# A Visitors' Guide to the geology at Lepe Country Park, Hampshire

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QRA
Quaternary Research Association

http://qra.org.uk/

# Lepe Country Park, Hampshire
# Geological Site of Special Scientific Interest (SSSI)

Preserved in the cliffs and foreshore at Lepe Country Park, Hampshire is a record of past environments spanning c. 200,000 to 30,000 years ago. This guide outlines the geology and explains the evidence for the environmental changes that have occurred. A separate worksheet available from the Park Office suggests two activities that can be undertaken by school groups with equipment available from the Park Office and funded by the Quaternary Research Association (QRA) as part of their Outreach activities. The QRA website (www.qra.org.uk) outreach section contains information about how the evidence at Lepe can be used in school curricula.

## *Overview of Quaternary geology*

### The Solent in the Ice Age

Over the last two million years (the 'Ice Age'), large ice-sheets have expanded and contracted across the northern Hemisphere, causing sea levels to fluctuate by 150-200 m worldwide, and huge shifts in plants and animals (Figure 1). Climate during the last two million years is separated into 'warm stages' with high sea levels like that at the present day; and 'cold stages' with low sea levels, when the landscape was very different.

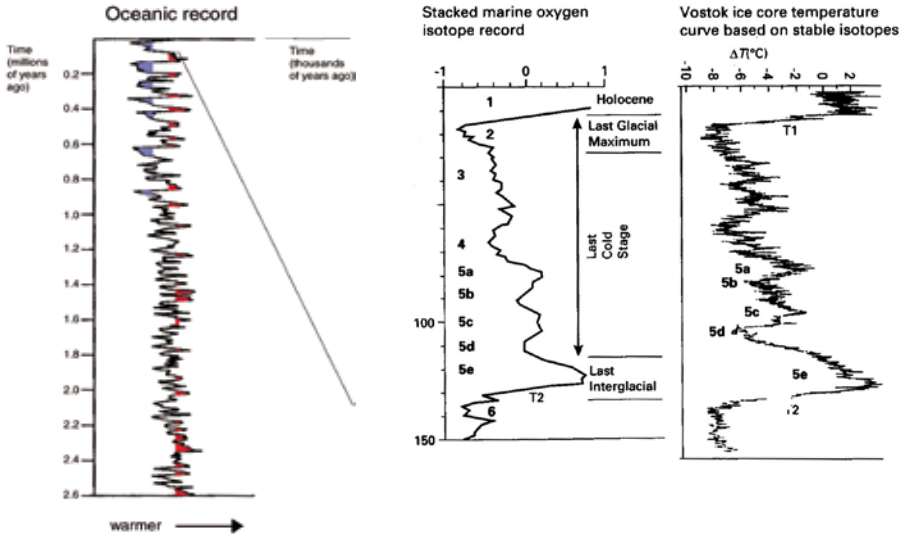



Figure 1 Record of cold and warm stages over the last two million years, with an inset of global ice volume changes (stacked marine isotope record) and temperature (Vostok ice core record) over the last 150,000 years (the time span represented at Lepe Country Park).

Figure 2 A braided river in Arctic Canada

The Solent seaway was once the route of a large river system similar in size to the Thames. This was confluent with the River Test at the junction of the Solent and Southampton Water. During 'cold stages', the Solent was a river, flowing southeast past the Isle of Wight to a large river system in the English Channel. This river was similar to rivers found in Arctic Canada at the present day (see Figure 2). It transported large amounts of gravel in lots of shallow (braided) channels. This gravel is found in the current cliffs at Lepe Country Park, Barton on Sea, near Lee-on-the-Solent and at many other locations in the New Forest and along Southampton Water. The ground would have been frozen for most of the year, and the river would only have flowed in the spring. During 'warm stages', the Solent would have been an estuary rather than the inland seaway it is at the present day. Otherwise, the landscape would have been similar to the present day.

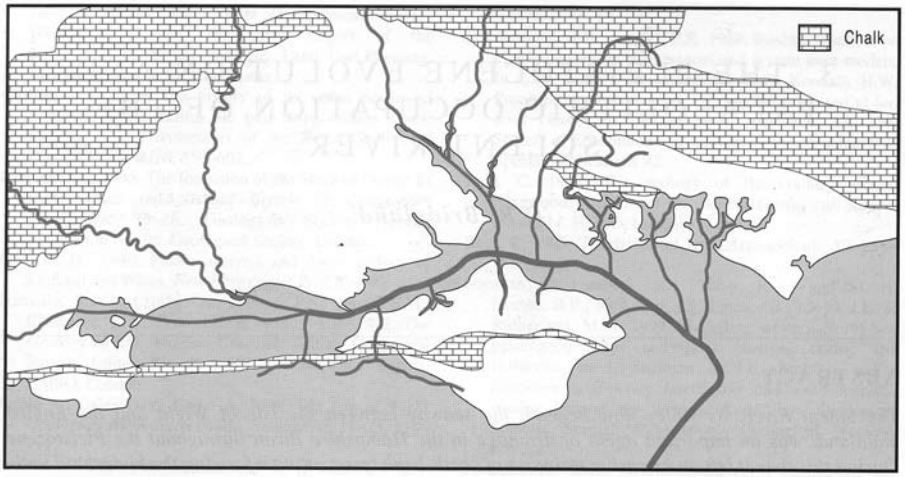



Figure 3 Route of the former Solent River before the Wight-Purbeck ridge was breached, before about 100,000 years ago.

In early parts of the Ice Age, there was a chalk ridge (the 'Wight-Purbeck ridge') that connected the Isle of Wight to the mainland and made the Solent a river system at times of low sea level and a sheltered estuary when sea level was high (Figure 3). More recently (in the last 100,000 years or so when sea level was low), this ridge was breached, and the Solent has been an inland seaway since sea level rose approximately 10,000 years ago (Figure 4).

## The sequence at Lepe Country Park

The geological sequence at Lepe Country Park includes deposits from both cold and warm stages dating from c. 200,000 to 30,000 years. A lower gravel is overlain by a thick sequence of clay and peat, then a thin bed of sand and silt and a final upper gravel, as shown in Figure 5. The gravels were laid down by the Solent river during cold stages with lowered sea level. The clay was deposited in a channel during a warm stage, the location of which is shown in Figure 6. Various fossils have been found within the channel: pollen grains, snail shells, seeds, beetles, small aquatic creatures called ostracods and foraminifera, algae called diatoms.

Recent work by an English Heritage-funded project called the Palaeolithic Archaeology of the Sussex / Hampshire Coastal Corridor project has reinvestigated these sediments and made the following findings:

- Using optically-stimulated luminescence (OSL) dating (see below) the lower gravel was found to have been deposited between 210,000 and 125,000 years ago, during marine isotope stage 6 (see Figure 1 and 7).
- OSL dating has also shown the upper gravel to have been deposited between 65,000 and 40,000 years ago, during marine isotope stage 4 (see Figure 1 and 7).

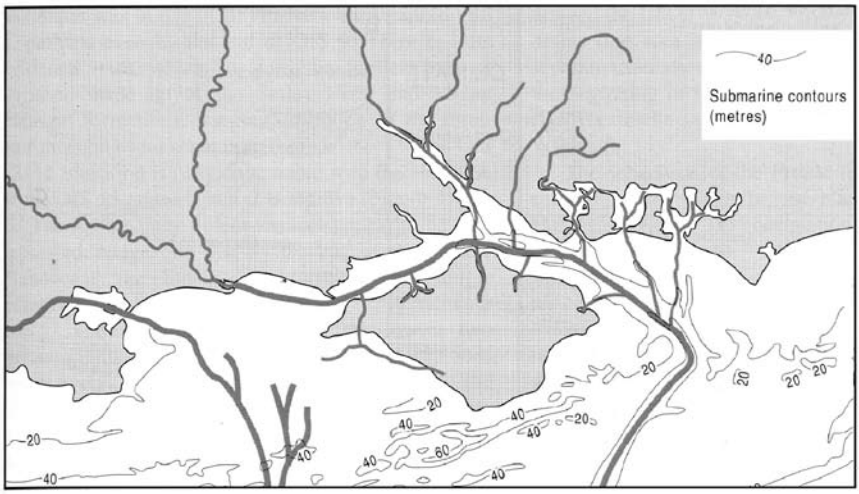



Figure 4 Route of the Solent river after breaching of the Wight-Purbeck ridge, during the last glacial period (c. 110,000 – 10,000 years ago). Since 10,000 years ago, the Solent has been an inland seaway.

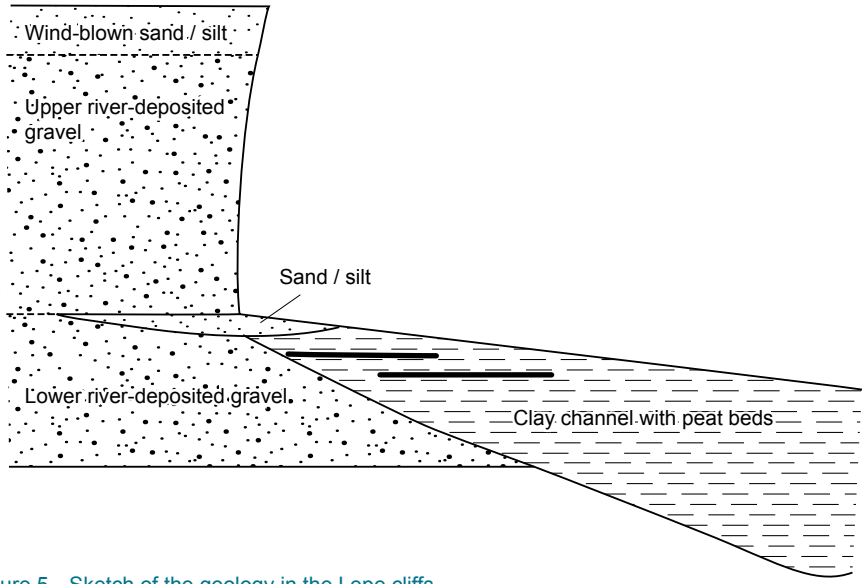



Figure 5 Sketch of the geology in the Lepe cliffs.

- The clay channel was therefore filled during the last interglacial (marine isotope stage 5e, see Figure 1).

Fossil analysis of the clay channel shows that the local environment changed during the lengthy period that sediment was deposited within it (the top of the clay sequence is seen in Figure 8), as follows:

**Base of sequence** *(c. 8.5 m below present day sea level (Ordnance Datum))*
- freshwater fen
- regional grass and pine vegetation

**Just above base of sequence** *(c. 8.2 m below Ordnance Datum)*
- intertidal mudflat with some freshwater influence
- regional vegetation again dominated by grasses and pine trees.

**Most of sequence** *(c. 8 m below Ordnance Datum upwards)*
- brackish tidal creek, grading upwards into a more open intertidal flat with lower salinity and development of saltmarsh habitats.
- regional vegetation changes upwards from being dominated by grasses, pine and birch to a mixed-oak woodland with a significant hazel component.

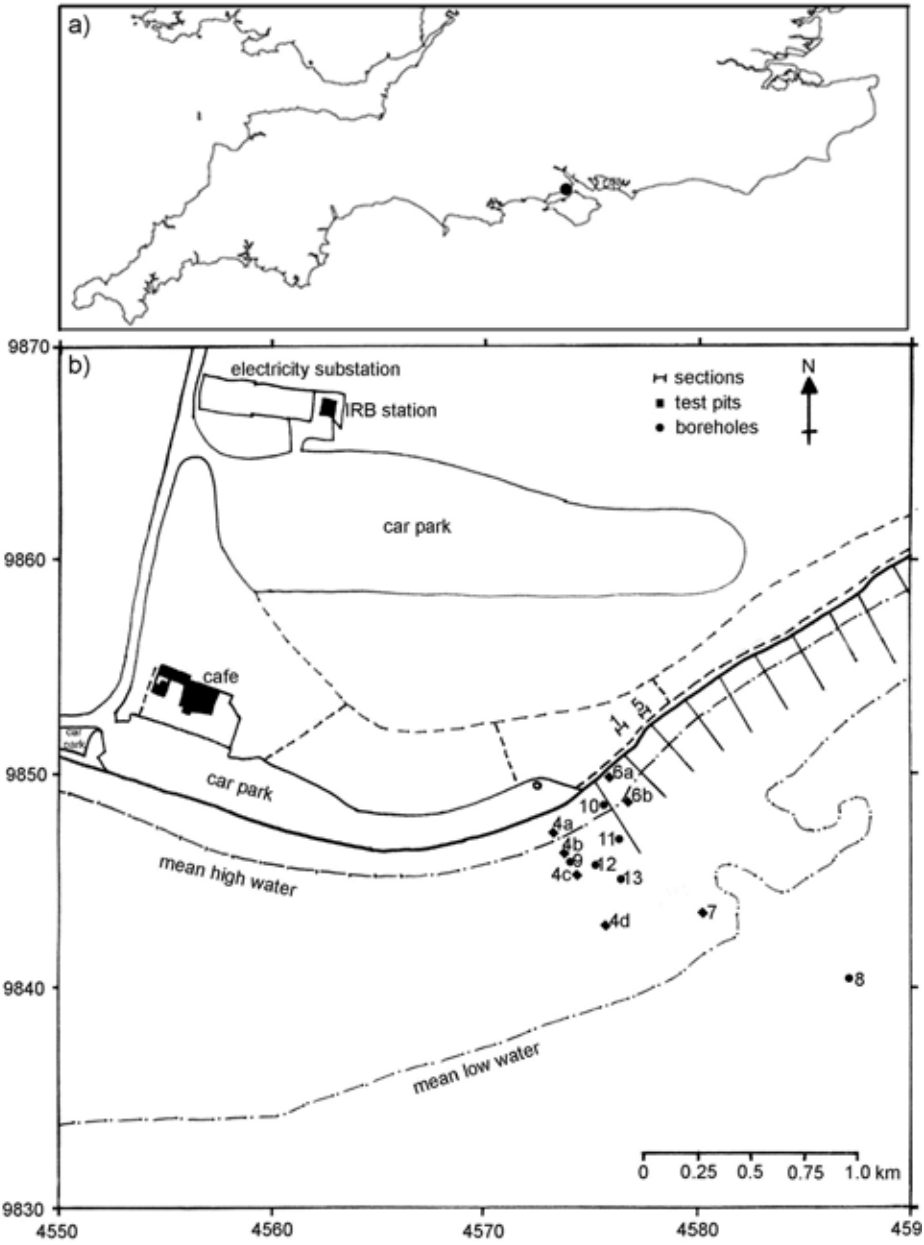



Figure 6 Map showing the location of recent PASHCC investigations at Lepe, showing by implication the location and extent of the clay channel deposits.

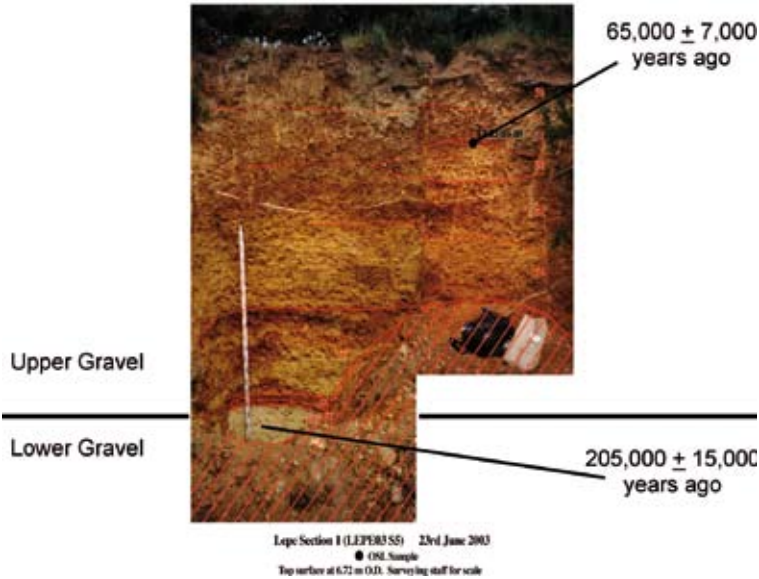
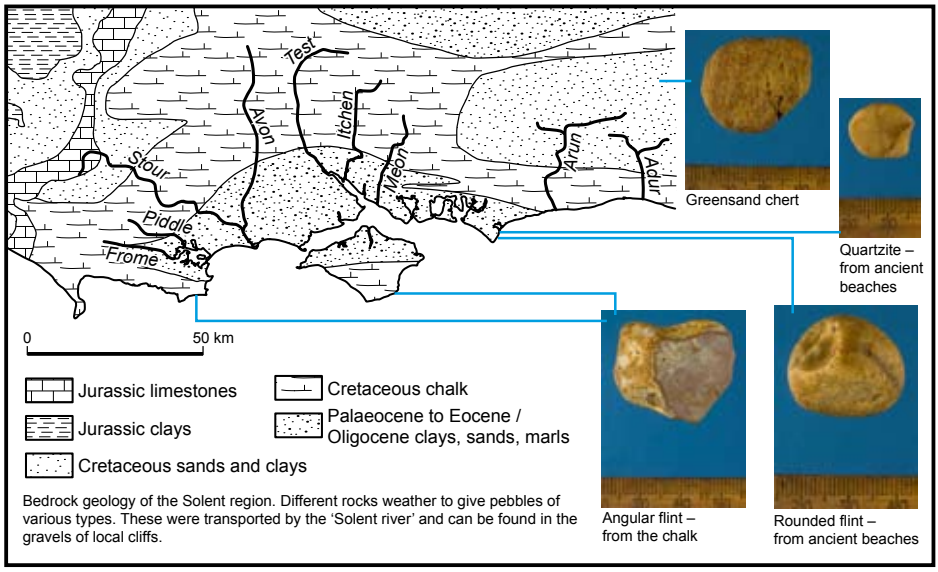



Figure 7 Upper and lower gravels at Lepe Country Park, Hampshire, showing age estimates using OSL dating.

Figure 8 Upper part of the clay channel, as exposed in a trench cut through the top of the beach, showing peat beds and the thin sand / silt bed also seen between the two gravels in the cliff.

## OSL dating – what is it?

- Each grain of sand in the cliff carries a signal that tells us how long ago the rivers that laid down the gravel were flowing.
- When the sand grain was buried, it was bombarded by radiation from the surrounding sediments.
- This causes electrons within the quartz of the sand grain to become trapped in the structure of the mineral.
- The amount of electrons trapped in the sand grain is proportional to the amount of time the sand grain has been buried – older grains have more trapped electrons.
- We measure these electrons in the laboratory by shining light on our samples. This means that we have to keep our samples in the dark from the time we collect them to the time we measure them.
- We then calculate the age because we know how radioactive the sediment is, and therefore how long it would have taken to build up that many electrons.




Bedrock geology of the Solent region. Different rocks weather to give pebbles of various types. These were transported by the 'Solent river' and can be found in the gravels of local cliffs.

Figure 9 Common rock types in the gravels and the local geology that they have come from.