Southerham (Lime Kiln Quarries)

[TQ 4265 0965]

Highlights

Although limited in diversity, the microshark fauna extracted from the phosphatic unit above Strahan's Hardground in the Lime Kiln Quarries of Southerham in East Sussex (Figure 13.21), is extremely important, being one of the very few Middle Chalk fish assemblages in the country.

Introduction

The largest sections in the Lewes area of the Middle and Upper Chalk (Turonian–Coniacian) succession are exposed in the disused quarries associated with the defunct cement works at Southerham. These pits are known collectively as the Lime Kiln Quarries and comprise the old Navigation (or Snowdrop) Pit (to the north), Chandlers Yard and the Southerham Works Quarry (in the south). The sections are now inaccessible but did provide an almost complete sequence through the Ranscombe, Lewes and Seaford Members of the Middle and Upper Chalk.

The Middle Chalk has never produced an abundant vertebrate fauna and the Upper Chalk is similarly impoverished. Thus the fish that can be recovered from the phosphatic New Pit Beds, overlying 'Strahan's Hardground', low down in the Middle Chalk (Ranscombe Member) section at Southerham Works Quarry, are extremely important.

The geology of the Middle and Upper Chalk succession in parts of the Lime Kiln Quarries has been documented by Strahan (1896) when the pit was still working, and subsequently by White (1926), Mortimore (1986) and Lake *et al.* (1987). The fish material has not been formally described, although it is listed by Strahan (1896, p. 464) and more recently sampled by D. Ward (pers. comm., 1995).

Description

The Lime Kiln Quarries expose over 40 m of Middle and Upper Chalk succession. Fish remains are only recorded from the basal 20 m of the section within an anomolous phosphatic flint sequence forming the uppermost levels of the New Pit Beds (Ranscombe Griotte Chalk Member of the Middle Chalk). These beds were formerly exposed in the southern end of the Southerham Works Quarry and were described by Strahan (1896), and his section appears to have been made about 230 m NNE of the railway level crossing (as reported by Lake *et al.,* 1987) where the phosphatic chalk deposit was thickest. The measurements have been converted to metres (after Lake *et al.,* 1987):

	Thickness (m)
Massive chalk with flints	
Flakey white chalk with a few flints and *Holaster planus* [passing down into]	1.22
Phosphatic chalk with many small fish teeth, a few spines of *Cidaris* and some nodules, partly green, partly brown, up to $1^1/_2$ inch [0.04 m] in diameter [a sharp line of demarcation]	0.46
Hard creamy limestone with calcite in veins and cavities, nodular (some of the nodules being green-coated), lumps of decomposed iron-pyrites	0.46
Hard, white, compact chalk, traversed by branching pipes and thin laminae of phosphatic chalk	0.91

Hard white, compact chalk, with the pipes [burrows] and laminae of phosphatic chalk less abundant and dying away downward	0.91

These beds overlaid the massive 'Strahan's Hardground'. The overlying phosphatic lag deposit was restricted in lateral extent (approximately 18.3 m in width; Lake *et al.,* 1987) and thinned rapidly towards both ends of the Works Quarry section. It was largely composed of shell fragments, phosphatized foraminiferan tests, pale brown coprolites, and scattered fish teeth and bones. The greenish mineral which Strahan described was probably glauconite and appeared as dark green specks set within the pale grey chalk (Lake *et al.,* 1987). Much of the vertebrate material is less than a millimetre in size, although larger bone and tooth fragments also occur and the coprolites may reach 0.04 m. Strahan (1896) equated the phosphatic chalk with the Chalk Rock of the Chilterns, and in doing so, took it to mark the base of the Upper Chalk. However, recent geophysical and field evidence indicates that this is not the case, and that the phosphatic beds lie within the top 15 m of the New Pit Beds (known as the New Pit Marls) at the top of the Ranscombe Member in the Middle Chalk succession (Mortimore, 1986). The New Pit Beds fall within the *Terebratulina lata* Zone of the Middle Turonian (Mortimore, 1986). The occurrence of a phosphatic chalk at this level in the Middle Chalk is unique in the British Chalk sequence (Lake *et al.,* 1987). However, the deposit may correspond to the weakly phosphatized Tilleul Hardgrounds 1 and 2 of Haute Normandie on the northern coast of France (Kennedy and Juignet, 1974).

Fauna

The fauna recovered from the phosphatic lag horizon has not been described, but is listed by E.T. Newton (*in* Strahan, 1896, p. 464) and has been sampled by acid preparation more recently by D. Ward (pers. comm., 1995).

Chondrichthyes: Elasmobranchii: Euselachii: Hybodontoidea

Ptychodus sp.

Chondrichthyes: Elasmobranchii: Neoselachii:

Squalomorphii

Protosqualus sp.

Chondrichthyes: Elasmobranchii: Neoselachii: Galeomorphii

Cretolamna sp.

'*Hemiscyllium*' sp.

'*Odontaspis*' sp.

'*Oxyrhina*' sp.

Scyliorhinus sp.

Squalicorax (*Corax*) *falcatus* (Agassiz, 1843)

Chondrichthyes: Elasmobranchii: Neoselachii: Batomorphii

Turonibatis cappettai Landemaine, 1991

Interpretation

Although according to Strahan (1896, p. 464) 'in the phosphatic band fish remains abounded, both minute pellets and teeth', the fauna listed here and given by D. Ward (pers. comm., 1995) is limited in diversity. The identifiable assemblage is composed wholly of shark teeth and these include representatives of the hybodonts *Ptychodus,* and neoselachian sharks, including the squalid *Protosqualus,* the common Chalk lamniforms *Cretolamna* and *Squalicorax falcatus* (Agassiz), the scyliorhinid *Scyliorhinus,* and the batoid *Turonibatis cappettai* Landemaine, 1991 (D. Ward, pers. comm., 1995). All these genera have been suitably described elsewhere (see the Totternhoe report above for the description of the neoselachian taxa, and the Machine Bottom Pit report for that of *Ptychodus*).

Ward (pers. comm., 1995) also recorded '*Hemiscyllium*' sp. in the acid residues from this site. This genus is an extant orectolobiform galeomorph, the 'epaulette' shark (Steel, 1991), known in the fossil record from Palaeocene and Eocene deposits of Belgium (Herman, 1974, 1977) and not previously recorded from the Upper Cretaceous, although the Hemiscyllidae are represented by three other genera from the Cenomanian (Cappetta, 1980, 1987). *Hemiscyllium* teeth are less than 1 mm in width and clearly cuspate (Cappetta, 1987), with a rudimentary pair of lateral cusplets flanking the main cusp. Today *Hemiscyllium* is a small benthic shark which inhabits the warm waters and coral reefs of the Indo-Pacific region (Steel, 1991). The dentition is of a clutching type.

In the original list of Strahan (1896), both '*Odontaspis*' sp. and '*Oxyrhina*'sp. were listed. *Odontaspis* is a modern lamniform, known as the 'sand tiger shark' (Steel, 1991), which has been recorded in rocks of Campanian age in North America (Cappetta and Case, 1975). *Odontaspis* had tearing-type teeth with up to three pairs of very sharp and high cusplets flanking a large main cusp, with prominent cutting edges. '*Oxyrhina*' is a defunct genus that includes three Chalk species (Woodward, 1902–1911), now assigned to three different lamniform genera (Longbottom and Patterson, 1987): the alopiid *Paranomotodon* (*Oxyrhina*) *angustidens* (Reuss), and the cretoxyrhinids *Plicatolamna* (*Oxyrhina*) *crassidens* (Dixon) and *Cretoxyrhina* (*Oxyrhina*) *mantelli* (Agassiz). All of these are large predaceous sharks with tearing-type dentitions (Figure 13.22) similar to the modern mako shark *Isurus* (Cappetta, 1987).

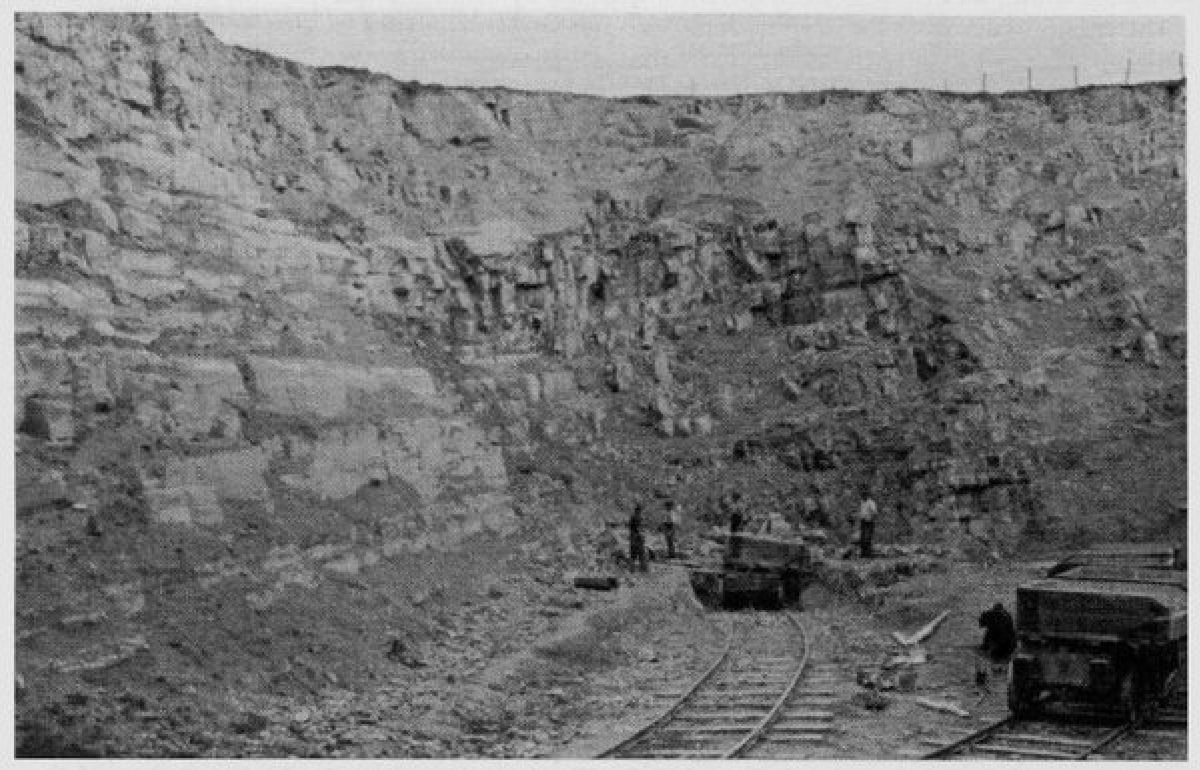
Comparison with other localities

Excavations between 1975 and 1985 for a new road near Southerham at [TQ 427 094], revealed a similar horizon at approximately the same level within the Middle Chalk (Lake *et al.,* 1987). The excavated section showed a fully developed hardground, approximately 0.7 m thick, with a convoluted, iron-stained surface, which was strongly mineralized (particularly in the upper 0.2 m) with glauconite and phosphates (Lake *et al.,* 1987). Burrows within the hardground were filled with pelletal phosphatic chalk and other debris, and the surface was overlain by 30 mm of similar sediment. The bed may be equivalent to 'Strahan's Hardground', or another lenticular phosphatic bed occurring at roughly the same level in the upper New Pit Marls (Lake *et al.,* 1987, p. 72). An invertebrate assemblage from these sediments was described by Lake *et al.* (1987) from these sediments, but no mention of any fish remains was made. However, there is a limited potential for fossil fish finds, in that bulk processing of any phosphatic horizons found by future excavations at this level might reveal the true extent of the fish fauna.

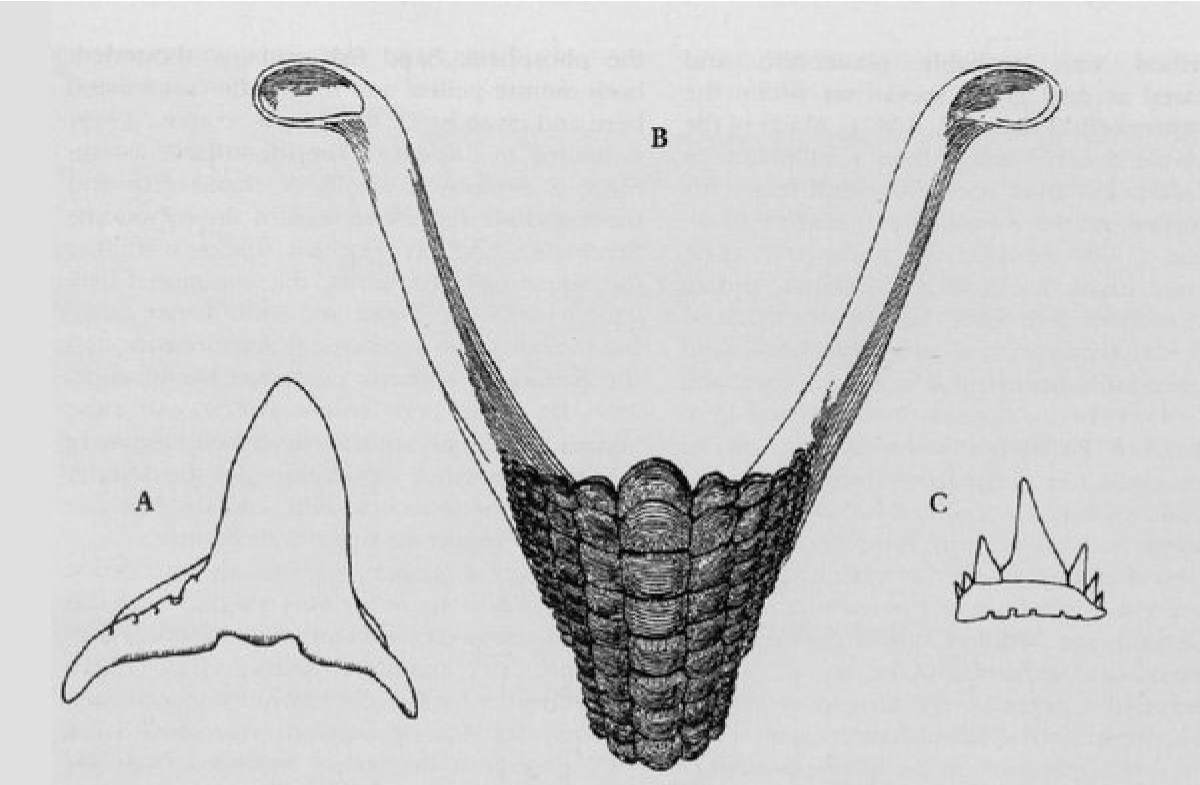
Conclusion

The restricted fish fauna recovered from the phosphatic chalk overlying Strahan's Hardground at the Lime Kiln Quarries at Southerham is important as it is one of the few Middle Chalk assemblages recorded and gives the site its conservation value. Recent excavations at the same level in the Middle Chalk at Southerham have revealed a second phosphatic unit, and further remains may be recovered by future excavations.

References



(Figure 13.21) Photograph of Lime Kiln Quarries, the marly chalk seen (above the talus) in the left (north) face of the quarry is in the Zone of Holaster subglobosus; that in the lowest 3 m or so of the farther (east) face is in the Zone of Schloenbachia varians. (Photo: BGS no. 2962; Crown Copyright Reserved).



(Figure 13.22) Chondrichthyan fishes from the Chalk at Southerham Lime Kiln Quarry (A) Plicatolamna crassidens x 1.0; (B) Ptychodus decurrens Agassiz, a restoration of the lower jaw x 1.0; (C) Paranometodon angustidens x 2.0. (From Longbottom and Patterson, 1987.)