

# QUATERNARY DEPOSITS AND LANDFORMS

by Clive Nicholas



Raised beach sandrock unconformable on Upper Devonian slates - at Saunton Sands

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## 1. BRIEF DESCRIPTION

Ice Ages, which feature the advance and retreat of ice caps and glaciers, have dominated worldwide history over the last 2.6 million years. This period of the Earth's history is known to geologists as the Quaternary. Studies of this time are crucial in understanding modern climate change. In this case the past is quite clearly the key to the present - and the future.

The photo above is of a sandy beach raised a few metres above present sea level resting on a wave-cut platform of much older slates. Other examples of raised beaches of late Quaternary age can be seen all around the Devon coastline. How can this be?

Also around the Devon coastline are estuaries known to geographers as 'rias', or 'drowned river valleys', such as Plymouth Sound and at Salcombe and Dartmouth. Sea level must have been much lower in the relatively recent past, perhaps more than 100m lower. How did that happen?

At present we are in an 'interglacial' with a relatively temperate climate and sea level is close to its highest. Conversely, when glacial advance was at its greatest and the weather at its coldest, much of the world's water was locked away in the ice sheets, so sea level was at its lowest – very much lower than today.

The fluctuating ice sheets in the coldest periods only just reached the north coast of Devon. South of this, the Devon's climate was very cold with fluctuating freezing and thawing, known as periglacial conditions. This formed a number of landscape features which can be recognised today, see the photograph gallery for examples.

## **2. GEOLOGICAL DETAIL**

There is good evidence for ice having reached North Devon. Erratic boulders ('erratic' in this case means 'from somewhere else') of a variety of different rock types foreign to Devon are known at a number of locations around the coastline. Photo QU 1 (later in this document) is of a rounded pink granite boulder over a metre in diameter, originating probably from western Scotland or Ireland, resting on the wave cut platform with the raised beach on top. Also on the wave cut platform beneath the raised beach, and therefore older, are fossil barnacles, see photo QU2.

On top of the Saunton raised beach is a deposit of 'head', seen at the top right of the photo. Head is the name for an ill-sorted mass of cobbles and pebbles in a finer matrix, generally found on top of everything else and usually regarded as a product of periglacial activity. This indicates that the raised beach was formed before the latest glaciation. The erratic blocks must therefore be from an older glaciation. Take great care if looking at these cliffs, the rocks are uneven underfoot and unstable in the cliffs and, as always, make sure to be aware of the state of the tide.

A pit has been worked for many years at Fremington (SS 529 327) feeding clay to the Brannam's Pottery at nearby Barnstaple. Sadly, the pottery closed in 2008. The pit is said to have worked 4 or 5 distinct units of clay, totalling about 10 metres in thickness. There has been disagreement about where this clay came from but scientists now think that it is from the bottom of a lake dammed by the ice along the north coast. Erratics and microfossils indicate that some of the material was derived, at least in part, from the Irish Sea Basin. It is believed to be about 450,000 years old, the time of the penultimate major glacial advance and this links in with the evidence from Saunton.

Elsewhere in Devon, evidence for periglacial conditions usually relates to the most recent glaciation, often known as the Devensian. This lasted from about 100,000 years ago to about 12,000 years ago, but its closest approach was South Wales.

Photo QU 3 of Great Staple Tor looking east from Cox Tor shows boulder runs formed by downhill solifluction (soil flow) from the tor as the frozen ground melted to a slurry. This photograph also shows 'patterned ground' nearer to the camera, another common, though less well understood effect of freezing and thawing on the flank of Cox Tor. Walk north to the tor at SX 531 762 from the large car park at Pork Hill beside the B3357 Tavistock-Princetown road on the western edge of the moor. The walk is steep and rocky needing good footwear but views make it well worthwhile.

River terraces on valley sides represent former floodplains abandoned and left at higher levels as the river valley became deepened. Terraces occur along most of Devon's river valleys as a result of past climatic and related sea-level changes (see photo QU 6). The

pattern is complex and research is ongoing. Palaeolithic implements made largely of local chert from the Upper Greensand and dated at around 200,000 years old, or earlier, have been found in the River Axe terrace gravels in East Devon.

Other human tools and bones of animals, now long extinct in Britain, are known from a range of ages in several limestone caves in South Devon. Kents Cavern at Torquay (SX 934 641), a tourist cave sensitively conserved, has yielded tools that may be as old as 500,000 years or more.

Hippopotamus and elephant remains found in peat and clay at Honiton and Barnstaple date from the last interglacial phase before the present, about 120,000 years ago and indicate that the climate then may have been significantly warmer than today.

### **3. USES**

Uses for minerals from the Quaternary in Devon are few, although nationally the industrial value of sand and gravel for construction purposes won from Quaternary river gravels and fluvio-glacial gravels (gravels from rivers associated with glaciers) is immense.

Only the Axe Valley gravels close to the Devon-Dorset border have been worked for local construction to any significant extent at Kilmington and Chard Junction.

Valley and terrace gravels of Quaternary age are present elsewhere in the river valleys of the county but they have not been worked because construction aggregates are available more readily from other deposits. There are no fluvio-glacial deposits in the county.

Small scale use of the glacial clay of Fremington in the manufacture of distinctive and much valued terracotta pottery at Barnstaple has been mentioned above but the pottery is now closed.

Not strictly a use, but especially important culturally and economically, is the value of the Quaternary landforms to the scenery and the tourism industry of Devon.

### **4. PLACES TO VISIT**

Please refer to the safety guidance about visiting geological sites on our website before visiting the places listed below.

#### **Saunton Sands and cliffs**

Location: Sea cliffs west of Saunton Sands Hotel, North Devon. Parking and bus service available.

Photo Viewpoint: Saunton Sands beach, looking north.

Ordnance Survey 1:50 000 Sheet 180, National Grid Reference: SS 442 378.

The coastline from Baggy Point south to Saunton Sands is a magnificent sight. The rocks are about 370 million years old (Devonian) and include a wide range of sedimentary rock types such as sandstones, shales, slates and limestones. The bulk of these were probably laid down in shallow marine or brackish waters. Today, the effect is impressive and the coastline boasts rugged cliffs rising in places to 60m. There is evidence of the past stresses and pressures that have been at work here, with dramatic folding and fractures in the rocks being quite common.

Of particular interest are the signs of Ice Age activity in the area. Raised platforms cut by wave action at times of high sea levels are now home to a number of large boulders transported here by ice. Some of these may have been carried considerable distances. The most famous, the Saunton Pink Granite, weighs in at 12 tonnes and is likely to have come all the way from the northwest highlands of Scotland. This can be viewed from the foreshore but if visiting the erratic please check the incoming tide as there is the risk of being cut off from the beach.

### **Braunton Burrows**

Location: Close to Saunton Sands, the same car park and bus service can be used. The SW Coastal Path and Tarka Trail cycle route run close by.  
Ordnance Survey 1:50,000 Sheet 202, National Grid Ref: SX 460 370

Braunton Burrows is one of the largest sand dune systems in Britain, about 5km long (north south) and 1½km wide, with lime-rich dunes up to 30m high. The central area of the Burrows consists of three ridges, separated by slacks. The ridges lie parallel to the shore with an overall width of 1.3km. The highest dunes and ridge occur in this region. There is much ecological interest here and most of the dune area is vegetated and considered stable. A mobile part of the dune system occurs at the rear (east side) in a fairly restricted area, Photo QU 6.

This area is part of the much larger world-class North Devon Biosphere, designated by UNESCO for its exceptional biodiversity. [www.northdevonbiosphere.org.uk/](http://www.northdevonbiosphere.org.uk/)

### **William Pengelly Cave Studies Centre and Joint Mitnor Cave, Buckfastleigh**

Location: Near the station in Buckfastleigh head uphill on the narrow and steep Russetts Lane towards the ruined church on the hilltop. Parking is available.  
Ordnance Survey 1:50,000 Sheet 202. National Grid Ref: SX 744 665

Higher Kiln Quarry and the associated field centre incorporates Joint Mitnor Cave which is famous as a prime location for cave vertebrate remains, it includes a remarkable talus cone in the cave with the richest assemblage in Britain of mammal remains from the last interglacial about 120,000 years ago, see photo QU 5. This includes straight tusked elephant, narrow-nosed rhinoceros, bison, hippopotamus and hyena. There is a display at the centre and guided tours of the cave operate during August, but best to phone beforehand.

### **Kents Cavern**

Location: In a built up area of Torquay, there are displays and a shop and restaurant at the site. A bus service operates from the town and parking is available. Directions are signposted off the main road. Guided tours of the cave operate several times a day throughout the year - [www.kents-cavern.co.uk/](http://www.kents-cavern.co.uk/). There is an admission charge.  
Ordnance Survey 1:50,000 Sheet 202, National Grid Ref: SX 934 642

Kents Cavern is fascinating for both its geology and human history. It boasts beautiful and spectacular geological formations and significant prehistoric finds, including flint hand-axes dating from over 450,000 years ago. It is one of the oldest recognisable human occupation sites in Britain.

## 5. PHOTOGRAPHS



Pink granite boulder – an ‘erratic’ - beneath the raised beach at Saunton, north Devon. Photo QU1  
© North Devon AONB



Fossil barnacles on the slate platform beneath the raised beach at Saunton, North Devon. Photo QU2  
© C Nicholas



Dartmoor periglacial features. Boulder runs at Great Staple Tor in distance; patterned ground in foreground at Cox Tor. Photo QU3  
© C Nicholas



Kents Cavern, Torquay show cave, famous for human and animal remains dating back hundreds of thousands of years. Photo QU4.  
© Kents Cavern



Joint Mitnor Cave, Buckfastleigh. Concentration of vertebrate remains on talus slope in the cave. Photo QU5.  
© Kevin Page



Three river terraces between the house and the River Exe north of Tiverton. Photo QU6.  
© Jenny Bennett