A Geological Code of Conduct

- Anston Stones Wood is a Site of Special Scientific Interest (SSSI). It is protected by law. Do not collect specimens and take care not to damage or disturb the flora and fauna.
- Beware of dangerous cliffs and rock faces. Wear safety helmets where appropriate
- Always seek permission before entering private land. Enclose an s.a.e. when asking to visit sites
- Carefully record your findings. Note the date and exact location (national grid reference). Take photographs where possible
- Obey the country code. Remember to shut gates and leave no litter. Do not light fires.

The South Yorkshire RIGS Group aims to increase awareness and involvement in geological conservation. It consists of volunteers with an interest in the Earth sciences, including amateur and professional geologists, museum workers and local authority representatives.

The planning and implementation of this leaflet has involved the collaboration of Anston Parish Council, the South Yorkshire RIGS Group, Rotherham Metropolitan Borough Council, Groundwork Creswell and the valuable assistance of many societies and individuals.

ANSTON PARISH COUNCIL

Rotherham R RIGS

GROUNDWORK CRESWELL

All photographs by Scott Engering

Anston Stones Wood

Geological Trail

A journey through deep time

50 ha.
Local N. Res.
SSSI
pot Sched Heritage Site

Low Mag Lst on Coal Meas
Dip to E

16 locally rare plants 28 butt'fs
15 sp. ferns 73 sp. moss
20 sp liverworts 200 fungi

Archaeo.
Up. Paleolith before 8,000 BC
Bronze age
Romano-British

Coppiced since at least 1553
→ 1800's early

33 ancient woodland indicator sps

Some features of national importance

The Story of Anston Stones Wood

The geological story of Anston Stones Wood begins in the Permian Period, some 260 million years ago.

Britain lay much nearer to the equator during this remote time, before even the dinosaurs, and the world was very different. All the continents had joined together to form one enormous land mass, named Pangaea (Greek: 'All Earth').

Because of its geographical position and the radically different climatic patterns in the Permian, Britain was mostly arid, sandy desert, burning hot and hostile to life.

Nevertheless, the desert was not completely waterless. A great region of shallow, salty water - named the Zechstein Sea - stretched from England to Poland, and it is in this tropical sea that we find the origins of the rocks of Anston Stones Wood. The sea water was rich in chemicals and minerals, rather like the Dead Sea in Israel today. It was not an ideal environment for life to flourish but, although life was scarce, the sea was fringed with reefs built by countless tiny shellfish, soft-bodied animals and colonies of primitive plants. Some of these reefs remain today as distinctive pale grey, gnarled crags and fossil remains can still be found within them. The crags stand out from the thinly layered, horizontal beds of limestone which mark the traces of the ancient sea bed itself.

The Zechstein Sea dried out in the relentless heat at least four times over millions of years, only to be replenished by salty ocean water. Each time the sea vanished it left behind thick beds of pale Magnesian Limestone, seen extensively throughout this trail. The limestone is called 'Magnesian' because it is rich in the chemical element magnesium which became concentrated as the sea evaporated. Eventually it transformed the calcium carbonate of 'normal' limestone into the mineral dolomite.

During the final stages of evaporation, the concentration of salts in the water increased still further. All marine life died out and thick beds of gypsum, halite (rock salt) and potash were laid down.

We can leave the story of Anston Stones Wood for the next 260 million years! New geological periods came and went, burying the Magnesian Limestone deep below the earth until processes of earth movement, erosion and weathering brought the now ancient Permian rocks once again to the surface. The next chapter in the story takes place during the first part of our own geological period - the Quaternary.

The continents were now very close to the positions they occupy today. For complex reasons still not fully understood, changing ocean currents had caused a long slow cooling of the Earth over a period of 30 million years. Ice caps had formed at the poles and, 1.5 to 2 million years ago, Britain was gripped by the first of a series of ice ages, which lasted intermittently until only 10,000 years before the present day.

Ice-sheets and glaciers covered the land, scouring and transporting vast amounts of rock and soil. However, the last glaciation was not so severe and covered only the mountainous areas of Wales and northern England. Anston Stones Wood was free from ice in this last phase, but torrential glacial meltwater rivers, laden with angular and abrasive rock debris, flowed over the ancient Permian landscape and cut rapidly and deeply into the Magnesian Limestone to form the beautiful gorge we know today.

During the warm intervals between Ice Ages, life was abundant. Elephants, bears, hippopotamus and hyenas roamed freely in the area and Man finally appeared, to fashion tools from stone and hunt down these large mammals. He also used the area as shelter, most famously at nearby Creswell Crags.

The tropical Zechstein Sea might now be silent stone, and the once mighty glacial torrent is now reduced to a mere trickle but geological processes never stop. Who can imagine what huge changes are in store for Anston Stones Wood over the next 260 million years?

Anston Stones Wood

Geological Trail

1 Granite Setts

The embankment wall provides an unusual example of reused road setts (cobbles). In contrast to the pale limestone of the gorge, you find a range of rocks here from as far away as the Channel Islands and the Lake District. These stones formed deep below the Earth's surface from slowly cooling molten rock (magma).

See how different minerals create a range of colours and textures, but all of them are hard and durable.

2 Railway Bridge

Two different types of building stone are found in the bridge and retaining walls. The walling is local Magnesian Limestone and the coping stones are Millstone Grit from the Pennines. The arch is built from the renowned Staffordshire Blue engineering bricks, which are valued for their strength and durability and have been used in bridges all over England.

Look at the craggy outcrops of limestone all along the south side of the gorge, sometimes forming dramatic cliffs with large fallen rocks.

3 Reef Limestones

This prominent gnarled landform is the remains of an ancient reef which survived at the edge of the shallow, warm and very salty Zechstein Sea. The climate of Britain was hot and dry at this time, 260 million years ago. Animal life was scarce, but the remains of shellfish and colonies of primitive organisms can be found.

Looking across the gorge, notice the large blocks of rock that have been undermined by erosion and have slipped down the hillside.

4 The Cut

The Magnesian Limestone here, seen on both sides of the path, was laid down in thin horizontal layers, in sharp contrast to the formless reef limestone. These layers record a series of original Zechstein Sea-beds, laid one on top of the other.

They contain abundant ripple marks, evidence of tides and currents gently shifting the ancient sediments.

5 Meander

The brook flows much slower here than through the gorge. It has changed course numerous times over the years, leaving thick deposits of silt behind.

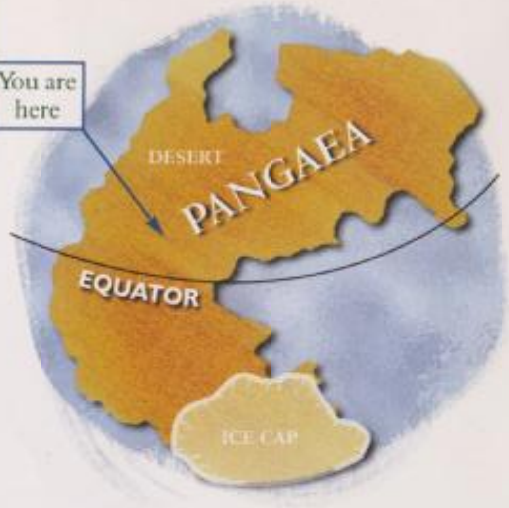
Where the meandering stream channel cuts through the bank, layers of silt and decomposing plant remains are exposed. In the stream bed and near to the banks, pebbles have been sorted and graded by the current and miniature rapids may be seen, where the flow of the water is disrupted by small outcrops of hard limestone hidden below the water's surface.

my = millions of years ago

- 250 my — PERMIAN
- 290 my — CARBONIFEROUS
- 355 my — DEVONIAN
- 405 my — SILURIAN
- 435 my — ORDOVICIAN
- 510 my — CAMBRIAN
- 570 my — PRECAMBRIAN

Palaeozoic Era

4600 Myr = Age of Earth



The Supercontinent Pangaea

The Permian

Pangaea formed 280 million years ago through the process of plate tectonics. Africa drifted north and crashed into Europe, causing widespread earthquakes and buckling the British landscape to create the Pennines and the bodies of granite now exposed in Cornwall and Devon.

Desert conditions prevailed in Britain, complemented by an extensive salty sea, which evaporated several times towards the end of the period.

With no ocean barriers to prevent migration, animal life evolved and spread rapidly on land, in particular many types of insects and reptiles. Some reptiles even began to show primitive mammal-like features. Where plant life flourished, conifers were dominant.

The Permian ended dramatically, 250 million years ago, with the extinction of up to 95% of all species both on the land and in the sea.

- 0 — HOLOCENE
- 10,000 yrs — PLEISTOCENE

Quaternary

- 1.8 my — PLIOCENE
- 6 my — MIOCENE
- 23 my — OLIGOCENE
- 38 my — EOCENE
- 56 my — PALAEOCENE

Tertiary

Cainozoic Era

- 65 my — CRETACEOUS
- 135 my — JURASSIC
- 205 my — TRIASSIC

Mesozoic Era

250 my

Britain during the last Glaciation

The Pleistocene

The existence of polar ice caps are relatively rare in geological history, marking periods when global temperatures were lower than normal. The causes of ice ages are fiercely debated, but may involve the pattern of continents around polar regions, changing ocean currents and oscillations in the Earth's orbit.

The Pleistocene Ice Age was a series of cold periods separated by warm "interglacials", when the climate was as warm, sometimes much warmer, than it is today. At its greatest extent, the northern ice sheet covered all but the most southern part of Britain.

As the ice retreated, humans (*Homo sapiens*) - a species which had evolved in the Pleistocene - migrated to settle on the newly exposed land, becoming the first inhabitants of Britain.

They lived by hunting the diverse wildlife in the area, including reindeer, bison and woolly mammoth.