Geology and Soils

Natural Devon
Devon Local Nature Partnership

Throughout this document 'Devon' refers to the administrative area of Devon County Council and 'Torbay' refers to the administrative area of Torbay Council. Italic hyperlinks will open the interactive Devon County Council Environment Viewer.

Economic Prosperity, Health and Wellbeing

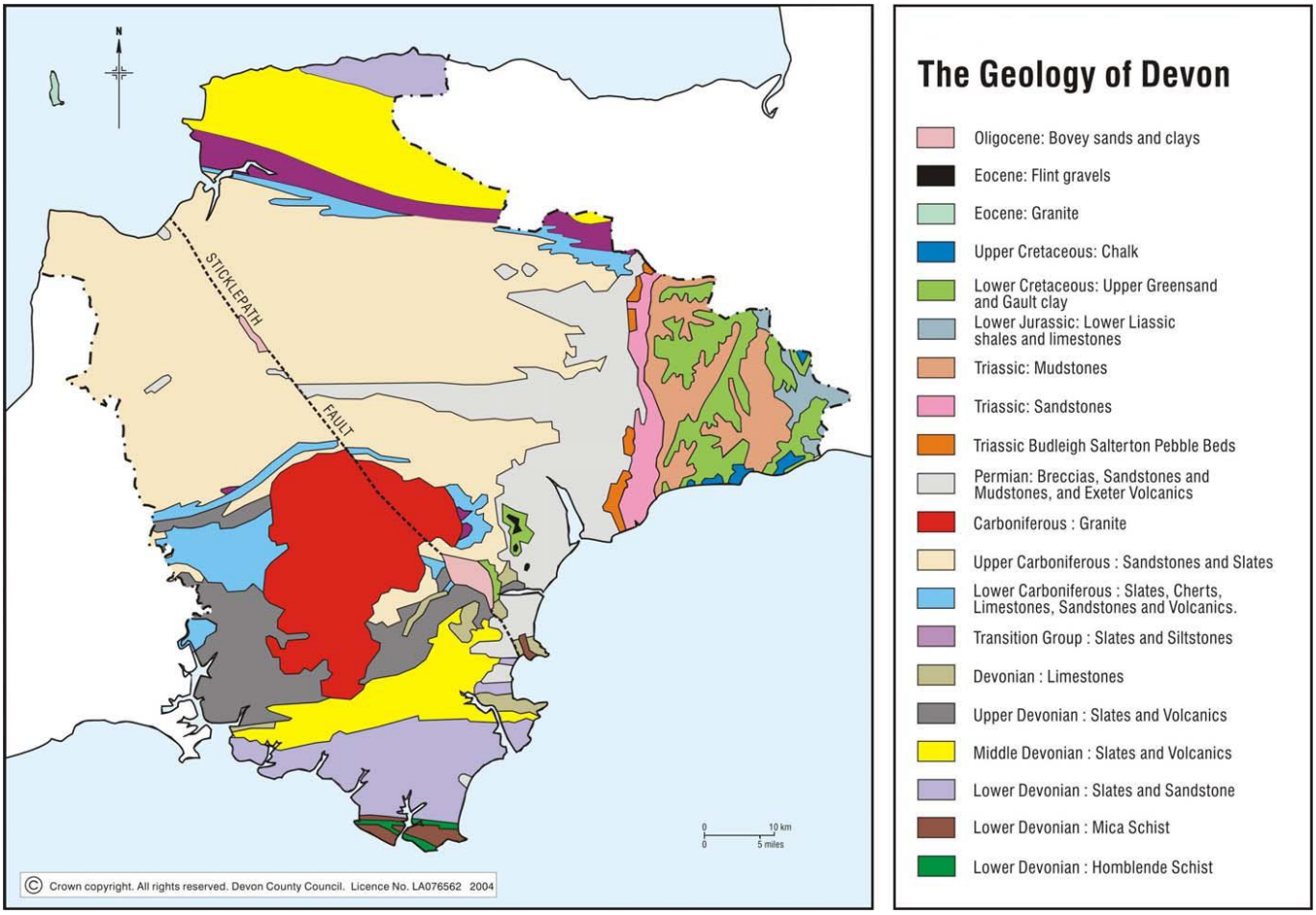
In addition to the underpinning role of geology and soil in key environmental processes (such as the hydrological cycle, carbon cycle, nitrogen cycle) geology plays an essential, but perhaps not immediately obvious, role in the global economy. Economic prosperity, as well as our health and wellbeing, is dependent on (amongst many things) clean water, agriculture, investment in technology and civil infrastructure and reliable supplies of energy and mineral resources. All of these are provided by geological processes[i]. Ultimately it is geology that governs what crops and wild plants will flourish, and why we build homes and set up industry in one place rather than another[ii]. Geological sites and features can be central to the promotion of a healthy and active lifestyle through, for example, walking on the South West Coast Path or enjoying the natural heritage of the Jurassic Coast.

The remaining chimney of the Gawton Mine, Tavistock Hamlets, which mined tin, copper and arsenic, principally between 1845 and 1887. The mine is now part of the Cornwall and West Devon Mining Landscape World Heritage Site. (Credit: Sue Watts)

Devon and Torbay's Geology

Devon and Torbay have one of the most varied geological resources in the British Isles (Map 1[iii]), reflected in the *variety of the landscapes*. Geological deposits range in age from the ancient slates of the lower part of the Devonian Period, around 410million years ago, to the most recent and still accumulating sandy and muddy deposits of its rivers and coastline. The uplands are dominated by the granite of Dartmoor and the sandstones, slates and other sedimentary rocks of Exmoor. Limestone can be found in areas along the south coast such as at Hope's Nose and Berry Head in Torbay. Around and to the east of Exeter and parts of Torbay is red sandstone, and Greensand is found on the high ridges of the Blackdowns in the east and the Haldon Hills. Chalk occurs in the Beer area in East Devon. Devon and Torbay were never covered by the glaciers of the Ice Age. As a result, the Ice

Age has a smaller effect on the landscape of Devon than most parts of Britain, and the relationship between the bedrocks and the resulting landform can be clearly seen[iv].



Map 1 - The Geology of Devon

Geological Sites

Two *World Heritage Sites*, which by definition are recognised internationally for their cultural or physical significance, are partly situated within Devon, both with a fundamental geological component. In addition, the Geopark in Torbay also receives international recognition for its rich geological, historical and cultural heritage. These listings commit members to adopt a sustainable approach to the management of the geological heritage.

The Dorset and East Devon Coast (Jurassic Coast): the cliff exposures along the Dorset and East Devon Coast provide a sequence of rock formations and fossils spanning some 185 million years of the earth's history[v].

Cornwall and West Devon Mining Landscape: the listing highlights the transformation of the Cornish and West Devon landscape in the 18th and early 19th centuries as a result of rapid growth in the pioneering copper and tin mining industries[vi].

English Riviera Geopark: unique in Western Europe, the Geopark is geologically renowned for its 350-400 million year old Marine Devonian limestones of great historical importance. It has been designated by UNESCO as part of the European and Global Geopark Network[vii].

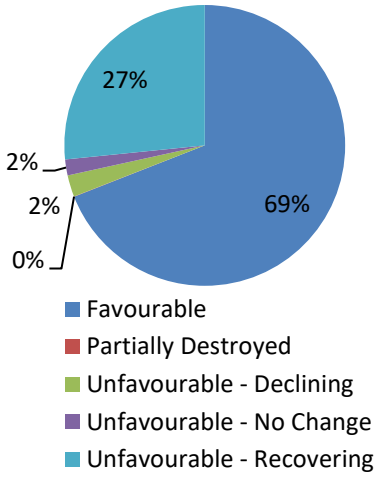


Figure 1 - Condition of SSSI Area Designated for Geological Interest

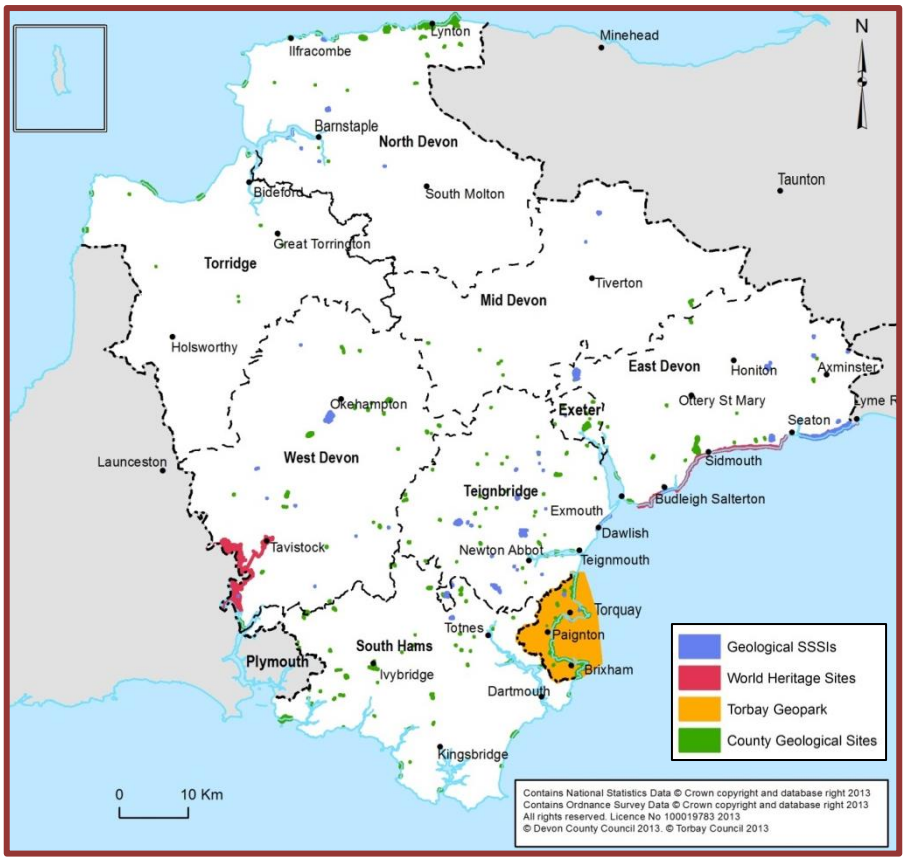
In Devon, Plymouth and Torbay 72 *Sites of Special Scientific Interest* (SSSI) are notified for their geological interest and a further 34 for a combination of wildlife and geological interest[viii]. The sites are shown on Map 2). Of those designated for geological interest, 96% of SSSI area is in 'favourable' or 'unfavourable recovering' condition (Figure 1[ix]). In addition to SSSIs, there are 365 *County Geological Sites* in Devon, Torbay and Plymouth[x].

Geological sites are extensively threatened in two main ways: firstly by degradation, such as the encroachment of scrub which obscures geological exposures; secondly by human pressure, particularly as a result of new development[xi].

Minerals of International Importance

Ball clay is one mineral of international importance found in Devon; within Britain it is found exclusively in Devon (the Bovey Basin in south Devon and the Petrockstowe Basin in north-west Devon) and the Wareham Basin in Dorset. It provides an important mineral for the international ceramics industry, pharmaceuticals and fertilisers – 84% of Britain's ball clay is exported[xii]. Also of international importance is china clay, which in the UK is only found on Dartmoor and in Cornwall, which is mainly used for paper and ceramics and production. 89% of UK china clay production is exported.

A number of areas within Devon contain areas of metalliferous mineralisation and have been worked in the past, including in the Tamar and Teign Valleys, and parts of South Hams and North Devon. Tin and copper have historically been the most productive. South west Dartmoor has one of the largest tungsten deposits in the world outside of China, which is likely to be worked again in the near future[xiii].



Map 2 – Geological Sites

Agricultural Land Classification and Soils

Due to the varied geology, Devon has a number of different soil types. Prominent types include: the wet acid soils of the Culm Measures and Blackdown Hills; the peat soils of Dartmoor; the slightly acid loams and clays of East and Mid Devon; and the free-draining, slightly acid loamy soils of the South Hams and parts of North Devon. Table 1[xiv] summarises the soils present in Devon and Torbay.

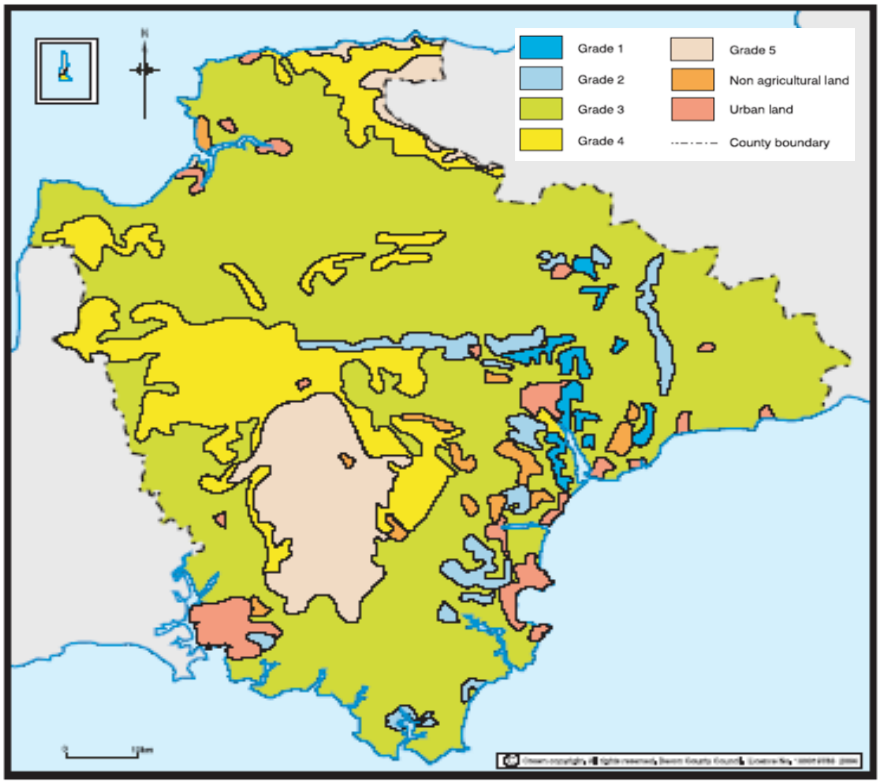
Land quality is a major factor in determining the type of agriculture an area can support. The best and most versatile agricultural land is defined as Grades 1, 2 and 3a with Grades 3b, 4 and 5 representing poorer quality agricultural land. The grading system considers climate, gradient, flood risk and the soil quality. Grade 1 land is concentrated in or close to the Exe valley, with areas of Grade 2 land also occurring in Teignbridge, to the east of Plymouth, in limited areas of the South Hams, in a belt across Mid Devon and in part of East Devon. The poorest, Grade 5 land is limited to the uplands of Dartmoor and Exmoor, while Grade 4 land occurs around their fringes, together with large parts of West Devon and Torridge, corresponding to the Culm Measures (Map 3[xv]).

The condition of many soils in the UK –fundamental to continued productivity and support of biodiversity – is considered degraded, mainly because of atmospheric deposition of pollutants and inappropriate management[xvi].

Table 1 – Soil Descriptions by Area of Devon and Torbay	
East Devon	Slightly acid loamy and clayey soils with impeded drainage – particularly concentrated on Woodbury Common; the soil type is ideal for woodland type habitats.
Exeter	Comprised mainly of freely draining and slightly acid loamy soils – the most common across Devon.
Mid Devon	A mix of freely draining slightly acid loamy soils, slowly permeable seasonally wet acid loamy and clayey soils and freely draining acid loamy soils over rock.
North Devon	Sand dune soil systems are present in and around the Estuary of River Taw and River Torridge – the largest amount of such soil in Devon.
South Hams	The majority of South Hams is comprised of freely draining slightly acid loamy soils and freely draining slightly acid by base-rich soils – similar to Torbay.
Teignbridge	Freely draining slightly acid sandy soils are present on the coast adjacent to the River Exe and some inland areas of Teignbridge.
Torbay	Torbay has two distinct soil types with areas of freely draining slightly acid but base-rich soils and areas of freely draining slightly acid loamy soils.
Torridge	Torridge is noted for its freely draining slightly acid loamy soils that comprise the majority of soil, as well as the presence of slowly permeable seasonally wet acid loamy and clayey soils that are less common across Devon.
West Devon	Areas of West Devon that do not include Dartmoor are comprised of mainly freely draining acid loamy soils over rock; a suitable environment for bracken gorse and oak woodlands.
Dartmoor	On Dartmoor there are large areas of blanket bog peat soils where wet heather and bog communities are likely to thrive.
Exmoor	As well as freely draining, slightly acid loamy soils there are freely draining very acid sandy and loamy soils, an ideal habitat for lowland dry heath communities that only have 1% coverage across England.

A sample of 1057 fields in Devon selected by farmers[xvii] identified that just 16% and 18% met Defra's pH targets (important for nutrient availability to the crop) for arable and grassland soils respectively. Almost 20% of arable samples but just 1% of grassland samples were below the recommended levels of soil organic matter (3% by volume; essential for chemical interactions within the soil). 37% and 44% of samples were below Defra's recommended levels of Phosphate and Potash (essential for crop growth) respectively.

The main threats to soil quality in Devon include erosion by flooding and surface water runoff, intensive cultivation, poor forestry practice and trampling by grazing animals[xviii].



Map 3 - Agricultural Land Classification in Devon

[i] The Geological Society (2012) *Geology and the Economy*. The Geological Society. Available at: https://www.geolsoc.org.uk/economy (Accessed 27th February 2014).

[ii] Devon County Council (2013) *Geology in Devon*. Devon County Council. Available at: http://www.devon.gov.uk/geology-in-devon-2013.pdf

[iii] Map prepared by Devon County Council

[iv] Devon County Council (Unknown). *The Geology of Devon* in Devon County Council (Unknown) *Education Register of Geological Sites*. Devon County Council. Available at: http://www.devon.gov.uk/geo-educational-register.pdf

[v] UNESCO (2013) *Dorset and East Devon Coast.* UNESCO. Available at: http://whc.unesco.org/en/list/1029 (Accessed: 16/09/2013)

[vi] UNESCO (2013) *Cornwall and West Devon Mining Landscape.* UNESCO. Available at: http://whc.unesco.org/en/list/1215 (Accessed: 16/09/2013)

[vii] UNESCO (2013) *English Riviera Geopark (United Kingdom).* UNESCO. Available at: http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/global-geoparks/members/united-kingdom/english-riviera-geopark-england/ (Accessed: 16/09/2013)

[viii] Natural England (2013) *Site of Special Scientific Interest – Search for SSSI details.* Natural England. Available at: http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm (Accessed: 12/07/2013)

[ix] Natural England (2015) *Sites of Special Scientific Interest: SSSI Condition Summary, Devon, October 2013.* Available at: http://www.sssi.naturalengland.org.uk/Special/sssi/report.cfm?category=C,CF (Accessed: 2017)

[x] Devon RIGS Group (2013) *County Geological Sites Across Devon.* Devon RIGS Group. Devon County Council (2013) *Data supplied by Devon County Council*

[xi] Devon Biodiversity Partnership (2009) *Devon Biodiversity and Geo-diversity Action Plan.* Devon BAP. Available at: http://www.devon.gov.uk/dbap-section_d.pdf (Accessed 27/04/2013)

[xii] Devon County Council (2006) *Devon's Minerals – Ball Clay: Devon County Minerals and Waste Development Framework.* Devon County Council. Available at: http://www.devon.gov.uk/mcs-ballclayfactsheet.pdf (Accessed: 17/09/2013)

[xiii] Dartmoor Preservation Association (Unknown). *Hemerdon Tungsten Mine*. Dartmoor Preservation Association. Available at: http://www.dartmoorpreservation.com/news-a-publications/archive-news/general-news-archive/19-hemerdon-tungsten-mine (Accessed 3/3/14)

[xiv] National Soil Resources Institute (2013) *Soilscapes.* Cranford University. Available at: https://www.landis.org.uk/soilscapes/ (Accessed: 02/05/2013)

[xv] Devon County Council (2004) *Devon Structure Plan 2001 to 2016*, Devon County Council

[xvi] UK National Ecosystem Assessment (2011) *The UK National Ecosystem Assessment: Synthesis of the Key Findings*. UNEP-WCMC, Cambridge. Available at: http://uknea.unep-wcmc.org/Default.aspx

[xvii]Soils for Profit (2013) *A report summarising the findings from soil samples collected by farmers in the south west*. Available at: http://www.swarmhub.co.uk/index.php?dlrid=3966

[xviii] Devon County Council (2011) *Soil and Land – Minerals Core Strategy Paper.* Devon County Council. Available at: http://www.devon.gov.uk/mcs-soilandland.pdf (Accessed: 16/10/2013)