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# South Toll House Cliff and North Bay, Scarborough, North Yorkshire

[TA 051 888], [TA 045 892]–[TA 048 893], [TA 040 894]–[TA 051 895]

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## Introduction

The GCR sites known as 'South Toll House Cliff' and 'North Bay, Scarborough' represent the surviving remnants of the historically important Callovian exposures on the south and north sides respectively of Castle Hill, Scarborough (Figure 5.17), as described in early literature (e.g. Phillips, 1829; Leckenby, 1859; Hudleston, 1876; Brinkmann, 1926). Stratigraphically important ammonite faunas occur at several levels and the type localities of a number of important species are almost certainly included, as well as the Callovian–Oxfordian stage boundary.

## Description

### South Toll House Cliff

The site is adjacent to a small storage area [TA 0515 8885], opposite a lighthouse and amusement arcade. The following description is based on Wright (1968) who is the only author to mention the section specifically.

	Thickness (m)
<b>?Oxford Clay Formation</b>	
Soft, ?silty material barely visible beneath soil	
<b>Osgodby Formation</b>	
<b>Hackness Rock Member</b>	
Sandstone, brown-weathering, with berthierine ooids and soft, flaggy base; <i>Peltoceras</i> ( <i>Peltomorphites</i> ) <i>subtense</i> (Bean) and <i>Quenstedtoceras</i> ex gr. <i>lamberti</i> J. Sowerby	c. 0.23
Berthierine oolite, massive, weathering red with pale-green ooids; macroconch and microconch <i>Quenstedtoceras</i> ;	c. 1.14
sandstone, pale-coloured, massive; few fossils	
<b>Langdale Member</b>	
Sandstone, grey, flaggy, very fine-grained; small burrows	c. 9+

In the past, the Cornbrash Formation has also been seen hereabouts (M.R. House, pers. comm.).

### North Bay, Scarborough

Cliff exposures and other small outcrops around the gardens on the north side of Castle Hill, Scarborough [TA 045 892]–[TA 048 893], and in landslipped blocks and narrow foreshore platforms below [TA 040 894]–[TA 051 895], reveal a composite Callovian sequence. The most detailed recent descriptions of the sections are those of Wright (1968, 1977) and Page (1988) on which the following notes are based.

The Cornbrash Formation (c. 1.08 m thick) is seen in three places: an exposure [TA 048 893] near the centre of the gardens below Scarborough Castle (Wright, 1977); a small exposure on the edge of the putting green at [TA 0470 8925] (J.K. Wright, pers. comm., 1996); and in a ?slipped block on the foreshore close to a tunnel at [TA 048 894] (Page, 1988). The succession comprises:

	Thickness (m)
<b>Cornbrash Formation</b>	

$\alpha_3$ : Limestone, bioclastic, sandy with well-preserved bivalves including <i>Lopha marshii</i> Sowerby), <i>Myophorella scarburgense</i> (Lycett) and <i>Trigonia elongata</i> (J. Sowerby), and the brachiopod <i>Microthyridina</i>	0.43
$\alpha_2$ : Limestone, rubbly, ooidal, with many pebbles including internal moulds of burrowing bivalves; <i>Macrocephalites</i> fragment	0.10
$\alpha_1$ Limestone, dark greenish-grey, weathering red; bivalves; well-developed <i>Thalassinoides</i> burrow-system at base	0.65

The overlying Cayton Clay Formation is not well exposed but the basal 0.10 m ( $\alpha_4$  of Wright, 1977) is seen above the Cornbrash Formation in the foreshore block noted above. Here, dark-grey, silty clay has yielded abundant *Meleagrinea braamburiensis* (Phillips) and *Modiolus bzpartitus* (J. Sowerby) (Page, 1988).

The overlying Osgodby Formation is exposed in the cliff exposures below Rutland Terrace [TA 045 892]. The Redcliff Rock Member is difficult to access in the sheer cliffs but additional sections are present in foreshore blocks near to that exposing the Cornbrash Formation. The overlying Langdale Member is well developed in the cliffs. Below Rutland Terrace, the Hackness Rock Member is very fossiliferous but the exposures are typically largely covered by soil and grass. The following composite section is based on Wright (1968) and Page (1988); bed numbers follow Wright (1968).

	Thickness (in)
<b>Osgodby Formation</b>	
<b>Hackness Rock Member</b>	
4–6: Limestone, weathering brown, with berthierine ooids	0.6
3: Sandstone with berthierine ooids; fossiliferous with <i>Camptonectes</i> , <i>Gryphaea</i> and <i>Kosmoceras</i> ( <i>Lobokosmokeras</i> ) ex gr. <i>proniae</i> (Teisseyre)	0.15
1–2: Sandstone with <i>Gryphaea lituola</i> Lamarck and belemnites in upper part	1.12
<b>Langdale Member</b>	
6: Siltstone, soft, and sandstone, fine grained, finely laminated; scattered belemnites, oysters and <i>Meleagrinea</i>	est. 9.75
5: Sandstone, fine grained becoming medium grained and well sorted towards base; belemnites 0.08 m above base	c. 1.5
<b>Redcliff Rock Member</b>	
4: Sandstone, clayey with quartz pebbles up to 6 mm diameter	0.2
3: Sandstone, deeply weathered, often deep-orange in colour; ammonites including <i>Chamoussetia?</i> , <i>Keplerites</i> ( <i>Gowericeras</i> ) cf. <i>indigestus</i> (S.S. Buckman) and <i>Proplanulites</i> cf. <i>ferruginosus</i> S.S. Buckman	c. 2.05
1/2: Sandstone, yellow to orange; shell fragments in upper part	c. 10.4

The upper part of the Hackness Rock Member is also exposed on a narrow wave-cut platform at the bottom of Marine Drive [TA 051 895]:

<b>Oxford Clay Formation</b>	
Marl, grey, poorly exposed; scattered berthierine ooids; occasional limestone nodules (up to 0.10 m diameter); <i>Cardioceras</i> cf. <i>scarburgense</i>	0.15–0.20
<b>Osgodby Formation</b>	
<b>Hackness Rock Member</b>	

Sandstone with berthierine ooids, weathering red; ammonites including *Euaspidoceras* cf. *hirsutum* (Bayle), *Hecticoceras* (*Putealicerias*) *puteale* (Leckenby), *Kosmoceras* (*K.*) ex gr. *spinosum* (J. de C. Sowerby) and *Quenstedtoceras* ex gr. *lamberti* (J. Sowerby); belemnites (*Hibolithes hastatus* (Montfort) and *Lagonibelus beaumontiana* (d'Orbigny)); bivalves (*Chlamys* sp. and *Gryphaea lituola* Lamarck); and the nautiloid *Paracenoceras* 0.3

## Interpretation

The once extensive exposures around Scarborough's Castle Hill, and material fallen from them, would have yielded the bulk of the Callovian ammonites collected and described by early workers, often as new species (e.g. Leckenby, 1859; Buckman, 1909–1930). The majority of these exposures were destroyed by the construction of the Marine Drive promenade in the 1860s (Wright, J.K., 1968; Wright, T, 1860); only the sections covered by the South Toll House Cliff and North Bay, Scarborough GCR sites remain.

Old fossil collections suggest that  $a_2$  of the Cornbrash Formation at North Bay is the source of at least some of the large numbers of *Macrocephalus* ex gr. *terebratus* (Phillips) labelled 'Scarborough' in old collections (including the neotype itself (Figure 5.18) and the holotype of the microconch *M. typicus* Blake); the former species gives its name to the Terebratus Subzone of the Lower Callovian Herveyi Zone. T Wright (1860) noted that most of the then-known fossils from the Cornbrash Formation had come from the north side of Castle Hill, and Fox-Strangways (1892) suggested that many had come from fallen blocks on the shore. He added 'it is probable that nearly all the fossils enumerated from the Yorkshire Cornbrash Formation have come either from these blocks or from the exposure in Cayton Bay at the foot of Red Cliff' (see Gristhorpe Bay, Yons Nab and Red Cliff-Cunstone Nab GCR site report, this volume).

In the Osgodby Formation, ammonites reported in the Redcliff Rock Member, which is similarly developed to that in areas farther south around Cayton Bay (see Gristhorpe Bay, Yons Nab and Red Cliff-Cunstone Nab GCR site report, this volume), are indicative of the *indigestus* Biohorizon of the Lower Callovian Koenigi Zone, Curtibus Subzone. The three units into which the member is divided in the above section correspond, from below, to Wright's (1968) subdivisions  $\beta_1$ ,  $\beta_2$  and  $\beta_3$ . Wright (1968) referred the overlying Langdale Member at South Toll House Cliff to his  $\gamma_2$  subdivision of that member but recognized both  $\gamma_1$  (Bed 5) and  $\gamma_2$  (Bed 6) at North Bay. No age-diagnostic ammonite fauna has been recorded but the member probably belongs to the Middle Callovian Coronatum Zone as at Cunstone Nab (see Gristhorpe Bay, Yons Nab and Red Cliff-Cunstone Nab GCR site report, this volume). Bed 3 of the Hackness Rock Member at North Bay is likely to be the source of most of the Upper Callovian Athleta Zone ammonites labelled 'Scarborough', which have been variously figured by Leckenby (1859), Buckman (1909–1930), Cox (1988) and Callomon and Wright (1989). These include *Alligaticeras rotifer* (Brown) (including the holotype), *Binatisphinctes binatus* (Leckenby) (possibly including the holotype), *Binatisphinctes hamulatus* (S.S. Buckman) (including the holotype), *Chamoussetia funifera* (Phillips), *Distichoceras bicostatum* (Stahl), *Hecticoceras* (*Orbignyceras*) *pseudopunctatus* (Lahusen), *Kosmoceras* (*Lobokosmokeras*) *rowlstonense* Buckman non Young and Bird, *Kosmoceras gemmatus* (Phillips), *Longaeviceras placenta* Leckenby (including the holotype), *L. polonicum* Callomon and Wright, *L. cf. schumarowi* (Nikitin), *Paralcidia glabellus* (Leckenby) (including the holotype), *Peltoceras* (*P.*) *athleta* (Phillips) (including the neotype (Figure 5.19), and its possible microconch '*Rursiceras*' *reversus* (Leckenby)), *Pseudopeltoceras famulus* Spath (including the holotype), *P. leckenbyi* Spath (including the holotype) and possibly *Reineckeia* (*Collotia*) sp. No trace of this fossiliferous unit of the Athleta Zone can be made out at South Toll House Cliff but it can be seen again farther south at Cayton Bay (see Gristhorpe Bay, Yons Nab and Red Cliff-Cunstone Nab GCR site report, this volume).

There can be little doubt that the following comments made by Leckenby (1859) refer to the Athleta Zone fauna detailed above: 'on the North side of Scarborough Castle, numerous blocks of this rock [i.e. Osgodby Formation] ... formerly strewn the base ... A few years ago the surfaces of these blocks were found to consist of cherty calcareous nodules, filled with fossils, and so diligently have these been explored that now hardly a block is to be found to reward the industrious collector'. The cherty calcareous nodules are undoubtedly equivalent to Bed 5 of Wright (1968). The early

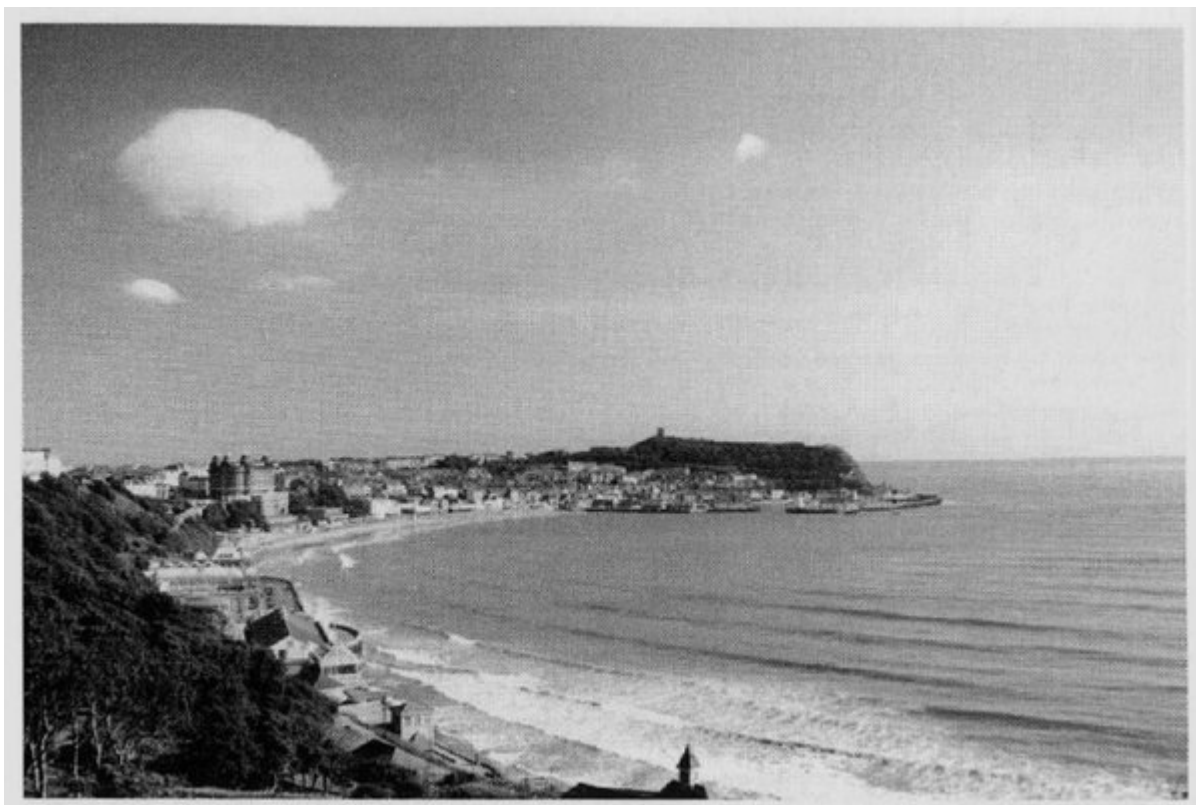
removal of much of the fossiliferous material would explain why it is now virtually impossible to re-collect this classic Athleta Zone fauna.

Beds 4–6 of the Hackness Rock Member at North Bay were assumed by Wright (1968) to belong to the Upper Callovian Lamberti Zone but he had no confirmatory ammonite evidence. However, the ammonite fauna recorded from the upper part of the member in the wave-cut platform at the bottom of Marine Drive is characteristic of the Lamberti Zone and Sub-zone. The Lamberti Zone faunas described in the past from around Castle Hill probably largely come from here and South Toll House Cliff where ammonites recorded from the Hackness Rock Member also indicate the Lamberti Zone and Subzone. They include *Alligaticeras alligatum* (Leckenby), *Euspidoceras hirsutum* Bayle, *Peltoceras* (*Peltomorbites*) *subtense* (Bean) (possibly including the holotype), and probably *Hecticoceras* (*Putealicer*) *puteale* (Leckenby) (including the holotype). The grey marl that overlies the Hackness Rock Member at the North Bay site could be the source of the specimen (?holotype) of *Cardioceras scarburgense* figured by Buckman (1924). At South Toll House Cliff, no diagnostic fauna has been recorded from the soft, ?silty material above the Hackness Rock Member but, by analogy with other sections, the Callovian–Oxfordian stage boundary must occur at this level.

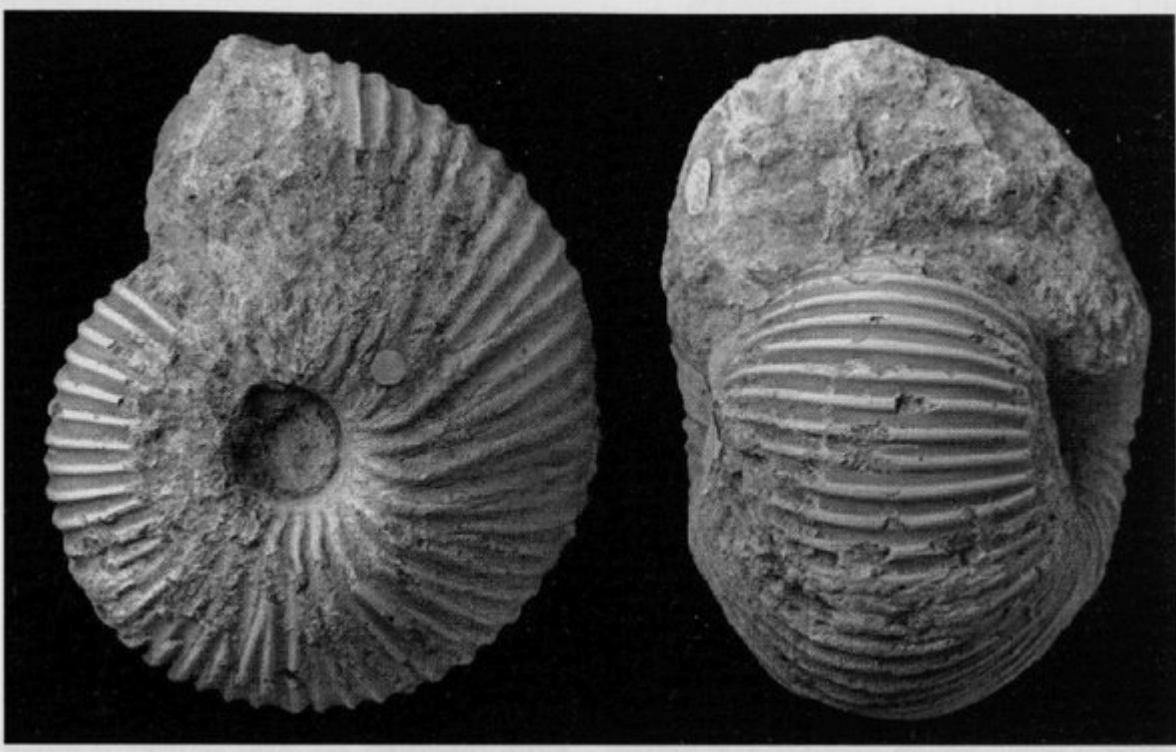
## Conclusions

The Callovian exposures of South Toll House Cliff and North Bay, Scarborough include historically important and fossiliferous sections of the Cornbrash and Osgodby formations. They are the only surviving parts of the once more extensive exposures of Callovian strata on Castle Hill, Scarborough. Many new species were established on the basis of material collected in the area prior to construction of the Marine Drive promenade and road. Even though opportunities for re-sampling are limited, access to remaining exposures is vital to re-interpretation of the stratigraphy of these early fossil collections. Important ammonite faunas are present at a number of levels and the type localities of several species are almost certainly included. North Bay is the likely source of the type material of at least three stratigraphical index species, *Macrocephalites terebratus* (Phillips) (Terebratus Subzone, Herveyi Zone), *Peltoceras athleta* (Phillips) (Athleta Zone) and the Early Oxfordian *Cardioceras scarburgense* (Young and Bird) (Scarburgense Subzone, Mariae Zone), and together, the two sites yield ammonite assemblages of both the Upper Callovian zones. Lateral variation and facies changes when compared to other localities in the district means that the sites also have a key role to play in palaeogeographical and basin evolution studies.

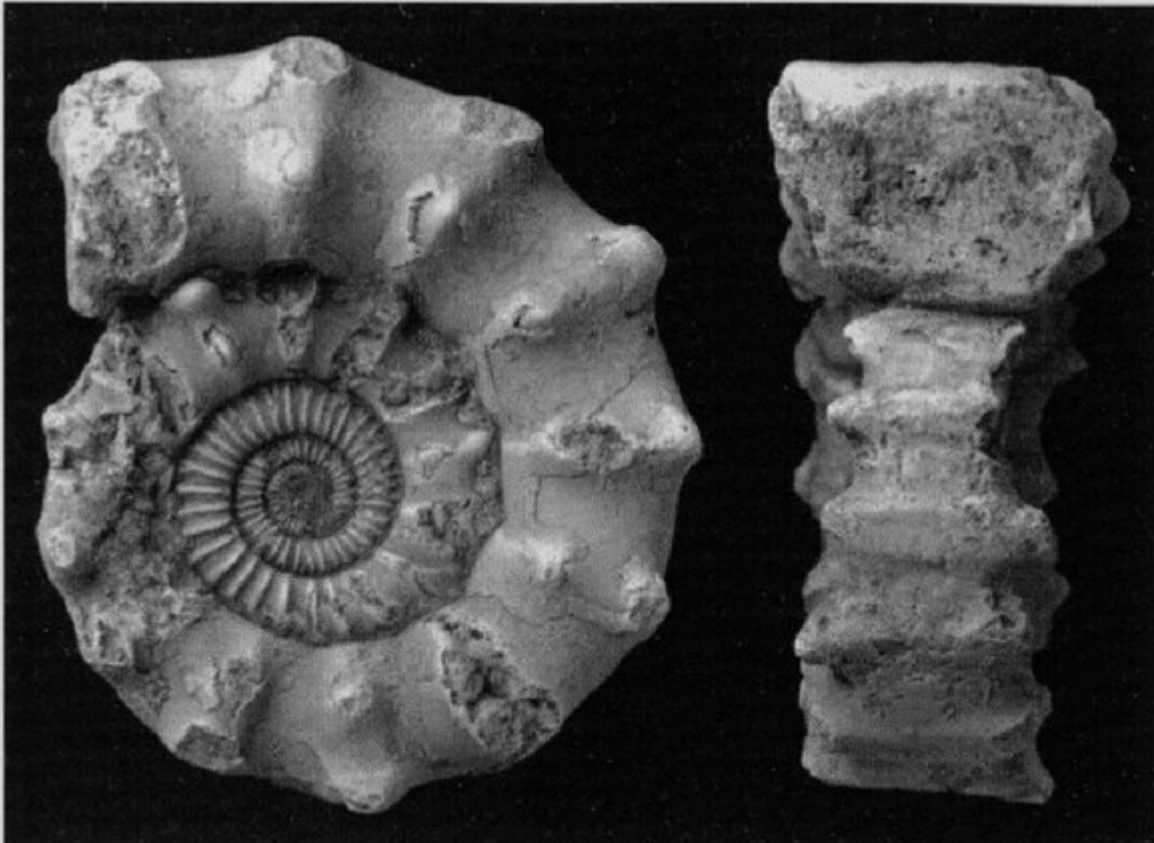
## References



(Figure 5.17) Castle Hill (a faulted outlier of Middle and Upper Jurassic rocks) (centre distance) and South Bay, Scarborough. (Photo: M.G. Sumbler.)



(Figure 5.18) Neotype of *Macrocephalites terebratus* (Phillips); The Natural History Museum, London, specimen No. 39566; natural size. (Photo: © The Natural History Museum.)



(Figure 5.19) Neotype of *Peltoceras athleta* (Phillips); The Natural History Museum, London, specimen No. 89052; approximately natural size. (Photo: © The Natural History Museum.)