

Summary of the geology of the Phase 2 part of the North Devon AONB and its immediate surroundings

Most of the area of this northern part of the AONB is underlain by sedimentary rocks belonging to the Middle and Upper Devonian, but some Carboniferous crops out in the Croyde to Barnstaple area. Pleistocene to Recent deposits occurs in the Croyde to Saunton area and flanking the northern side of the River Taw.

The Devonian rocks were laid down in conditions ranging from fluvial to shelf marine, in a fault-controlled basin which derived its supply of sediments from the north. The topmost Devonian sediments indicate a deepening of the sea and this trend continues into the Carboniferous. During the late Carboniferous the Devonian and Carboniferous rocks were folded and faulted during the Variscan Orogeny.

During the Ice Age the ice came as far south as the Taw Estuary leaving transported erratic boulders such as granite and granulite gneiss. Raised beaches belonging to interglacial phases during the Ice Age are well developed. River deposits which were deposited since the Ice Age and are still being deposited today lie along the Taw Estuary



Based upon BGS Geological 1:250,000 map sheets 17N 800L Lundy and 17N 800R Bristol Channel, by permission of the British Geological Survey.
© Crown Copyright and the British Geological Survey 1999. All rights reserved.

Figure 2. Geological map of the northern part of the North Devon AONB

Devonian

The Devonian sediments of North Devon were deposited in an environment ranging from fluvial to shelf marine and were derived from a landmass to the north in the area of what is now Wales. The approximately east – west shoreline oscillated from north to south in its position. Southward movement brought the more continental and fluvial conditions more characteristic of the Welsh Devonian into North Devon, while a retreat northwards allowed the more marine conditions normally found in south Devon to migrate to North Devon. The types of sediments and their contained fossils which characterize these marine and continental pulses are described below in the formation and member descriptions (Fig.3).

Middle Devonian

Hangman Grits

Although this formation does not crop out within the AONB for completeness it is described. The formation is divided into five members in which sandstones predominate along with some conglomerate. These beds are of fluvial origin and some sandstones show convolute bedding and some yield remains from primitive plants. Intercalated into this mainly sandy Figure 3. Stratigraphy of the northern part of the North Devon AONB sequence are three formations which contain marine fossils and indicate marine transgressions into the area.

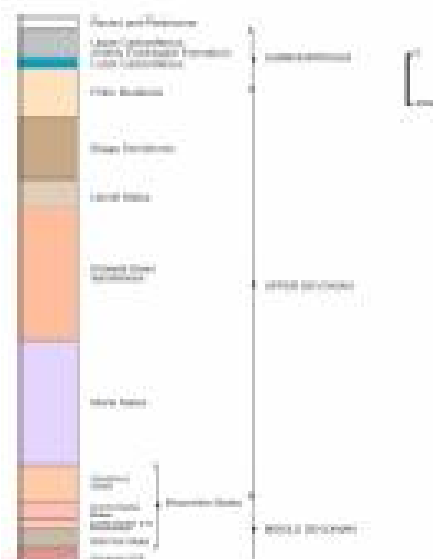


Figure 3. Stratigraphy of the northern part of the North Devon AONB

Ifracombe Slates

This formation is divided into four members all marine in origin, the Wild Pear Slates, the Lester Slates- and- Sandstones, the Combe Martin Slates and the Kentisbury Slates

Wild Pear Slates

This member consists of slates with subordinate sandstones and siltstones with a few limestones. There is a poorly developed marine fauna and indications are that the member was deposited on the front part of a delta.

Lester Slates and Sandstones

This member comprises slates sandstones, some cross-bedded and some coarse and thin crinoidal limestones. In part of the member corals and brachiopods have been found indicating shallow offshore conditions.

Combe Martin Slates

The Combe Martin Slates consist mainly of slate with three distinctive limestone beds and some sandstone and siltstone. The faunas in the limestones are dominated by corals along with crinoids brachiopods and gastropods. The environment was fully marine. Variation in nature of the coral faunas from the same member in the Quantock Hills, well to the east of the present area westward to the Combe Martin area, suggest that the sea was deepening westwards.

Kentisbury Slates

This highest member in the Ilfracombe Slate is still dominantly slate but with common siltstones and sandstones some coarse-grained and up to 2m thick. It is possible that the junction of the Middle and Upper Devonian occurs within the Kentisbury Slates but lack of good diagnostic fossil material. The presence of much sand and lack of a well developed marine within the member suggests a progradation of the shoreline from the north. The member may have been deposited on a delta platform.

Upper Devonian

Morte Slates

This formation is made up dominantly of greenish grey to purple slates with a few thin sandstone bands and calcareous nodules. A poorly developed fauna consisting of brachiopods such as *Cyrtospirifer verneuili* and bivalves suggests that fresh and brackish water from a nearby delta was reducing the salinity in the pro delta area.

Pickwell Down Sandstones

Cross-bedded and ripple marked red purple and green sandstones. At the base there is keratophytic tuff band known as the Bittadon 'Felsite' which has yielded fish remains. These sandstones represent a return to continental sedimentation probably in rivers and lakes not dissimilar to the conditions appertaining to the sedimentation of the Old Red Sandstone of South Wales.

Upcott Slates

Greenish grey slates and siltstones with occasional fine-grained cross-bedded sandstones dominate the member. Some comminuted shell debris is present. It has been suggested that these beds were deposited in alluvial back-swamps or shallow freshwater lakes.

Baggy Sandstones

The formation is characterised by massive cross-bedded sandstones, thin-bedded sandstones, conglomerates and slumped beds as well as thin limestones. The fauna is poor but contains bivalves, possibly of brackish to freshwater affinities, and plant remains. Trace fossils are common. The Baggy Sandstones were probably deposited

in a delta being built out southwards from a river coming from the north.

Pilton Mudstones

The Pilton Mudstones which span from the Devonian up into the Carboniferous are made up of fossiliferous slates and sandstones, although the amount of sandstone diminishes upward into the Carboniferous part of the formation. The delta of the Baggy Sandstones retreated northward and the Pilton Mudstones were deposited in a well oxygenated shelf sea which showed signs of deepening upward into the Carboniferous.

Carboniferous

The Carboniferous is not well represented at outcrop in the area of the AONB owing to a cover of alluvium and Blown Sand, but outcrop to the east suggests that both Lower and Upper Carboniferous may be present.

Lower Carboniferous

Pilton Mudstones

This probably consists of mudstones containing fossils such as trilobite, and brachiopods deposited in a deepening shelf environment.

Codden Hill Chert

To the east of the area this formation consists of cherts and dark grey to black mudstones deposited in deep water with a lack of oxygen in the bottom waters. Thus the fossils found came from free swimming organisms such as goniatites and bivalves which lived in the better oxygenated upper waters.

Upper Carboniferous

Evidence from farther east suggests that dark grey shales and sandstones of the Crackington and Limekiln formations may underlie part of the area. These sediments were deposited in water less deep than during the deposition of the Lower Carboniferous, by the action of turbidity currents flowing down a southward dipping slope, probably from deltas to the north.

Variscan Orogeny

Deposition of the Devonian and Carboniferous sediments ceased late in the Carboniferous and earth forces connected with the Variscan Orogeny compressed the rocks in a south to north direction producing folds overturned to the north and with crests aligned east – west. At the same time as the development of folding, the compression caused recrystallisation and reorientation of the platy minerals found particularly in the more muddy rocks and this produced a fissility along planes at an angle to the original bedding. This fissility or ability to be easily split is known as slaty

cleavage and in this area is particularly marked in such formations as the Morte Slates. This cleavage has an axial planar relationship to the folding (Fig. 4).

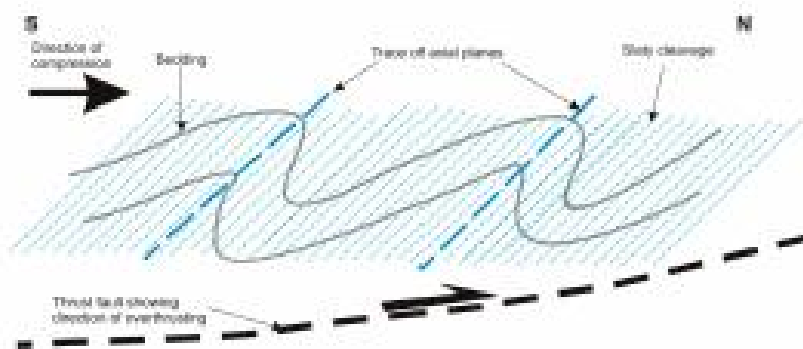


Figure 4. Generalised relationship of cleavage to bedding in the North Devon area showing possible thrust fault at depth.

The deformation of the area during the Variscan Orogeny also led to much faulting which is of three main types. One type, which is least easy to detect, is normal faulting sub parallel to the dip and the folding. One example of this is the Brushford Fault which passes along the southern edge of Exmoor and may reach the west coast under Braunton Burrows. Another type is wrench faulting, which in this area trends NW-SE or NNW-SSE. This faulting typically shows dextral movement, and is part of a swarm of such faults which cut South-West England. The best known within the AONB is the Combe Martin Fault with which may be associated the silver /lead mineralisation of Combe Martin. The Sticklepath Fault to the west of the present area is probably the most studied of these faults in S.W. England. These wrench faults are best seen crossing the cliffs and foreshore around Morte Point and to the east of this towards Combe Martin. The third type of faulting is thrusting which is not seen cropping out at the surface at all but may be deduced from geophysical data and other tectonic considerations. One such major thrust may underlie the Exmoor area carrying it northwards over Carboniferous rocks of Mendip aspect.

Mineralisation

The most important mineralisation within the AONB is that of silver bearing lead at Combe Martin. The argentiferous galena there is reputed to have been worked as early as the 13th Century but the last major working was in the time of Queen Elizabeth I. The ore is mainly associated with the Lester Slates and Sandstones and may have been formed before the main Variscan deformation. During that episode the ore bodies appear to have been folded and some of the ore redistributed within the cleavage and in fault structures such as the Combe Martin Fault.

Quaternary

Since there is no direct evidence of the occurrence of sediments of Permian to Tertiary age over Exmoor, the next proven deposition took place during the

Pleistocene with marine beach sediments from interglacial times and erratics from the glacial periods. The Saunton to Baggy Point Coast SSSI contains examples of both the beach deposits and the erratics.

It is thought that ice of the Wolstonian Stage reached the north Devon and Cornish coast and pushed up the Taw Estuary. The last glaciation of the Ice Age, the Devensian ice did not reach farther south than south Wales. The Wolstonian ice transported erratic blocks including gneiss, porphyry, dolerite and epidiorite into the area and these are now found on old shore platforms within the Saunton area. These erratics probably came in the ice from western Scotland.

Later in the geological history of the area is the establishment in the late Pleistocene and Flandrian of a river and estuary system with attendant river terrace gravels and loams as well as estuarine muds. This system bore some resemblance to the present Taw and Torridge river system.