HASTINGS FIELD WEEKEND, September 2003
Mole Valley and Bath Geological Societies

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We arrived in bright sunshine at the Strand Guest House in Winchelsea on Friday 19th September to be greeted by members of our own Society and our friends from Mole Valley. The weekend had been ably organised by Joanne Cassidy and other members of the Mole Valley Society committee. The arrangements were perfect for not only was the Strand Inn delightful with its timber beams, tiny rooms and quaint sloping ceilings, walls and wardrobes but Joanne had even arranged for an excellent restaurant, the Bridge Inn, to be just opposite.

The field weekend was expertly led by Ken Brooks whose book *'Geology and Fossils of the Hastings Area'* is to be recommended. On Saturday morning, we met at the Ore Centre in Hastings for an introductory illustrated talk by Ken before we set off for our first site, Pett Level, on the coast between Hastings and Winchelsea. During the weekend we would be looking at rocks from the Lower Cretaceous, c.140 - 120 million years old. Our area at the beginning of this time was at approximately 40^0N and experiencing a sub-tropical climate.

Pett Level TQ 890133

The small bay here is surrounded by sandstone cliffs of the Cliff End Sandstone (c.10m thick) within the Wadhurst Clay, *(sequence shown on the right)*. Text-book normal faults were evident in the cliffs and the sandstone near the top is stained very dark grey by carbonised plant material, *(photograph 1)*. Ken believes this represents fusain or the charcoal from forest fires. There is also much evidence of vertical roots.

Photograph 1: Carbonised vegetation

Also notable in this bay are the remains of a submerged forest, *(photograph 2)* which can be seen in the mud and sand when the tide is out. Carbon dating of trees such as oak, alder and hazel has given the trees an age of 5000 years. Perhaps Stone Age people walked though this forest in search of food?

Sequence:

Drift deposit - glacial material (seen on top of cliffs at Pett Level)

Lower Cretaceous (Hastings Beds)
Wadhurst Clay - shale/clay
Cliff End Sandstone - sandstone unit of c.10m within Wadhurst Clay
Upper Ashdown Formation - sandstone
Lower Ashdown Formation - Fairlight Clay

Photograph 2: Submerged Forest, Pett Level
Cliffs show, from the top - glacial material, Wadhurst Clay, Cliff End Sandstone and Upper Ashdown Sandstone

As we continued south west towards Fairlight Cove, we saw that the Wadhurst Clay shales contained thin lenses of a very coarse sandstone, the Cliff End Bone Bed. Once we had recognised it, we found many examples on the beach at a safe distance from the crumbling cliffs. To our delight this rock contained small teeth of the fish *Lepidotes* and the shark *Hybodus*. Between us, we also found bivalves, carbonised plant fragments, fish scales and even crocodile teeth. Obviously a lot of material was picked up, possibly by flood water, moved along and so jumbled up. Ken told us that it was possible to find tiny teeth from the earliest rodents. Remember that this was still 'The Age of the Dinosaurs'; 'The Age of the Mammals' was yet to come.

We next looked at the basal Wadhurst Clay Ironstone, below the Cliff End Sandstones. This was extremely important as a source of iron-ore for the Wealden iron industry in medieval times.

It is not simply the finding of rocks and fossils but the palaeoenvironment that they reveal that has always fascinated me about geology and we were rapidly gathering evidence to put together a picture of dense vegetation in a low-lying river environment. Our next find gave us another piece of evidence - casts of narrow water channels or gutters, *(photograph 3)*. These snake-like structures were all trending one way. They must have been carved as thin grooves by flowing water on a flood plain or river delta. These grooves eventually filled up with sediments which hardened into the casts.

Photograph 3: Gutter casts

Ken had told us that there were siltstones with a 'churned-up' appearance where a number of Iguanodon had left footprints and toe impressions. There were other curved grooves which have been interpreted as dinosaur tail drag marks. We gazed at all these with some scepticism but were totally convinced further along the beach, near Haddock's reverse fault, where there were several small, three-toed footprints preserved on a bedding plane. They were about 15cm long from heel to toe and were much more bird-like than Iguanodon footprints. It was here that we decided to stop and where Joanne found that she had chosen to sit on a massive footprint to eat her lunch! (*Photograph 4*).

Photograph 4: Tetrapod footprint

We could not believe our good fortune and thought at first that Ken and Joanne had arranged the discovery. However, they assured us that this was not the case. The footprint is likely to have been made by a large theropod dinosaur. No doubt it fancied the smaller bird-like ones for its dinner. As we were staring in awe at Joanne's remarkable find, Ken told us that recent discoveries on his beach include a turtle's carapace, dinosaur vertebrae and a rib, about 80cm in length.

Again we found much evidence of plants remains, especially horsetails (Calamites, *photograph 5*) along this beach. Opposite the reverse fault there is an outcrop of iron-stained sandstone containing carbonised horsetail rhizomes and stems still in their original growth position.

Photograph 5: Ironstained horsetail stems

Haddock's reverse fault shows the older Ashdown Sandstone pushed up against the younger Cliff End Sandstone. We also noted sedimentary structures, giving us more clues to palaeoenvironment. These included wedge-shaped point-bar deposits which formed when sediments built up on the inside of a river meander. There were also cross sections of channels, eroded by fast-flowing streams and showing first deposited sands and then silts as the current slowed. There were also excellent examples of cross bedding and ripple marks. I wish I could include all the photographs of these structures.

In Fairlight Cove we observed the tragic consequences of coastal erosion. During the last 100 years the average rate of erosion here has been about 1m per year. The local authorities have now built a rip-rap barrier of huge boulders of larvikite from Norway. At least these foreign rocks gave us a chance to do a bit of igneous petrology as well as sedimentary. It seems that the protection plan is working because, as the rate of erosion has decreased, vegetation is now growing on a well established scree slope on the cliffs behind the barrier.

Fairlight Reverse Fault, now covered by landslip, is shown by an abrupt change from vertical sandstone cliffs of the Upper Ashdown to the sloping clays of the Lower Ashdown or locally, the Fairlight Clays. These can be

identified by the red, purple and yellow staining produced by oxidation of dissolved iron minerals in groundwater. Ken told us that the Fairlight Clays were once famous for the variety of ferns preserved in them but it is now difficult to find good specimens. There were lots of fragments, however, fronds of *Onychiopsis* and *Weichselia*.

The Fairlight Clays are fine-grained and suggest deposition in slow-moving water. The Upper Ashdown sandstones, however, suggest that they were deposited in braided streams and meandering rivers on flood plains. It is suggested that deposition conditions changed and the massive beds of sandstone reflect the subsequent erosion of an uplifted London area as rivers cut down so bringing coarser material to the flood plains. The rivers flowed into lakes and deposited their load to form deltas and the thickness of the deposits suggest a steady supply of land derived sediment into a subsiding area for a very long time. The land would periodically flood during the wet season and so layers of silt and sand would settle in horizontal beds. As the floodwater drained away it left small water channels (gutters, mentioned previously) in soft, muddy silts. Sand ripples, plant roots and, of course, dinosaur footprints provide the evidence for these conditions. We found no evidence of any marine organisms and it appears that the area was cut off completely from the sea while these sediments were deposited.

Rock-a-Nore TQ 831095

On Sunday morning we studied the cliffs just east of Hastings. These cliffs are formed of massive sandstone of the Upper Ashdown Formation overlain by shales and sandstones of the Wadhurst Clay Beds. There are distinct junctions between one horizontal bed and another and these usually mark times of erosion. Our first finds were fragments of small ferns and flattened branches of carbonised wood within a silty mudstone. We also found specimens of the fresh-water gastropod, *Viviparis*. Today, its descendants lives in ponds and streams. Many of us found the tiny bivalve shells of *Neomiodon*. Some bedding planes in the sandstones appeared to be covered with it. New to me were the remains of conchostracans, small crustaceans often described as clam shrimps. These were enclosed in shell-like carapaces, usually measuring about 7mm in length. I thought they were bivalve shells.

Fish and reptile remains can also be found along this stretch of coastline. We found a fin spine and numerous scales of the fish Lepidotes *(photograph 6)* and also a scute or horn-like plate, *(photograph 7)* from a turtle shell. Bones and teeth of crocodiles can also be found but were not found by us.

Readers of this article will find it hard to believe that as we were once again eating our lunch, there was another cry from Joanne. Yes, she was sitting on another three-toed footprint! *(Photograph 8)*. Ken thought this probably belonged to *Iguanodon* and the creature had been walking by the river or lakeside. Its footprint dried quickly in the hot sun and the impression was later filled with sand or silt.

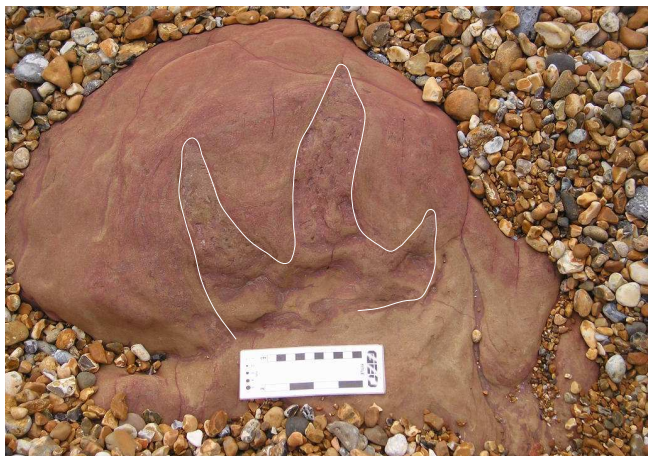
Photograph 6: Lepidotes scales

Photograph 7: Turtle scute

About half a kilometre along the coast we found some very good specimens of the horsetail *Equisetes*. Some were about 4cm in length and we could see their distinctive stripy appearance and the tiny holes where leaves once grew around the stem.

Conclusions

During the Lower Cretaceous, Hastings was towards the eastern side of the Wealden lake or swamp and was covered by a complex of flood plains, lakes and lagoons. For millions of years, rivers flowing from the north and the southwest deposited layers of sand, silt or clay depending on energy conditions. The faster the flow of the river (high energy) the larger the particles it can carry and deposit. The area was covered in vegetation which included horsetails and ferns. There were many fresh-water creatures living in the streams and braided channels, including fish, turtles and crocodiles. Dinosaurs roamed around on the alluvial plains.



Photograph 8: Another Dinosaur footprint