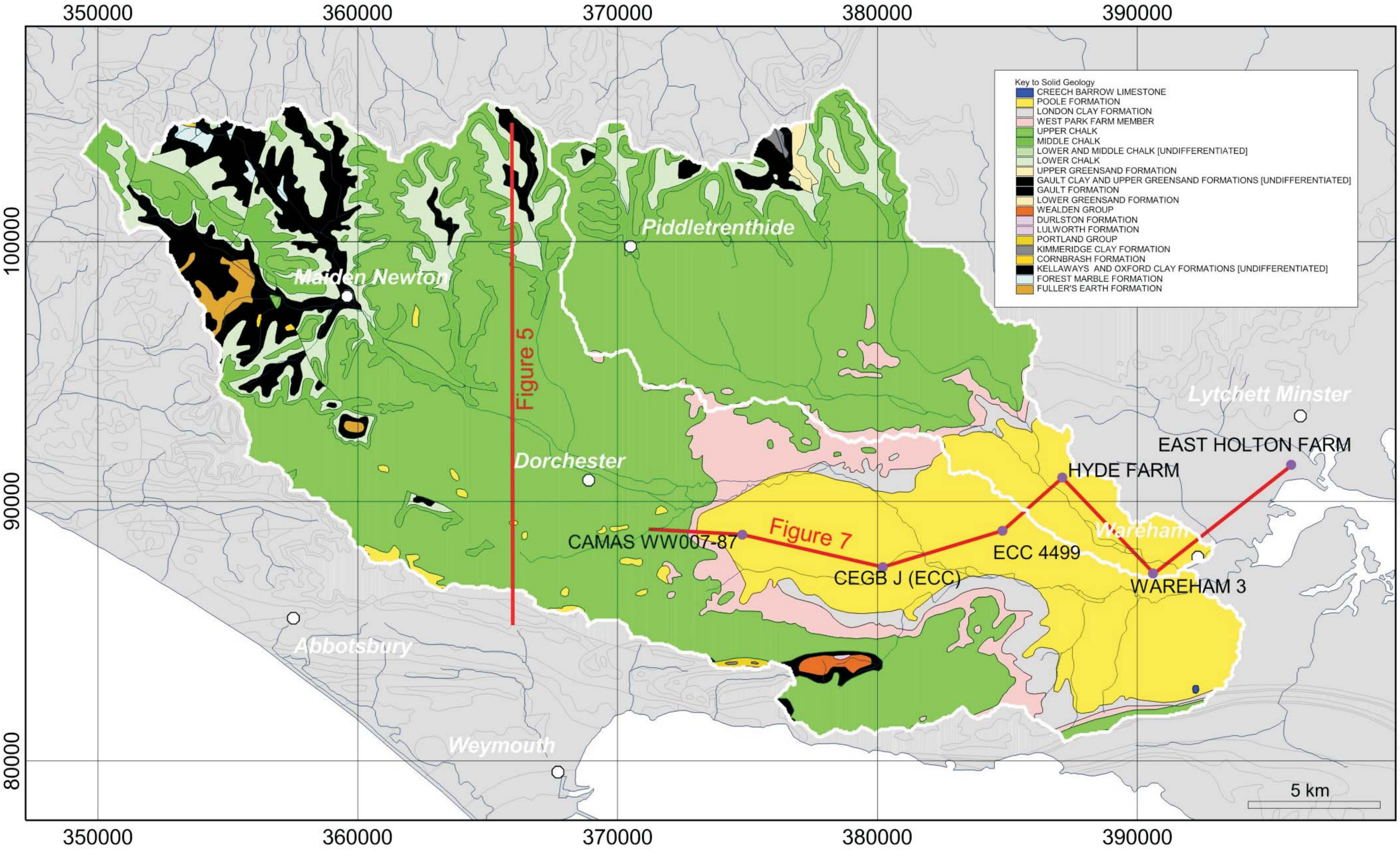


Figure 4. Solid geology of the Frome-Piddle Catchment

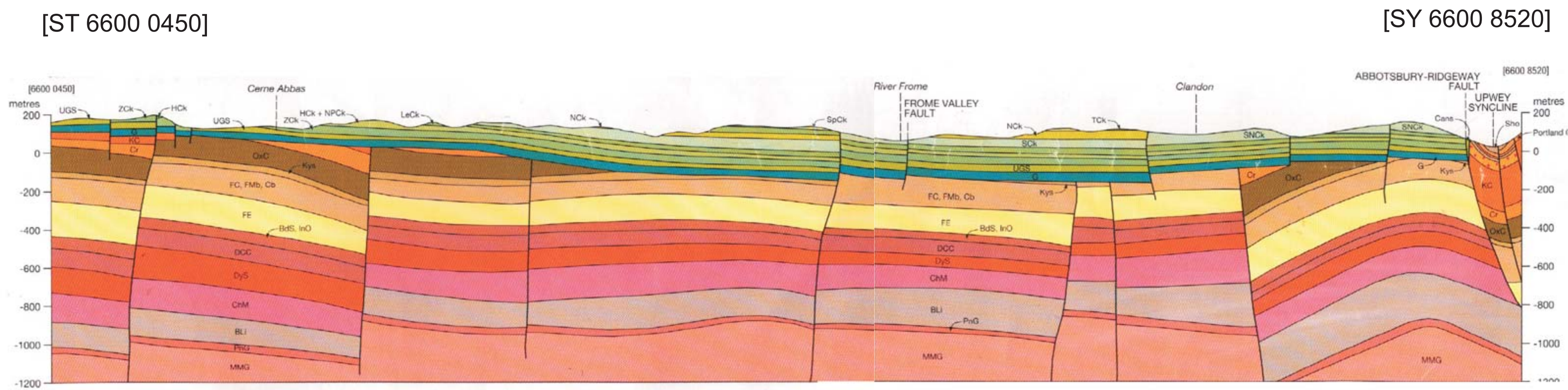


Figure 5. N-S cross-section showing Aptian-Albian Unconformity developed at the base of the Gault (G) and Lower Greensand (LGS) formations (see Figure 4 for location of section)

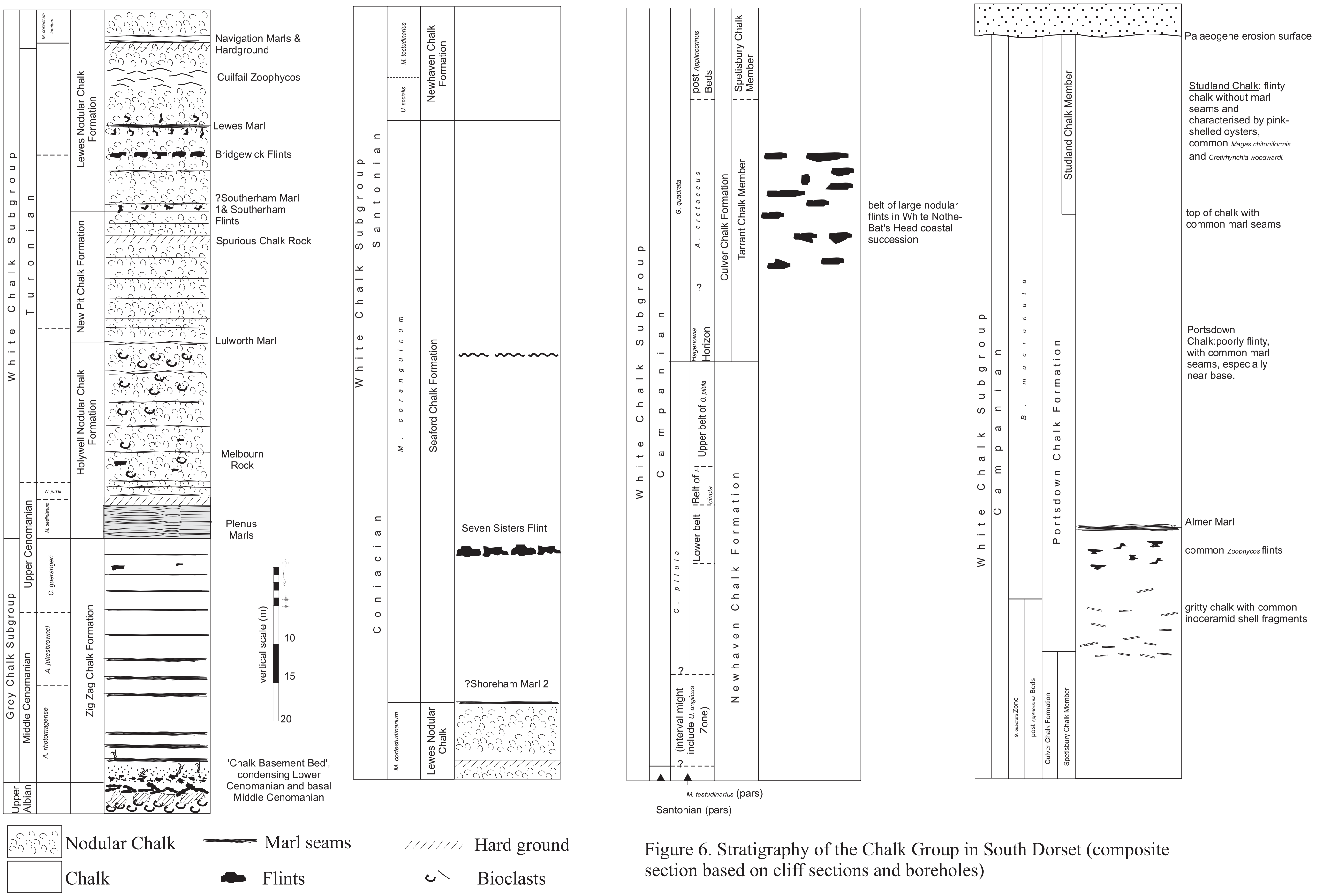


Figure 6. Stratigraphy of the Chalk Group in South Dorset (composite section based on cliff sections and boreholes)

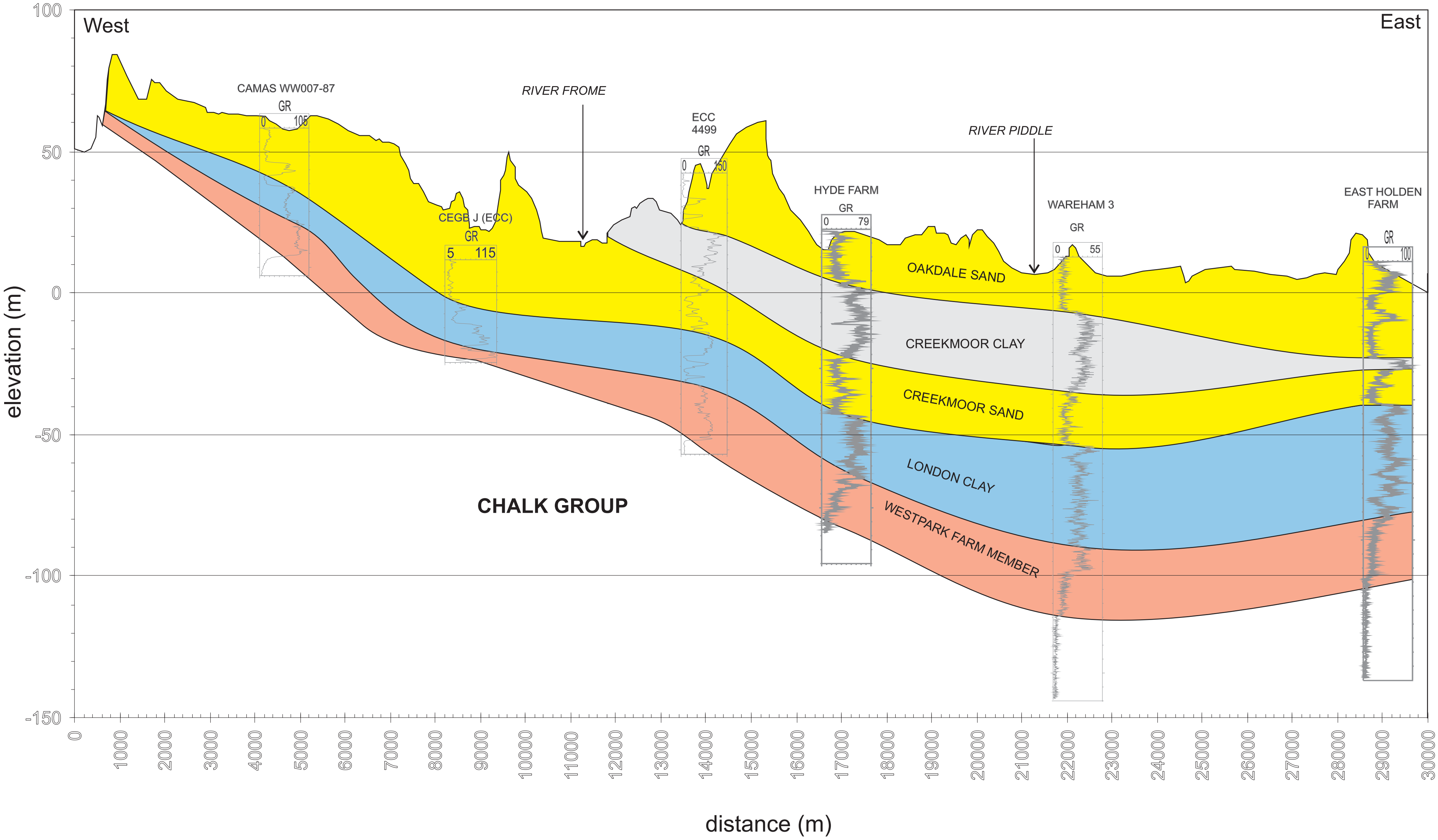


Figure 7. West-East section through the Palaeogene deposits of the Wareham Basin based on correlation of borehole gamma-ray logs (see figure 4 for location)

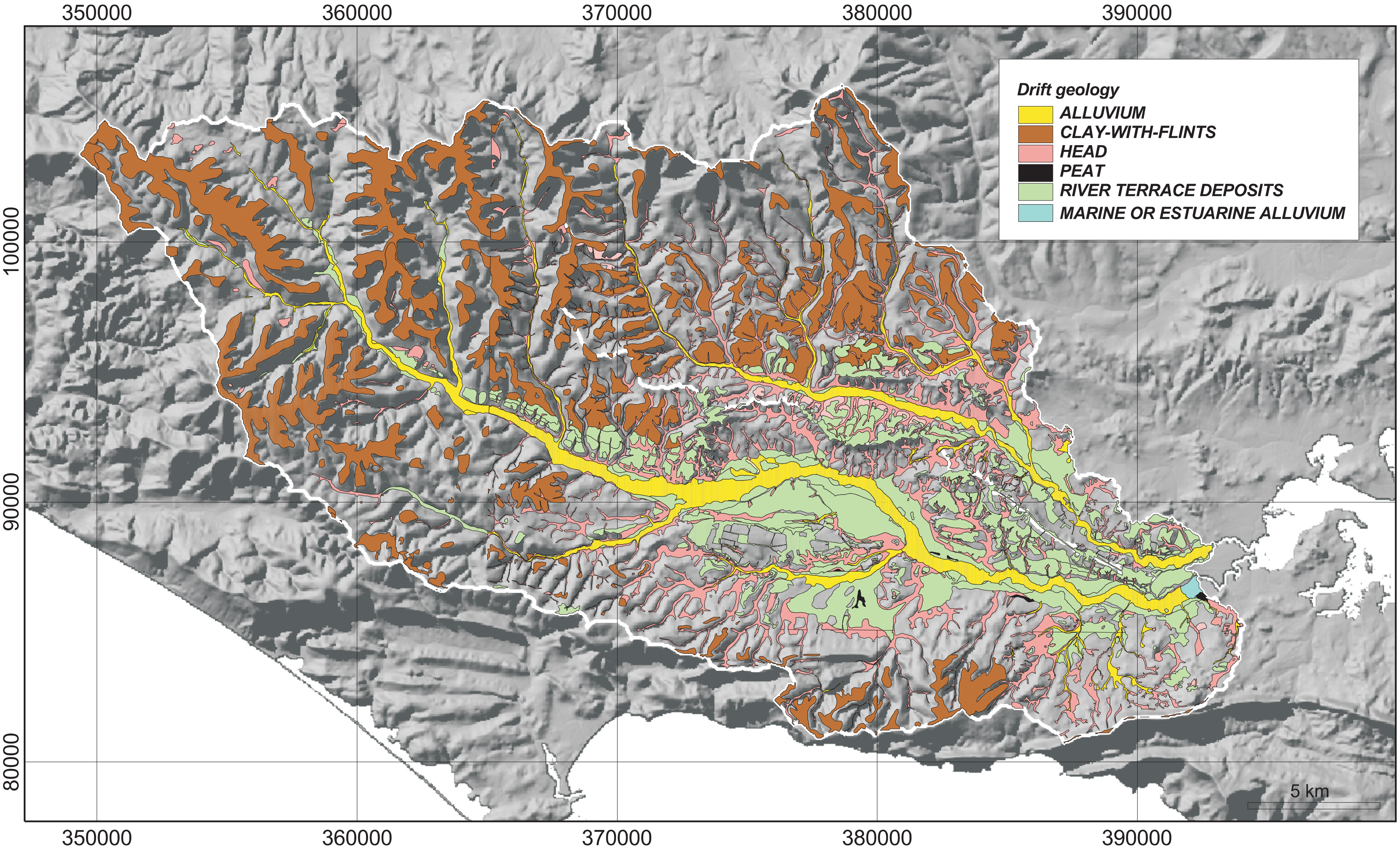


Figure 8. Drift geology of the Frome-Piddle Catchment

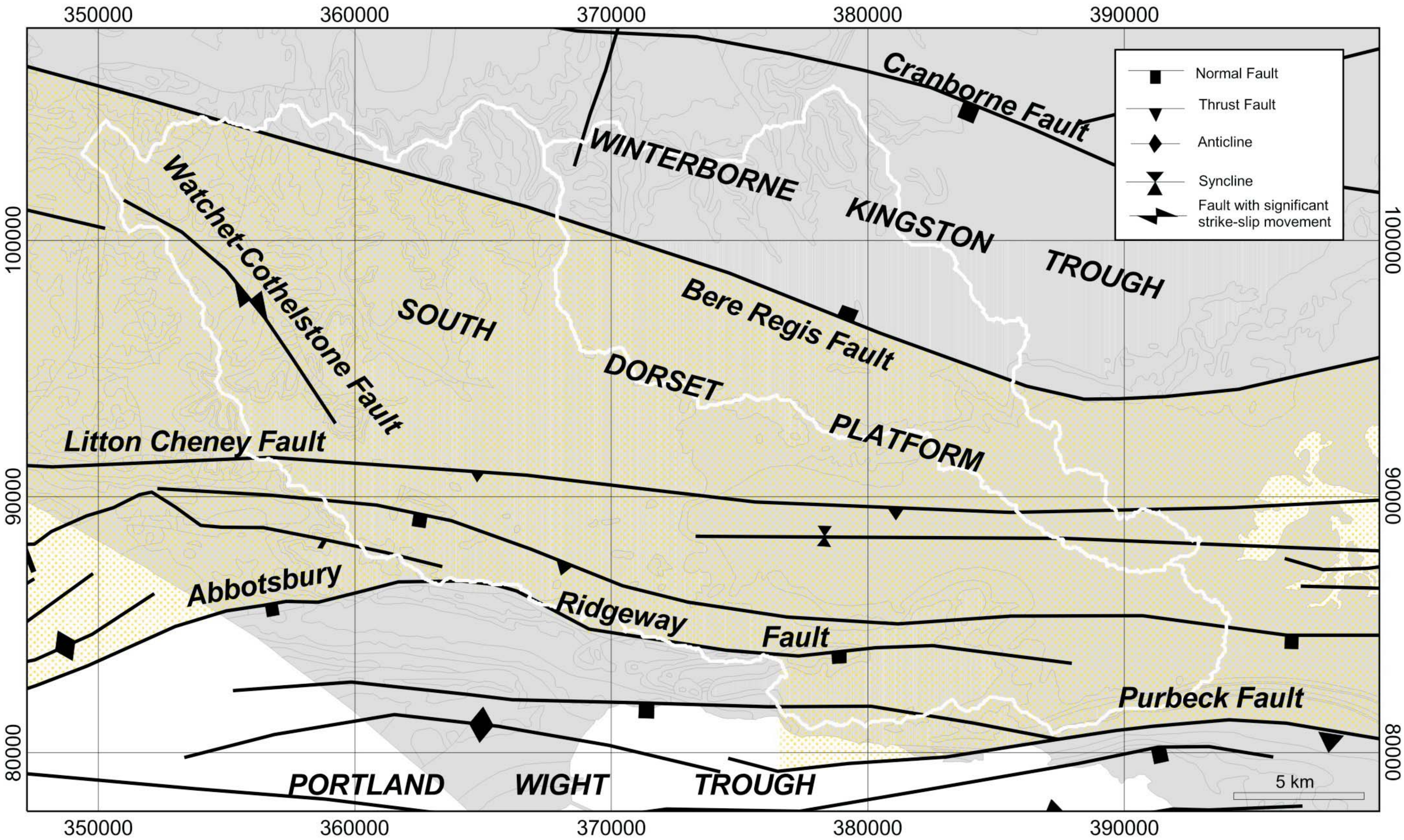


Figure 9. Deep structure of the Frome-Piddle Catchment

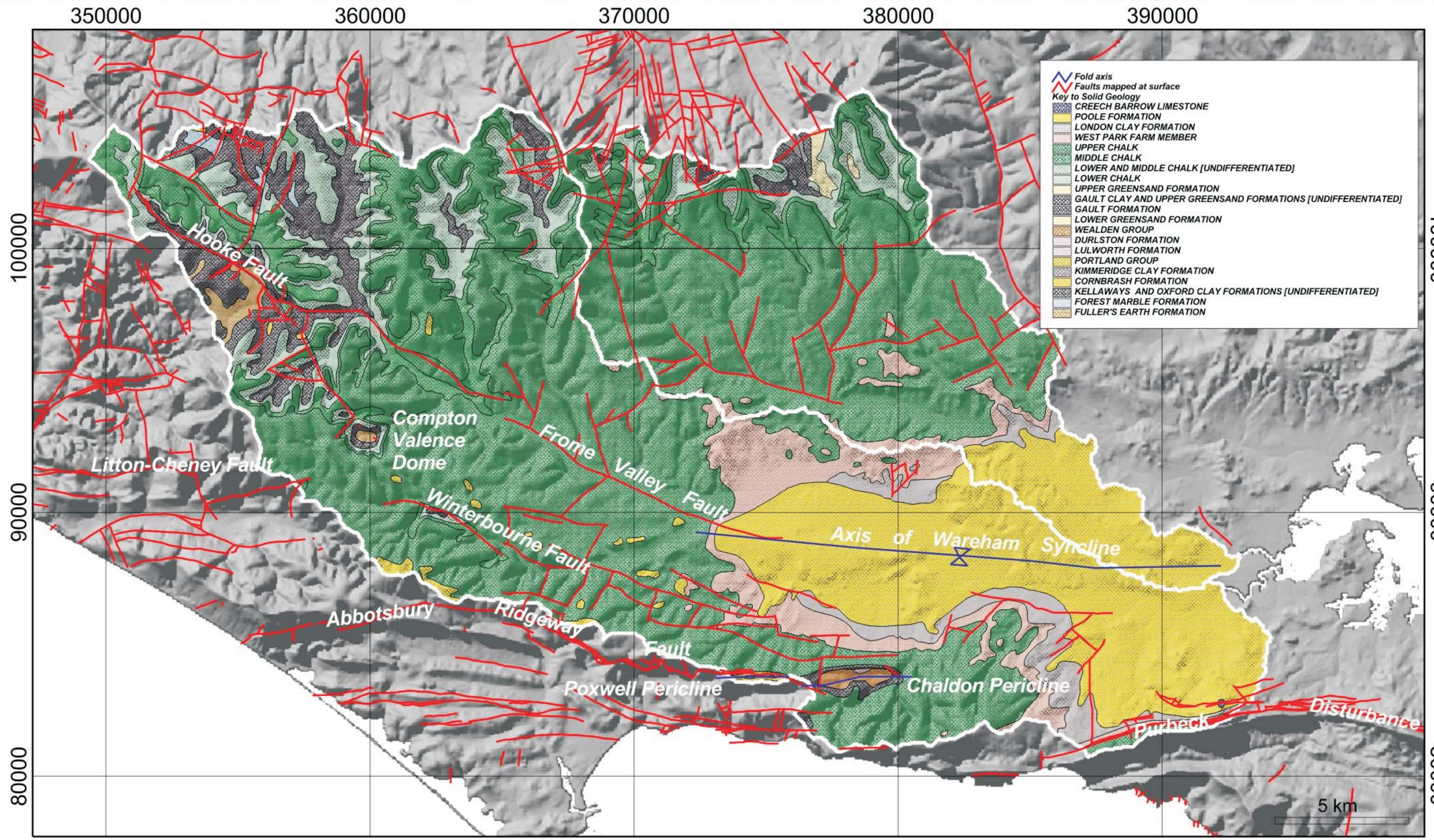
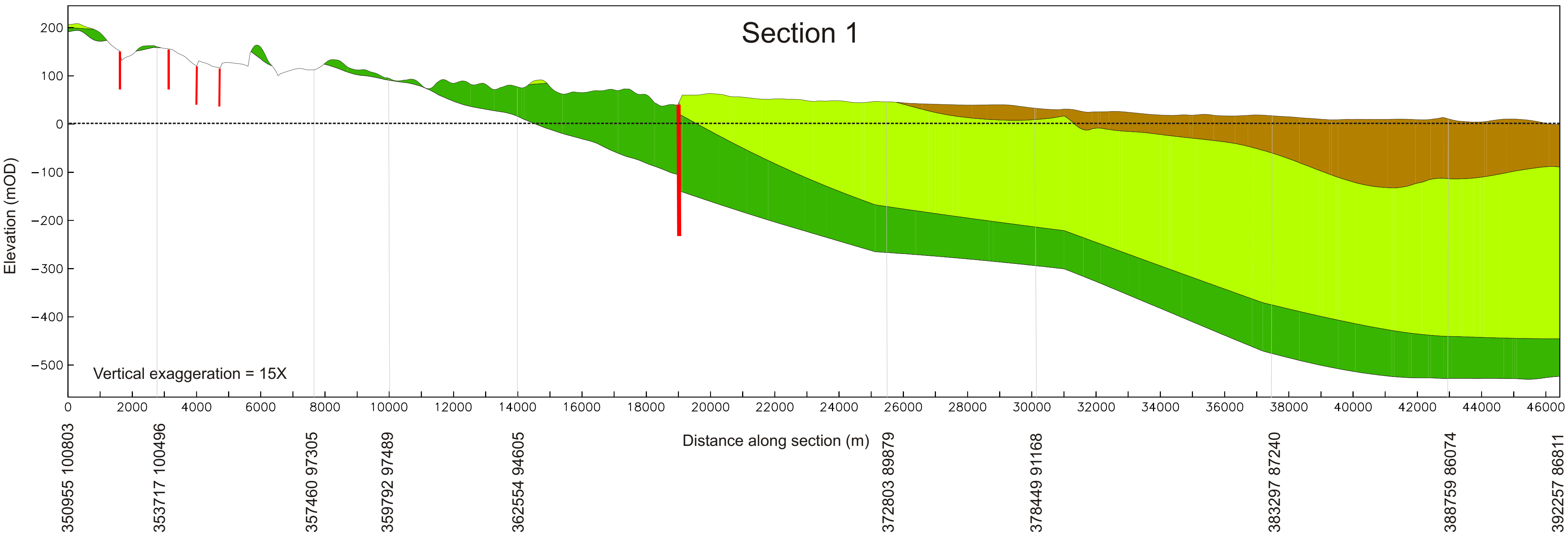
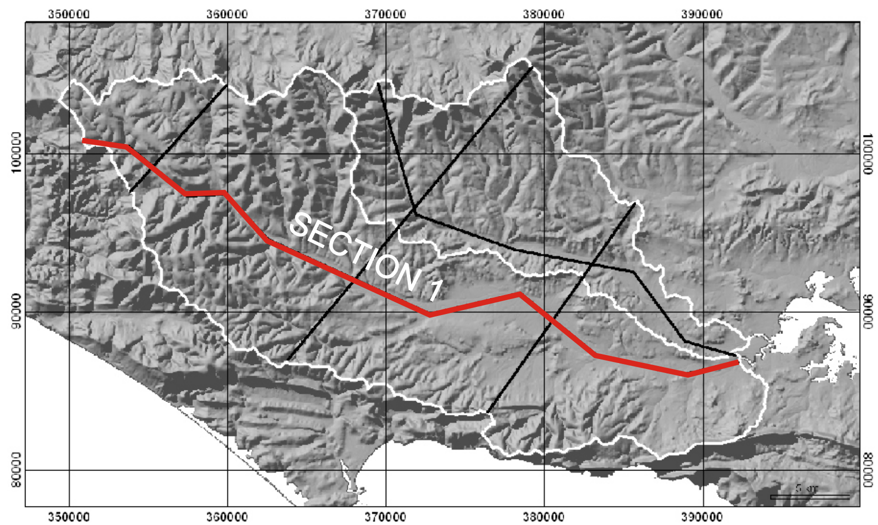


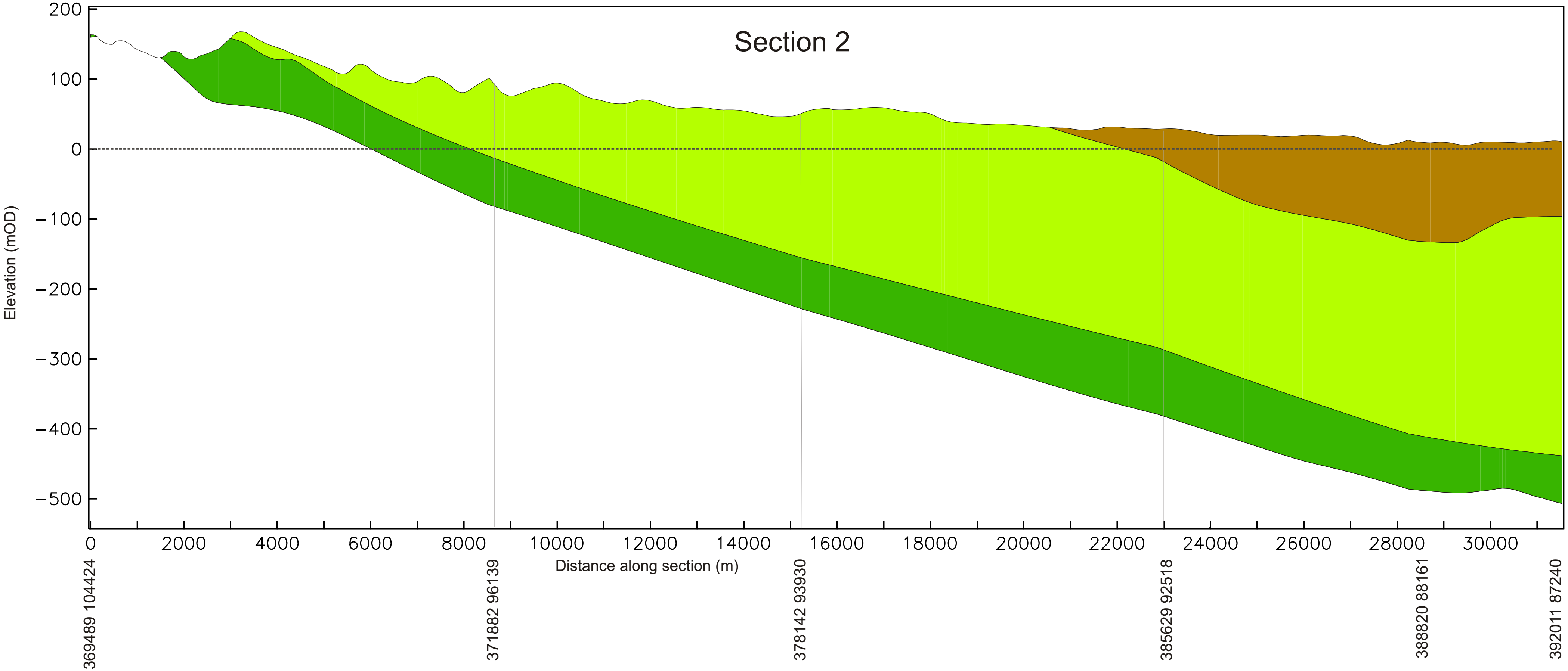
Figure 10. Faults and major folds mapped at surface



Key

- Palaeogene
- Upper Chalk
- Lower and Middle Chalk



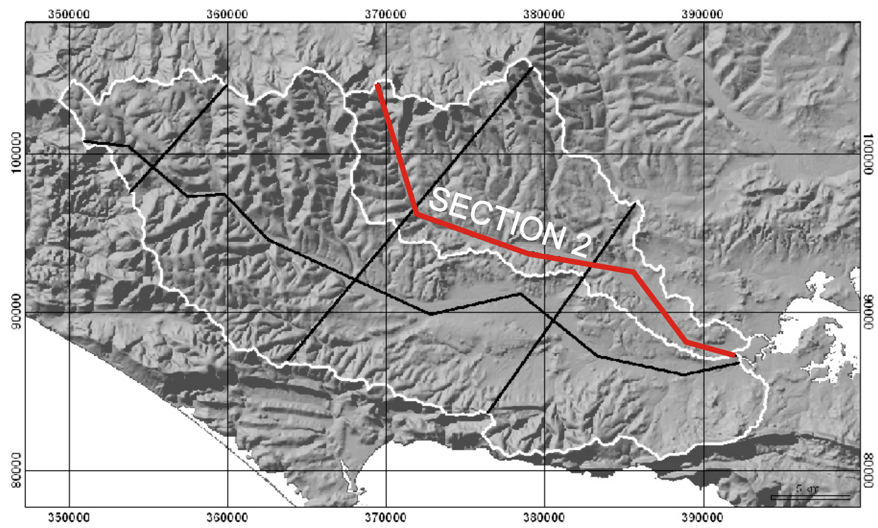


Key

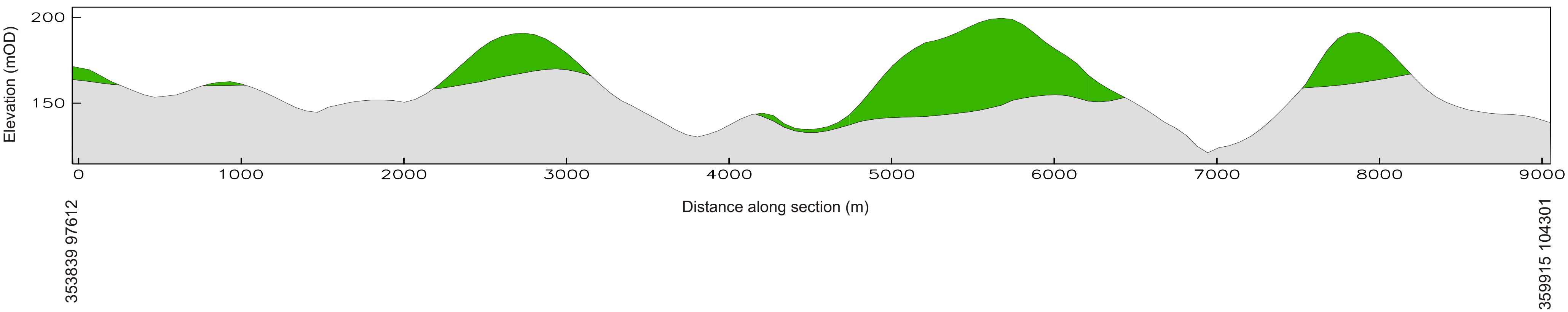
Palaeogene

Upper Chalk

Lower and Middle Chalk

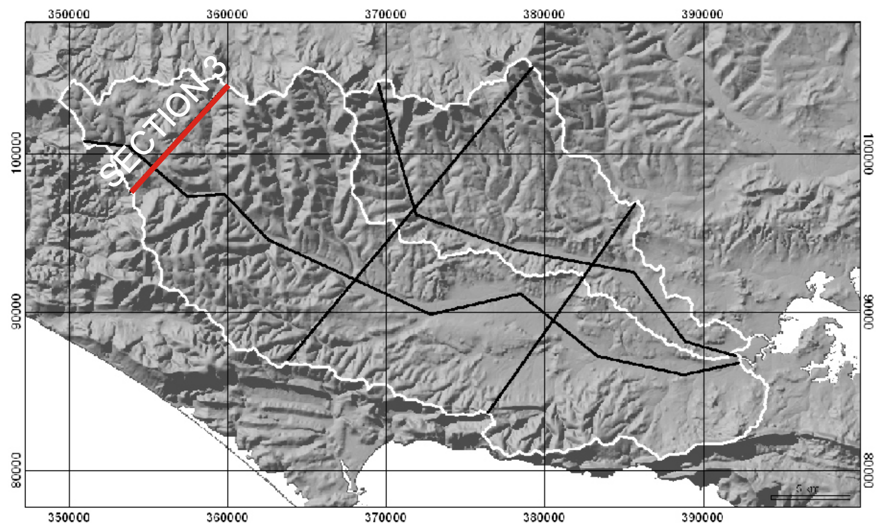


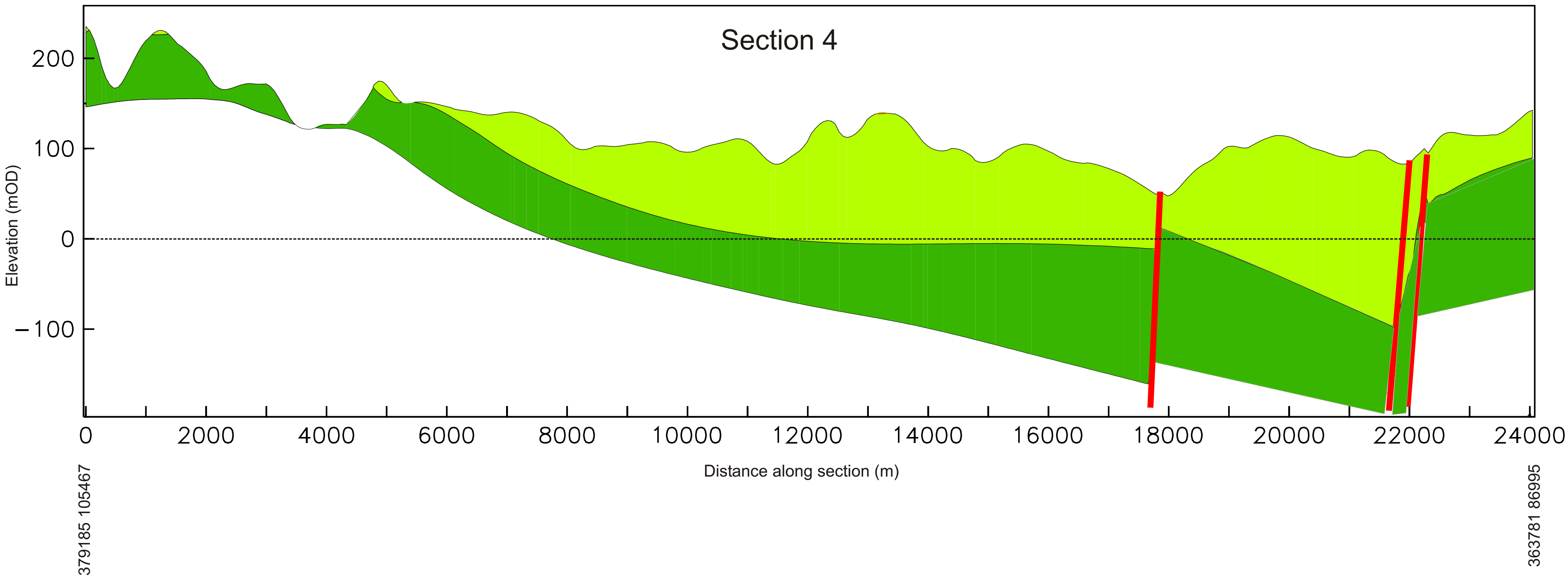
Section 3



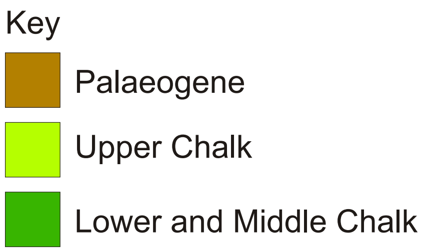
Key

- Palaeogene
- Upper Chalk
- Lower and Middle Chalk
- Pre-Chalk

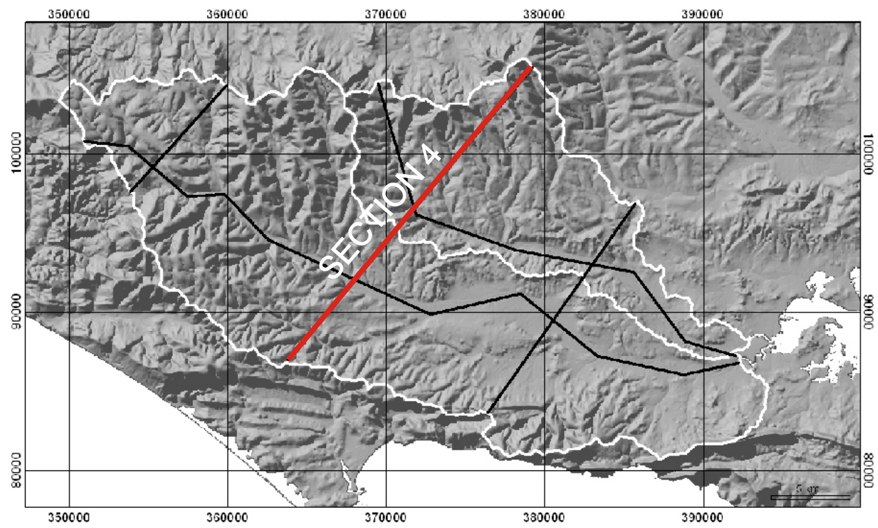




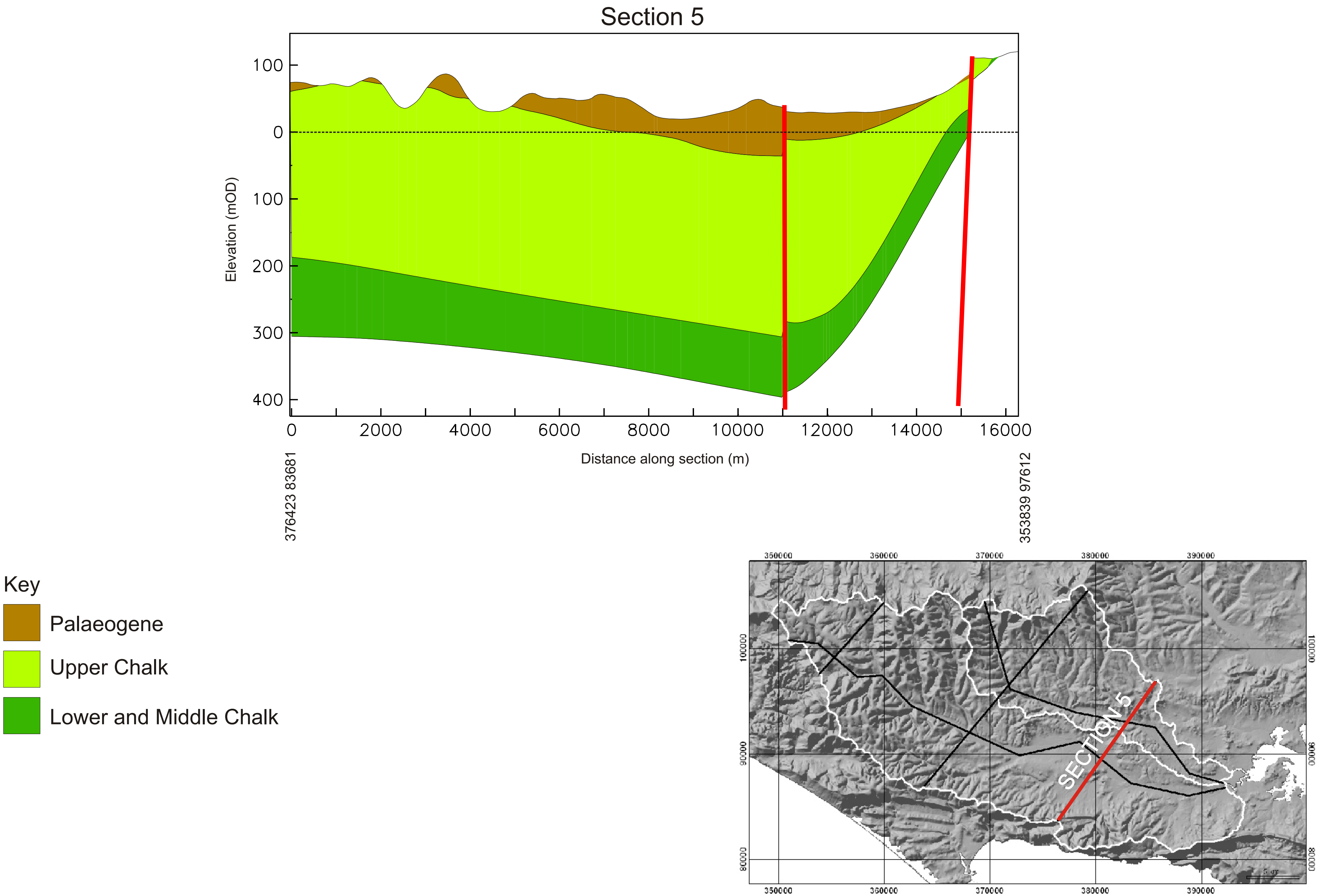
Section 4
Elevation (mOD)
200
100
0
−100
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
24000
Distance along section (m)
379185 105467
363781 86995



Key
Palaeogene
Upper Chalk
Lower and Middle Chalk



350000
360000
370000
380000
390000
100000
90000
80000
SECTION 4


Section 5
Elevation (mOD)
100
0
100
200
300
400
0
2000
4000
6000
8000
10000
12000
14000
16000
Distance along section (m)
376423 83681
353839 97612
Key
Palaeogene
Upper Chalk
Lower and Middle Chalk
350000
360000
370000
380000
390000
100000
90000
80000
SECTION 5