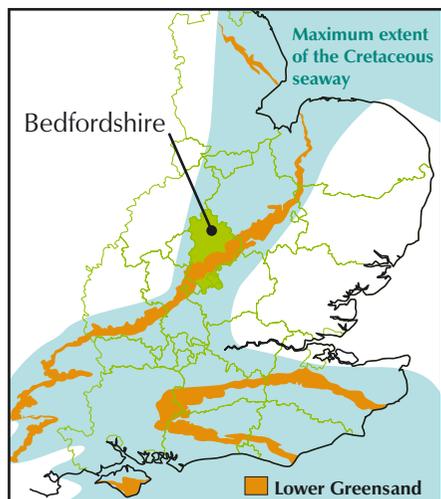


## The Lower Greensand Formation

The Lower Greensand Formation outcrops from Hunstanton in Norfolk, through Cambridgeshire, Bedfordshire, Buckinghamshire and southwards to the Isle of Wight. The sediments comprise a set of sands, sandstones, silts, clays and ironstones that change in character across the region. They were deposited in the early Cretaceous from c. 115 million years ago (during the late Aptian, *nutfieldienseis* Zone, to the early Albian, *mammillatum* Zone).

### Regional setting

In southern England, the topmost Jurassic and lowermost Cretaceous sediments (the Purbeck and Wealden deposits and other sediments up to Barremian in age) were deposited in continental lagoonal, lacustrine and fluvial conditions. During the earliest Cretaceous what is now Norfolk and Bedfordshire was part of the London Platform. The phosphate pebble bed found at the base of the Lower Greensand from Great Brickhill (Bucks) to Potton (Beds) and Upware (Cambs) are evidence of an early pulse of the sea-level rise that eventually flooded this region. These reworked phosphatised marine fossils were one of the 'coprolite' beds exploited for fertiliser production during the late 1800s to early 1900s. During the Aptian the sea transgressed over a deeply eroded surface forming a shallow, tidal seaway.



## The Bedfordshire & Luton Geology Group

We exist to encourage understanding of the geology and geomorphology of the county and to undertake site recording, interpretation, advice and education. We aim to:

- Protect local geological and geomorphological sites
- Encourage public enjoyment of rocks, fossils and landscape
- Encourage the use of RIGS\* sites by the public, by schools and local groups
- Keep a listing of RIGS sites in Bedfordshire
- Provide information for potential users of sites
- Encourage landowners to participate in the scheme
- Involve landowners and users of RIGS in good practice and management

### What are RIGS?

Regionally Important Geological and Geomorphological Sites, places that reveal our geological past and are considered important enough to deserve conservation. They include sites where rocks can be seen (such as quarries and road cuttings) or where the geology or geological processes can be inferred from the shape of the landscape. Even buildings made of local stone can be RIGS! Official RIGS are recognised by county councils and by Natural England (the statutory nature conservation body of England).

### How to contact us

For more information about the BLGG and our events as well as the geology and geomorphology of your area visit our website at

[www.bedsrigs.org.uk](http://www.bedsrigs.org.uk)

or contact Chris Andrew c/o Bedford Museum,  
Castle Lane, Bedford, Bedfordshire MK40 3XD.  
Tel: 01234 353323; Fax: 01234 273401



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# The Lower Greensand for geologists



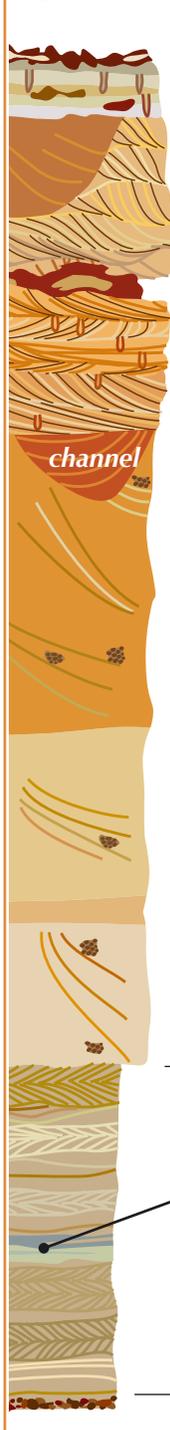
Stone Lane Quarry, Heath & Reach.

The Lower Greensand formation is known as the **Woburn Sands** in Bedfordshire and Cambridgeshire.

The *Silver Sands* (above) is perhaps the best-known of the Woburn Sands.



## A generalised section through the Lower Greensand



### Ironstone and Shenley Limestone

**The Silty Beds** appear only in the Heath & Reach area.

### The Red Sands

The base of the Red Sands shows trace fossils including *Planolites*, *Teichnichus*, *Skolithus*, *Ophiomorpha*, *Macronichus* and echinoid burrows. Sedimentation was too rapid later on to allow organisms time to burrow.

**The Silver Sands** contain abundant wood, largely from cycads, tree ferns and pteridophytes. The wood is preserved in several different ways: charcoal (indicating forest fires), lignite (often in pyrite coated nodules, testifying to rapid deposition), limonite or haematite cemented nodules, and tree trunks. Evidence of the newly evolved angiosperms is a very rare occurrence in the Aptian fossil record, which makes the search in these sands particularly exciting!

**The Brown Sands** appear across Bedfordshire, but are at their best in the Heath & Reach area.

Seams of Fuller's Earth (a bentonite clay derived from re-worked ash) preserved within the Brown Sands are evidence of volcanic eruptions in northwest Europe.

**Phosphate pebble bed**

The Lower Greensand of Bedfordshire is informally divided into the Red Sands and Silver Sands (*Upper Woburn Sands*) and the Brown Sands (*Lower Woburn Sands*). The sands are up to 120m thick in total and fill a 25-30km wide NE-SW trending trough. The formation also includes the Silty Beds, in which the uppermost ironstone horizon contains the Shenley Limestone.

**The Silty Beds** are up to 10m thick, comprising silts, sands, muds, and ironstone beds containing carbonaceous material as well as pyritised, glauconitic and otherwise preserved body and trace fossils. Some beds are highly bioturbated. Others include fine parallel-lamination, small cross-stratification, soft sediment deformation, fine ripple lamination and flaser bedding, all evidence of fast-moving currents. The clay palynoflora was largely freshwater with some brackish forms. All the evidence suggests an intertidal flat environment with early diagenetic ironstone formation.

The *Shenley Limestone* is a bioclastic limestone filling cavities in the topmost ironstone. It is a highly unusual micrite, full of poorly sorted clasts (pebbles and sand) and many fossils, largely cementing/attaching animals such as bryozoa, brachiopods or serpulids, with abundant echinoid spines and rare (possibly reworked) ammonites. This is a marine deposit, a very nearshore accumulation resulting from still water deposition (micrite) with high-energy currents or waves adding pebbles and debris.

**The Red Sands** are found only in the Leighton Buzzard area. These are largely quartz, distinguished from the other sands by the presence of c. 1mm ooliths composed of goethite, an iron mineral. The alternate black (goethite-rich) laminae and pale (quartz) laminae highlight the very large-scale cross-stratification. The evidence suggests these sands formed as c. 8m high dunes in channels up to 100m wide cut into the other sands by fast-moving water flowing from west to east.



Red Sands, Pratt's Pit, Heath & Reach.

### Silver Sands

Pure quartz mineralogy (including rose quartz, citrine and rarer amethyst) clearly distinguishes these from the underlying Brown Sands. They are coarse-grained with granule horizons, and large-scale cross-stratification (20cm up to 2m). The palaeocurrent direction was predominantly to the SSW, but – as for the Brown Sands – it can be bidirectional, indicating the estuary influence is still locally important. However, all the sediment and fossil evidence points to the Silver Sands forming as a sand bar at the offshore mouth of the estuary.

### Brown Sands

The most notable feature of the Brown Sands is the thin (c. 20cm) beds that show distinctive bidirectional (herringbone) cross-stratification. The cross-stratification and well-developed ripples are highlighted by clay drapes, which show the 'tidal bundles' formed during the spring-neap tidal cycles over a Cretaceous fortnight. These are exceptional – where else could you see 14 days of history formed 115 million years ago!

The sands are fine-grained, micaceous, and usually beige in colour. They commonly include limonite cemented wood fragments and other iron nodules and iron pan horizons. The Brown Sands are notable for abundant trace fossils including *Taenidium*, *Siphonites*, *Planolites*, *Rhizocorallium* and *Teichnichus*. The clay horizons have been analysed for palynoflora, which proved to be particularly rich in brackish species and terrestrially-derived pteridophyte spores, with some freshwater algae. This evidence, together with the sedimentary structures, indicates a nearshore estuary mouth location.



Mud drapes in the Brown Sands.