Natural Area: 57. South Devon	**Geological Significance:** Outstanding **(provisional)**

General geological character: The South Devon Natural Area comprises relatively low-lying agricultural land underlain in the main by deformed Devonian rocks (approximately 400-360 Ma). Start Point Peninsula, once believed to be Precambrian in age, is now classed as a sequence of highly deformed Devonian rocks. The best exposures are coastal where a near complete Devonian succession is revealed. Lower Devonian Dartmouth Slates crop out in Bigbury Bay and the overlying Meadfoot Slates are exposed around Torquay. The Middle Devonian limestones of Torquay and Plymouth are both founded on volcanic edifices; the limestones yield rich faunas of stromatoporoids and corals and locally other fossils such as brachiopods, trilobites and molluscs. The Middle Devonian richly fossiliferous limestones of the Chudleigh area are very condensed and accumulated on a submarine swell. The Upper Devonian yields faunas of cephalopods and ostracods (small crustaceans). Dating in poorly fossiliferous parts of the succession has been obtained from conodonts. Volcanic rocks include the Ashprington Volcanic Group in the south and the pillow lavas around Chipley in the east. Local pockets of red-beds unconformably overlie the Devonian; whilst most of these are Permian (approximately 280 Ma) some may be of latest Carboniferous age. Carboniferous intrusive activity, associated with the Variscan Orogeny, lead to the emplacement of granitic bodies such as Dartmoor and produced mineralisation widely exploited in the area and also produced the folding seen around Start Peninsula and thrust faulting seen along the coast. The youngest rocks of the region are the Oligocene lake clays of the Bovey Basin overlying Eocene gravels.

Though the area was not glaciated during the Pleistocene it was affected by the fluctuating glacial/interglacial climate. Cave deposits are particularly important often containing rich and unique vertebrate faunas. Raised beach deposits also document Pleistocene sea level changes.

Key geological features:

- Refolded folds in Start Peninsula
- Coastal sections in Devonian rocks
- Superb coastal exposures of Variscan thrust structures
- Devonian fossils
- Devonian pillow lavas
- Coastal platform
- Devonian 'swell' succession at Chudleigh
- Slapton shingle ridge

Number of GCR sites:

Marine Devonian: 15 Mineralogy of SW England: 4 Coastal Geomorphology of England: 2
Permian-Triassic: 2 Pleistocene/Quaternary of England: 2 Palaeogene: 1
Variscan Structures of South West England: 1 Igneous Rocks of SW England: 1
Pleistocene Vertebrata: 1

Geological/geomorphological SSSI coverage: There are 22 (P)SSSIs in the Natural Area covering 29 GCR SILs and representing 9 different GCR networks. The Marine Devonian coverage is dominant and includes several type localities (eg. Hope's Nose to Walls Hill, Babbacombe Cliffs, Meadfoot Sea Road and Daddyhole) which lend their names to key rock units. Carboniferous mineralisation producing unique mineral assemblages (antimony ore and associated gold at Wheal Emily) and particularly rich deposits (Devon Great Consuls was the largest single producer of copper and arsenic in the Southwest and at one point in the world) is also important in the area. Located on the edge of the Bovey Basin Aller Sand Pit is the type locality for the Tertiary Aller Gravels. Pleistocene sediments (Wolstonian, Ipswichian and Devensian) with a rich and unique vertebrate fauna are preserved in Torbryan Caves and Hope's Nose raised beach records Pleistocene sea level changes.

Key geological management issues:

- Degradation/infill of important Devonian sites.
- Threats posed by over-collecting/irresponsible collecting of minerals and fossils.
- Threats to caves and cave deposits through recreation.
- Loss of mineralogical resource by collecting and levelling of tips.

Key geological objectives:

1. **Ensure sites are adequately managed and no net loss occurs; integrate with RIGS system** to assist coverage of all important sites is maintained

2. **Establish responsible collecting policies** (mineral and fossil) on sensitive sites.

3. **Develop Cave Conservation Plans with relevant groups.**

4. **Investigate and promote the educational/interpretative/recreational potential of the area (e.g link between geology and mineral extraction).**

6. **Ensure geological policies are established in local plans.**

7. **Develop Shoreline Management Plans that include geological objectives.**

8. **Develop cross-cutting initiatives** linking geology, habitat and landscape.

Useful guides/references:

DURRANCE, E.M. & LAMMING, D.J.C. 1982: The Geology of Devon. Publ. University of Exeter.

EDMONDS, E.A., *et al.* 1975: British regional Geology, South Wset England. Institute of Geological Sciences. HMSO. London.

HOUSE, M.R. 1977: A correlation of Devonian rocks in the British Isles. Geological Society Special Report No. 8.

MacFADYEN, W.A. 1970: Geological highlights of the West Country. NCC.

Earth science (P)SSSIs in the Natural Area:

- Chipley Quarries
- Ransley Quarry
- River Lemon Valley Woods
- Torbryan Caves
- Hope's Nose to Walls Hill
- Babbacombe Cliffs
- Aller Sand Pit
- Daddyhole
- East Ogwell Quarry
- Hallsands
- Kents Cavern
- Lummaton Quarry
- Meadfoot Sea Road
- New Cut/Torquay
- Saltern Cove
- Slapton Ley
- Devon Great Consols
- Faraday Road
- Lockridge Mine
- Mount Wise
- Richmond Walk
- Wheal Emily

Natural Area: 58. Bodmin Moor	Geological Significance: Some (provisional)

General geological character: Bodmin Moor forms the most south-westerly upland area in Britain. The moor is essentially the eroded remnant of a granite massif or dome, most of which lies above 250 metres AOD. The geology is dominated by the Bodmin granite, emplaced about 290 million years ago during the Variscan Orogeny (a mountain building period). The intense heat and pressure associated with this event cause deformation and alteration of the pre-existing Devonian (380 to 370 Ma) rocks. This formed the slates and shales (locally termed 'killas') which now fringe the Natural Area. During more recent Quaternary times (the last 2 million years) the entire area was subjected to periglacial conditions and suffered cold-climate weathering. This produced the distinctive granite tors and surrounding clitter which cap many of the moorland summits. The wealth of mineral deposits such as tin, copper, iron and silver fringing the moor is shown by the numerous remains of mining activity on Bodmin Moor.

Key geological features:

- Natural and man-made exposures of the Bodmin granite
- The granite tors on the moorland summits
- Palaeo-environmental information contained in vegetation and peat deposits of the moor
- Remains of mines and mining history

Number of GCR sites:

Pleistocene/Quaternary of South West England: 2 Igneous of South West England: 1

Geological/geomorphological SSSI coverage: There are 3 (P)SSSIs in the Natural Area containing 3 GCR SILs and representing 2 different GCR networks. Two of the sites selected (Hawks Tor Pit and Dozmary Pool) provide detailed information about recent (the last 15,000 years) vegetational and environmental history of South West England. Taken together, the information from these two sites spans the transition from the late glacial period through to present day climatic conditions. The other SSSI (De Lank Quarries) is an important exposure of the Bodmin granite, illustrating the composition of the granite intrusion and accompanying mineralisation.

Key geological management issues:

- Potential conflict between mineral extraction industry and earth science conservation at active quarry sites such as De Lank Quarries
- Protecting the integrity of existing, sensitive landforms such as tors and clitter slopes from tourism and development.

Key geological objectives:

1. Prevent damage to the tors and clitter slopes.

2. Protect the important Quaternary SSSIs through on-going site management.

3. Safeguard existing geological exposures.

Useful guides/references:

ENVIRONMENTAL CONSULTANTS (CTNC) LTD. 1994: Bodmin Moor Natural Area: A Quality Profile. Report to English Nature. Numerous references are contained within this report.

Earth science (P)SSSIs in the Natural Area:

- Dozmary Pool
- Hawks Tor Pit
- De Lank Quarries

Natural Area: 59. Cornish Killas and Granite	**Geological Significance:** Outstanding **(provisional)**

General geological character: The rocks of the Cornish Killas and Granite Natural Area are primarily of Devonian (408 to 362 Ma) and Carboniferous (362 to 290 Ma) age. The Devonian rocks consist of shales, slates and sandstones which were deposited on a sea floor and contain the fossil remains of marine organisms such as bivalves and brachiopods.These rocks are strongly folded and faulted becoming slate-like ('killas') by later movements of the Earth's crust during a long period of mountain-building known as the Variscan Orogeny during the Carboniferous Period. The numerous granite masses intruded into the area were emplaced as molten rock during the later part of this Variscan orogeny. There are many mineral ore veins associated with these granites, and these form the heart of Cornwall's tin and copper mining history. In recent geological time, during the Quaternary (the last 2 million years), the rocks of the Natural Area have been subjected to both cold and temperate weathering processes as the temperatures in England fluctuated through the 'Ice Ages'. Periods of intense cold during this time were sufficient to break up and transport the older rocks. The effects of these fluctuating climates are reflected by the periglacial slope deposits ('head'), the weathered tors and raised beaches.

Key geological features:

- Coastal exposures of deformed "killas" rocks
- Upland granite masses and associated coastal exposures
- Ancient mineral mines, spoilheaps and links with mining heritage.
- Type mineral localities such as Arthurite (Hingston Down Quarry and Consols)

Number of GCR sites:

Igneous Rocks of South West England: 21 Mineralogy of South West England: 18
Marine Devonian: 11 Variscan Structures of South West England: 6
Pleistocene/Quaternary of South West England: 4 Coastal Geomorphology of England: 1
Pliocene: 1 Dinantian of Devon and Cornwall: 1

Geological/geomorphological SSSI coverage: There are 44 geological/geomorphological (P)SSSIs in the Natural Area containing 63 GCR SILs. These represent 8 different GCR networks but relate especially to the story of the Variscan Orogeny. Most of these sites are coastal exposures (eg. Penlee Point) or inland mines and quarries (eg. Penberthy Croft Mine). The Marine Devonian (eg. Bull Cove), Dinantian (eg. Viverdon Quarry) and many igneous sites (eg. Kingsand to Sandway Point) represent the conditions before the Variscan Orogeny, whilst others (eg. Crocadon Quarry) show the structures and mechanics of the orogeny. The granite and mineralisation at sites such as Luxulyan Quarry is evidence of the final stages of this orogeny. Coastal exposure such as the raised beach at Boscawen show the more recent effects of climatic changes during the 'Ice Ages'.

Key geological management issues:

- Maintain and enhance existing exposures
- Maintain natural coastal processes
- Agree conservation sections in working quarries
- Promote the heritage value of mines and mine dumps

Key geological objectives:

1. Maintain and enhance the geological resource in coastal sections through the use of Shoreline Management Plans, by agreeing conservation faces in working quarries and encouraging joint initiatives with RIGS Groups.

2. Promote the geological resource through on-site interpretation and strengthening links between geology, habitats, scenery, cultural and industrial heritage.

Useful guides/references:

BARTON, R.M. 1969: Geology of Cornwall. D Bradford Barton Ltd, Truro.

EMBREY, P.G. & SYMES, R.F. (1987) Minerals of Cornwall and Devon. British Museum (Natural History), London.

Earth science (P)SSSIs in the Natural Area:

- Bull Cove
- Clicker Tor Quarry
- Crocadon Quarry
- Hingston Down Quarry and Consols
- Kingsand to Sandway Point
- Polyne Quarry
- Rosenun Lane
- St Mewan Beacon
- Carn Grey Rock and Quarry
- Harbour Cove
- Luxulyan Quarry
- Mulberry Downs Quarry
- Pentire Peninsula
- Roche Rock
- South Terras Mine
- Stepper Point
- Viverdon Quarry
- Wheal Boys
- Wheal Martyn
- Belowda Beacon
- Cameron Quarry
- Cuckoo Rock to Nar Rock
- Gerrans Bay to Camel Cove
- Penhale Dunes
- Perhaver
- Rosemullion
- St Agnes Beacon Pits
- Tregargus Quarries
- Trelavour Downs
- Wheal Gorland
- Boscawen
- Ayre Point to Carrick Du
- Cudden Point to Prussia Cove
- Folly Rocks
- Great Wheal Fortune
- Gwithian to Mexico Towans
- Penberthy Croft Mine
- Penlee Point
- Penlee Quarry
- Porthcew
- Porthgwarra to Pordenack Point
- St Erth Sand Pits
- Tater-Du
- Wheal Alfred

Natural Area: 60. The Lizard	**Geological Significance:** Considerable **(provisional)**

General geological character: The rocks of the Lizard Natural Area are of Devonian (408 to 362 Ma) age. The rocks are primarily igneous , with an area of slates and sandstones ('killas') in the north of the area. The rocks were all formed at the bottom of an ancient sea, where layers of muds and sands built up to form the killas beds. The Lizard is composed mainly of igneous rocks (gabbros and basalts) which represent a slice through the ancient seafloor crust under the sediment. The famous Lizard serpentine is rock from below the Earth's crust -the mantle - which is not normally seen at surface. These rocks were brought to the surface during the early part of the Variscan Orogeny, a mountain building episode which began approximately 350 million years ago, and strongly contorted rocks across southwest England and much of central Europe. In more recent geological times (the last 2 million years), the rocks of the Natural Area have been weathered by tundra-like conditions during the 'Ice Ages', to form the characteristic low lying landscape and soils. Longshore drift along the coast has since built up the impressive Loe Bar from flints derived from offshore chalk beds.

Key geological features:

- Coastal exposures of oceanic crust and mantle in the 'ophiolite'
- Coastal exposures of deformed 'killas' and 'mélange' rocks
- Mineral localities and links with mining heritage
- Coastal geomorphological features

Number of GCR sites:

Igneous Rocks of South West England: 10 Marine Devonian: 3
Mineralogy of South West England: 2 Variscan Structures of South West England: 1
Pleistocene/Quaternary of South West England: 1 Coastal Geomorphology of England: 1

Geological/geomorphological SSSI coverage: There are 13 geological/geomorphological (P)SSSIs in the Natural Area containing 18 GCR SIIs representing 6 different GCR networks. At least one of the sites, Kynance Cove, is regarded as being of possible international significance. The sites selected predominantly represent the story of the Lizard 'Ophiolite'. Most igneous sites show parts of this complex body (eg. Coverack Cove and Dolor Point), with two other sites (eg. Mullion Island) showing the igneous activity on the ocean floor nearby. The sediments of the ocean floor are represented in the Marine Devonian sites (eg. Menage Coastal Section), and the structural site shows important evidence of the effects of the Variscan Orogeny in the area. Mineral sites relate to both the Lizard's emplacement (Dean Quarry) and the later Variscan granites (Wheal Penrose). The geomorphological sites represent recent coastal processes.

Key geological management issues:

- Maintain and enhance existing coastal exposures, particularly against coastal protection works
- Agree conservation plans for active quarries
- Maintain natural coastal processes
- Promote heritage value of all sites

Useful guides/references:

BARTON, R.M. 1969: Geology of Cornwall. D. Bradford Barton Ltd., Truro.

EDMONDS, E.A., MCKEOWN, M.C. & WILLIAMS, M. 1969: British Regional Geology: South-West England, 3rd Edn. Institute of Geological Sciences, HMSO, London.

FLOYD, P.A., EXLEY, C.S. & STYLES, M.T. 1993: Igneous Rocks of South-West England. JNCC GCR Series Volume 5, Chapman & Hall, London.

Earth science (P)SSSIs in the Natural Area:

- Baulk Head to Gunwalloe Cliff
- Caerthillian to Kennack
- Coverack Point and Dolor Cove
- Coverack to Porthousestock
- Kennack to Coverack
- Loe Pool
- Meneage Coastal Section
- Mullion Cliff to Predannack Cliff
- Porthallow Cove to Porthkerris
- Porthleven Cliffs
- Porthleven Cliffs East
- West Lizard
- Wheal Penrose

Natural Area: 61. Dartmoor	**Geological Significance:** Considerable **(provisional)**

General geological character: The Dartmoor Natural Area is dominated by the massive igneous intrusion of the Dartmoor Granite. This granite was emplaced during the late Carboniferous/early Permian (around 280 Ma) into pre-existing Devonian and Carboniferous shales, sandstones, limestones and lavas which had been thrusted and faulted during the earlier Variscan Orogeny (between 380 and 300 Ma). Most of these 'country rocks' surrounding the granite have been altered by the great heat and pressure, resulting in the development of a variety of different metamorphic rocks. In the later stages of the cooling of the granite, hydrothermal activity produced kaolinisation of parts of the granite intrusion to form the china clays. The hydrothermal activity also induced mineralisation of the granite margins and the surrounding country rocks. Mineralisation is dominated by the formation of tin and copper veins, both of which have been worked economically on Dartmoor. Later ground movements in the Tertiary led to the opening of 'strike-slip' basins (eg. the Bovey Tracey Basin) around the granite intrusion. Sediment derived from the weathering of the granite infilled these basins with the economically important ball clays. The Sticklepath Fault to the northeast of the Natural Area (now the Bovey Valley) forms a corridor through the area and shows the importance of structural geology in determining settlement patterns. Late Tertiary and Quaternary chemical weathering are responsible for the development of the famous Dartmoor Tors, although the exact detail of the tors is determined by the patterns of joints developed in the granite as it cooled. Quaternary ice sheets never extended into Devon , and the main effects of Quaternary environmental change have been the development of periglacial features in the form of tors, clitter slopes, boulder runs and solifluction deposits. Blanket bogs consisting of peats up to 7 metres deep occur on the higher parts of Dartmoor and are currently forming in areas of impeded drainage and around springlines. The Dartmoor landscape also displays classic radial drainage patterns due to the dome shape of the granite intrusion, except in areas where drainage has been modified by faulting.

Key geological features:

- The Dartmoor Granite intrusion and related metamorphism and mineralisation of surrounding rocks
- The effect of the Sticklepath Fault on cultural development
- Granite weathering features such as tors and clitter slopes
- The extensive peat deposits of the Dartmoor landscape

Number of GCR sites:

Pleistocene/Quaternary of South West England: 5 Igneous of South West England: 4
Mineralogy of South West England: 2 Variscan Structures of South West England: 1
Pleistocene Vertebrata: 1 Caves: 1

Geological/geomorphological SSSI coverage: There are 15 (P)SSSIs in the Natural Area containing 14 GCR SILs. These represent 6 different networks, dominated by sites showing the structure of the granite intrusion (eg. Burrator Quarries SSSI), the associated mineralisation of the surrounding rocks (eg. Devon United Mine SSSI) and the Quaternary landscape evolution of Dartmoor. Sites such as Two Bridges Quarry SSSI and Laughter Quarry SSSI show the effects of weathering and periglacial processes on the area during the Quaternary, whilst vertebrate remains at Buckfastleigh Caves SSSI and Pridhamsleigh Caves SSSI illustrate the changing fauna of the area over this time period.

Key geological management issues:

- Management of existing sites to promote and enhance geological exposures within the Natural Area
- Promotion of the geological resource and its cultural, aesthetic and economic importance in this National Park area

Key geological objectives:

1. Maintain and enhance the existing geological exposures and natural processes in the Natural Area

2. Encourage initiatives aimed at the joint management of the geological and biological resources

3. Encourage interpretation of the Dartmoor landscape and links with geology, scenery, tourism, mining history and recreation.

Useful guides/references:

CAMPBELL, S. (in press): The Quaternary of South West England. Geological Conservation Review Volume. Chapman and Hall, London.

DUFF, P. McL.D. & SMITH, A.J. (eds) 1992: Geology of England and Wales. The Geological Society, London.

Earth science (P)SSSIs in the Natural Area:

- Laughter Quarry
- Ashburton Road Cuttings
- Buckfastleigh Caves
- Burrator Quarries
- Devon Unite Mine
- East Dartmoor
- Haytor and Smallacombe Iron Mines
- Haytor Rocks and Quarries
- Leusdon Common
- Merrivale
- North Dartmoor
- Potters Wood
- Pridhamsleigh Caves
- South Dartmoor
- Two Bridges Quarry

Natural Area: 62. Culm Measures	**Geological Significance:** Outstanding **(provisional)**

General geological character: The rocks of the Culm Measures Natural Area are mostly of Carboniferous (362 to 290 Ma) age. The sediments belonging to the Carboniferous Culm Measures are a sequence of mainly sandstone and slate rocks, formed as sands and muds at the bottom of a marine gulf. Deposition of the Culm rocks stopped when this sea area was squeezed closed, during the mountain-building period known as the Variscan Orogeny. This fractured the Culm rock into sections many square miles across, which were piled over one another by the squeezing, and folded up into spectacular and complex patterns, best seen in present-day coastal cliffs. Late in the Variscan Orogeny, molten granite rock rose from deep in the Earth, cooling as the Dartmoor Granite. The hot granite baked the surrounding rocks, and also caused the formation of mineral veins nearby. In the last two million years, the Natural Area's landforms have been shaped by the tundra-like conditions of the 'Ice Ages', and subsequently modified by river channels. The erosive power of the sea has carved the distinctive high rugged cliffs along the coast, slicing through the rolling valley and hill landscape behind.

Key geological features:

- Coastal exposures of deformed rocks
- Quarry exposures of Igneous and sedimentary rocks
- Mineral localities and links with mining heritage
- Coastal geomorphological features

Number of GCR sites:

Variscan Structures of South West England: 13 Igneous Rocks of South West England: 8
Mineralogy of South West England: 3 Dinantian of Devon and Cornwall: 3
Pleistocene/Quaternary of South West England: 2 Coastal Geomorphology of England: 2
Namurian of England and Wales: 2 Marine Devonian: 2 Fluvial Geomorphology: 1

Geological/geomorphological SSSI coverage: There are 28 geological/geomorphological (P)SSSIs in the Natural Area containing 36 GCR SILs representing 9 different GCR blocks. At least one site is of international significance (Meldon Aplite Quarry). The sites selected predominantly represent the story of the Variscan Orogeny. Devonian, Dinantian and Namurian sites show how the marine sediments formed between two colliding plates. The collision is illustrated in Variscan Structures sites, both on the coast (eg. Bude Coast) and inland (eg. Greystone Quarry). Igneous sites show the volcanic products of the orogeny both before and during the collision (eg. Pitts Cleave). Mineral sites are related to the effects of the granites which were emplaced into the sediments late in the Variscan Orogeny. The geomorphological sites represent both fluvial and coastal erosion and coastal depositional features in more recent times.

Key geological management issues:

- Maintain and enhance existing coastal exposures
- Agree conservation plans for active quarries with landowners and occupiers
- Maintain natural coastal processes
- Promote heritage value of all sites

Key geological objectives:

1. Maintain and enhance the coastal geological resource through inclusion of geology in shoreline management plans; long term conservation and restoration plans for active quarries; site clearances at disused quarries. Encourage involvement of RIGS groups in providing know-how/ drive for local based conservation.

2. Promote the geological resource - particularly through the link between the coastal cliffs and the Variscan story.

Useful guides/references:

DURRANCE, E. M. & LAMING, D.J.C. (eds.) 1982: The Geology of Devon. University of Exeter, Exeter.

EDMONDS, E.A., McKEOWN, M.C. & WILLIAMS, M. 1969: British Regional Geology: South-West England, 3rd Edn. Institute of Geological Sciences, HMSO, London.

FLOYD, P.A., EXLEY, C.S. & STYLES, M.T. 1993: Igneous Rocks of South-West England. JNCC GCR Series Volume 5, Chapman & Hall, London.

Earth science (P)SSSIs in the Natural Area:

- Bickleigh Wood Quarry
- Bonhay Road Cutting
- Boscastle to Widemouth
- Brent Tor
- Bude Coast
- Cholwell Brook
- Chudleigh Caves and Woods
- Coryton Quarry
- Crockham Quarry
- Fremington Claypit
- Greystone Quarry
- Hannaborough Quarry
- High Down Quarry
- Lidcott Mine
- Lydford Gorge
- Marsland to Clovelly Coast
- Meldon Aplite Quarry
- Meldon Quarry
- Northam Burrows
- Park Gate Quarry
- Pitts Cleave
- Polyphant
- Ryecroft Quarry
- Spara Bridge
- South Brentor Quarry
- Stourscombe Quarry
- Webberton Cross Quarries
- Yeolmbridge Quarry

Natural Area: 63. Exmoor and the Quantocks	**Geological Significance:** Considerable **(provisional)**

General geological character: The Exmoor and Quantock Hills comprise a series of gently undulating upland heather moors and blanket bogs which reach topographic heights in excess of 485m AOD. The solid geology of the Natural Area is represented almost entirely by mid Devonian to early Carboniferous aged (385 to 355 Ma) sediments; a thin belt of Permo-Triassic strata (290 to 210 Ma) extends from Porlock to Timberscombe and Carboniferous 'Culm' limestones and sandstones crop out at the mouth of the River Taw near Braunton Burrows. Generally the strata youngs to the south.

Coastal sections are frequently sheer and dramatic, and provide almost continuous exposure extending from Lynton to Barnstaple. Inland the beds may be traced into West Somerset where they disappear beneath Permo-Triassic sediments. To the northwest, the Quantock Hills form a fault-bounded inlier set apart from the main north Devon section. The total thickness of Devonian sediments exceeds 5,600m; strata are often highly deformed and the development of slaty cleavage is typical, fossils where present are usually recrystallised.

Transitions between marine and non-marine conditions dominate the stratigraphic history of the Devonian sediments of Exmoor. The oldest strata exposed are the Lynton Beds which sporadically contain fossil marine shells although species diversity is low and preservation poor. These pass up into the 'fluvio-estuarine' Hangman Sandstone Group, which in turn are overlain by the Ilfracombe Slates. These are marine slates, sandstones and siltstones with intermittent limestones; the latter contain fossil corals and stromatoporoids which have assisted in dating and correlating the strata. Above the Ilfracombe Slates is a thick sequence of slates and fine sandstones referred to the Morte Slate, Pickwell Down Sandstone and Baggy Sandstone. Structures in these sediments indicate their deposition within fluvio-lacustrine, possibly deltaic environments. There is a gradual change from the Baggy Sandstone into the Pilton Shales which mark the Devonian/Carboniferous boundary. The Pilton Shales yield abundant and varied marine fossils including bivalves, brachiopods and trilobites. Many of these Devonian sediments have been folded/faulted by the Variscan (mid Palaeozoic) earth movements. The stratigraphical sequence is similar (but not identical) in the Quantock Hills where generally poorer exposure has for a long time inhibited geological interpretation.

Permo-Triassic sediments in the north east corner of the Natural Area are represented by red pebble-bed conglomerates, breccias, sandstones and mudstones although these strata are better exposed in the Vale of Taunton. They represent lacustrine/fluvial deposits which were laid down during arid desert-like conditions. The youngest sediments exposed in the area are Quaternary-aged (or younger) and fall into three categories: i) blown sand deposits at Braunton and Morte Bay, ii) peats and peaty soils on higher 'plateau' between Simonsbath and Challacombe and iii) river terrace deposits and alluvium at the mouth of the River Taw and Porlock Bay to Luccombe. Porlock Bay is also the site of a 3km long shingle ridge which has accumulated through the interruption of longshore drift at Hurlstone Point. The ridge has been modified and embanked at places but still remains an excellent example of a drift-aligned barrier with its geomorphological structure and clast architecture largely intact. The beach also includes an intertidal boulder/cobble frame with evidence of palaeoenvironmental change, notably the 'submarine' forest bed.

Key geological features:

- Dramatic exposures of folded Devonian strata on north Devon coast
- Inland exposures complimenting coastal sections, particularly in the Quantock Hills
- Marine fossil faunas in limestone bands (Ilfracombe Beds) and Pilton Shales
- Sand-dune systems at Braunton Burrows
- Shingle ridge and associated features at Porlock Bay

Number of GCR sites:

Marine Devonian: 9 Pleistocene/Quaternary of SW England: 3 Dinantian of Devon/Cornwall: 2 Caves: 1 Coastal Geomorphology of England: 1 Fluvial Geomorphology of England: 1 Palaeozoic Palaeobotany: 1 Silurian-Devonian Chordata: 1

Geological/geomorphological SSSI coverage: There are 14 (P)SSSI in the Natural Area containing 19 GCR SILs representing 8 different GCR networks. The main interest is connected with the Marine Devonian block in which Dean Steep, Plaistow Quarry, Watersmeet and coastal sections at Saunton-Baggy Point, West Exmoor Coasts and Woods and Barricane Beach have been selected to represent the stratigraphy. At Mill Rock the Pickwell Down Sandstones have yielded a well preserved Upper Devonian fish fauna. In 1952 the River Lyn was the scene of a unique rainfall sequence and flood event; the rapid movement of enormous volumes of water and sediment created valley erosional and depositional features including slope scars and boulder deposits. Sections within the SE corner of the Natural Area at Kersdown and Five Oaks, expose Lower Carboniferous 'Culm' and limestones.

Key geological management issues:

- Maintain the existing coastal/inland exposures
- Maintain the existing natural coastal processes especially in relation to sand-dune and shingle bank systems
- Maintain the operation of natural fluvial processes
- Enhance/increase where possible the number and/or extent of inland exposures especially in the Quantock Hills

Key geological objectives:

1. **Maintain the operation of natural coastal processes**

2. **Maintain the integrity of inland and coastal exposures** seeking enhancement of exposures/recording of temporary sections wherever practicable

Useful guides/references:

EDMONDS, E.A. & WILLIAMS, B.J. 1985: Geology of the county around Taunton and the Quantock Hills. Memoir for sheet 295, New Series, British Geological Survey, NERC

DURRANCE, E.M. & LAMING, D.J.C. 1982: The Geology of Devon. University of Exeter

EDMONDS, E.A., MCKEOWN, M.C. & WILLIAMS, M. 1975: South-West England. British Regional Geology handbook, Institute of Geological Sciences, NERC

Earth science (P)SSSIs in the Natural Area:

- Dean Steep
- Five Oaks, Bampton
- Kersdown Quarry
- Napp's Cave
- North Exmoor
- Plaistow Quarry
- River Lyn
- Watersmeet
- West Exmoor Coast and Woods
- Saunton to Baggy Point Coast
- Mill Rock
- Barricane Beach
- Morte Point
- Braunton Burrows

Natural Area: 64. Vale of Taunton	Geological Significance: Considerable (provisional)

General geological character: The Vale of Taunton Natural Area is famed for its exposures of Permo-Triassic and Lower Jurassic sediments which have been studied since the last century and have contributed significantly to the development of biostratigraphy and palaeontology. Topographically the area consists mainly of low-lying rolling countryside rarely exceeding 100m AOD. The centre of the Natural Area is punctuated by the Quantock Hills which are composed of Devonian slates, sandstones and occasional limestones; these are considered within the 'Exmoor and the Quantocks' Natural Area.

The oldest strata in the Vale of Taunton crop out along the western margin of the area and form a north-south trending belt running along the eastern foot of Exmoor and the Brendon Hills. These Permo-Triassic rocks (280 to 235 Ma) attain a maximum thickness of up to 660m in the Taunton district and comprise basal pebble-bed conglomerates, breccias and sandstones ('Aylesbeare' and 'Sherwood Sandstone Groups') which fine-up into thick sequences of red mudstones and marls (the Mercia Mudstone Group, approximately 235 to 210 Ma). The Mercia Mudstones extend eastwards and northwards around the perimeter of the Quantock Hills. They are believed to have been deposited under arid conditions in playa/ephemeral lakes.

In the north of the Natural Area the constantly eroding low cliffs between Blue Anchor and Lilstock expose a 235 to 195 Ma key sequence through the upper Triassic (Rhaetic; Mercia Mudstone and Penarth Groups) and lower Jurassic (Lower Lias; Hettangian and lower Sinemurian Stages). The top of the Mercia Mudstones is marked by a series of alternating red/green mudstones assinged to the Blue Anchor Formation. Overlying these is the Penarth Group which comprises lower black shales (Westbury Formation), buff thinly-bedded limestones and shales (Lilstock Formation or 'White Lias') and upper alternating limestones and shales ('Pre-planorbis' Beds). These beds mark the transition from a 'terrestrial' lacustrine environment into shallow marine conditions and contain a restricted fossil bivalve fauna, rich in numbers of individuals but low in diversity. Lower Jurassic sediments (approximately 208 to 200 Ma) are assigned to the Lower Lias (especially the 'Blue Lias'). The beds consist of alternating grey shales, mudstones and limestones (which weather yellowish). The same strata are also excellently exposed along the foreshore 'reefs' where the beds are repeated by numerous approximately north-south trending faults. The sediments are highly fossiliferous yielding numerous marine vertebrate (ichthyosaur, fish) and invertebrate (espcially ammonite and bivalve) remains. Parts of the sequence at St. Audries Bay and East Quantoxhead-Kilve are being considered as international stratotypes for the base of the Hettangian (ie. base of the Jurassic) and Sinemurian Stages respectively. This coastal strip also exposes Quaternary-aged (1.5 Ma or younger) loams, sands and cobbly gravels which are believed to have formed in a periglacial head environment transversed by rivers and streams. Quaternary to present-day alluvium deposits also extend along the tributaries of the River Tone.

Key geological features:

- Inland exposures of Permo-Triassic pebble-bed conglomerates, breccias, sandstones and mudstones
- Coastal and foreshore exposures of late Triassic-lower Jurassic and Quaternary sediments; key localities of international importance represented
- Structural geology and sedimentology
- Invertebrate and vertebrate fossils remains; high potential for biostratigraphic correlation

Number of GCR sites:

Rhaetian: 2 Coastal Geomorphology of England: 1 Hettangian-Pliensbachian: 1
Pleistocene/Quaternary of Somerset: 1

Geological/geomorphological SSSI coverage: There is 1 coastal SSSI in the Natural Area containing 5 GCR SILs representing 4 different GCR networks. The Blue Anchor to Lilstock SSSI is of key national (and potential international) importance for:

i) stratigraphy and sedimentology, marking the transition from 'terrestrial' Mercia Mudstones to marine Lower Lias environments across the Triassic/Jurassic boundary
ii) biostratigraphic correlation assisting the definition of the base of the Jurassic Period; Hettangian and Sinemurian Stages
iii) evolution of early ammonite and marine reptile faunas

Key geological management issues:

- Maintain the existing coastal/foreshore exposures and natural coastal processes
- Threats to coastal/foreshore exposures from coastal engineering and coastal defence projects
- Enhance/increase where possible the number and/or extent of inland exposures
- Overuse and misuse of sensitive fossil locations

Key geological objectives:

1. **Maintain the operation of natural coastal processes**

2. **Maintain the integrity of inland, coastal and foreshore exposures** seeking enhancement of exposures/recording of temporary sections wherever practical

3. **Encourage responsible fossil collecting** and contact with the County Museum

Useful guides/references:

EDMONDS, E.A. & WILLIAMS, B.J. 1985: Geology of the country around Taunton and the Quantock Hills. Memoir for sheet 295, New Series, British Geological Survey, NERC

WHITTAKER, A. & GREEN, G.W. 1983: Geology of the country around Weston-super-Mare. Memoir for sheet 279 with parts of 263 and 295, New Series, Institute of Geological Sciences, NERC

Earth science (P)SSSIs in the Natural Area:

- Blue Anchor to Lilstock Coast