Tenants' Cliff, Cayton Bay

[TA 065 847]

Potential GCR site

J.K. Wright

Introduction

The Tenants' Cliff site is situated in the central and northern parts of Cayton Bay, south of Scarborough (Figure 4.11). The site comprises a faulted area of rock platform and cliff exposures in the triangle covered by [TA 062 850], [TA 065 850] and [TA 067 845]. Its distinctive feature is the occurrence of outcrops of the Lower Calcareous Grit Formation containing calcareous concretions that yield a prolific, exceptionally well-preserved fauna of cardioceratid ammonites. The fauna of the concretions has been known since Victorian times, and numerous examples of ammonites from museum collections were figured by Arkell (1935–1948). The museum labels simply said 'Low Calc. Grit, Scarborough', and Arkell had to attempt to identify a horizon from which these specimens had been collected. The obvious choice was the Ball Beds, a series of concretionary beds within the Lower Calcareous Grit well exposed at Filey Brigg (see site report for Filey Brigg, this volume), and at Castle Hill, Scarborough. However, only later did it become evident that the fauna had been collected from Tenants' Cliff, Cayton Bay, a locality where the Ball Beds concretions are not exposed. The fauna had been collected from an older series of concretionary beds in the Lower Calcareous Grit sequence, a unit that Wright (1983) named the 'Tenants' Cliff Member'. The Ball Beds were renamed the 'Saintoft Member' (Figure 4.3).

Description

The following section was measured by the present author in 1983:

	Thickness (m)
Lower Calcareous Grit Formation	
Saintoft Member, Bukowskii Subzone	
6. Fine-grained, brown, very spicular sandstone	seen to 0.9
5. Fine-grained, sandy micritic limestone passing up from fine-grained sandstone	0.80
Tenants' Cliff Member	
4. Massive, fine-grained, sporadically spicular sandstone with many infilled *Thalassinoides* burrows	2.36
3. Massive argillaceous, sandy spicular siltstone with the frequent development of small, very fossiliferous, calcareous concretions	7.97
2. Moderately well-bedded, slightly sandy, spicular siltstone with argillaceous partings, and weathering quite readily. Fossiliferous calcareous concretions 1 m in diameter and 0.5 m thick are developed in four distinct rows	2.15
Praecordatum Subzone	
1. Soft-weathering, argillaceous sandy siltstone, becoming slightly tougher and spicular above	seen to 3.63

The section was measured in the cliff that forms the western side of the site, and a log of this section is given in (Figure 4.12). The cliff forms a stable feature, despite its being marked on BGS Sheet 54 (Scarborough) as landslip overlying Oxford Clay. The map of Wright (1968, fig. 9), partially reproduced in (Figure 4.11), interprets the area as one of solid geology broken up by faults.

Samples from Bed 1 collected at the base of the cliff break down readily in water, containing 73% silt and clay, and thus this unit might be grouped with the Oxford Clay, though it weathers yellow/brown as does the Lower Calcareous Grit and cannot be distinguished from calcareous grit in the field. The incoming of *Rhaxella* spicules at the top of this bed marks the more typical calcareous grit facies. There is then an obvious, though irregular, increase in the quartz sand content upwards, though all beds of the Tenants' Cliff Member except Bed 4 are technically sandy siltstones. Beds 5 and 6 (Saintoft Member) mark the incursion of slightly coarser grained sand, still with much silt and clay.

Bed 1 contains frequent *Cardioceras* (*Scarburgiceras*) *praecordatum* Douvillé and is thus allocated to that subzone. The concretions of beds 2 and 3 have a very similar matrix, and fossils collected loose cannot be allocated to individual beds. Concretions are present both in the cliff section and boulders beneath, and in the large area of rock platform extending northwestwards from the cliffs. Many concretions are barren, or contain bivalves: *Chlamys fibrosus* (J. Sowerby), *Nanogyra nana* (J. Sowerby), *Anisocardia minina* (J. Sowerby), *Modiola bipartita* (J. Sowerby), *Pleuromya uniformis* (J. Sowerby), *P. alduini* (Brongniart), and *Pseudomonotis* sp.. Nests of *Rhynchonelloidella thurmani* (Phillips) and *Alaria* cf. *laevigata* Morris and Lycett are also common. Perhaps one in twenty concretions contains ammonites, all indicating the lower part of the Bukowskii Subzone. Arkell (1935–1948) recorded from the matrix of beds 2 and 3: *Cardioceras* (*Scarburgiceras*) *harmonicum* Maire, *C.* (*S.*) *excavatoides* Maire, *C.* (*S.*) aff. *alphacordatum* Spath, *C.* (*S.*) *gloriosum* Arkell (holotype), *C.* (*S.*) *leckenbyi* Arkell (holotype), *C.* (*S.*) *bukowskii* Maire, *C.* (*S.*) cf *reesidei* Maire, *C.* (*Vertebriceras*) *bulbosum* Arkell* (holotype), *C.* (V.) *tumescens* Arkell* (holotype), *C.* (V.) *phillipsi* Arkell (holotype), *C.* (*V*) *sequanicum Maire*, C.* (*V.*) *gracile* Arkell* (holotype), *C.* (V.) *pumilum* Arkell* (holotype), *Goliathiceras* (*Pachycardioceras*) *anacanthum* (S. Buckman)*, *G.* (*P.*) *magnacanthum* Arkell*, *G.* (*P.*) *globulus* Arkell* (holotype), *G.* (*Korythoceras*) *falcatum* Arkell (holotype), *G.* (*Goliathites*) *goliathus* (d'Orbigny), *G. pavlovoides* Arkell* (holotype), *Perisphinctes* (*Properisphinctes*) *bernensis* de Loriol, *P* (*Prososphinctes*) *matheyi* de Loriol, *P.* (*P.*) *mairei* de Loriol*, *P.* sp., *Mirosphinctes frickensis* (Moesch), *Aspidoceras* (*Euaspidoceras*) *douvillei Collot, A.* (*E.*) *loricatum* Spath, *Peltoceras gerberi* (Prieser), *and Neocampylites delmontanus* (Oppel). Species marked * are recorded from Cayton Bay, and thus came from Tenants' Cliff. All others are in 'Ball Beds' matrix, and almost certainly came from Tenants' Cliff Loose blocks from Bed 5 have yielded *Pachyceras* sp., *Cardioceras* (*Vertebriceras*) sp. and *Myophorella triquetra* (Seebach).

Interpretation

The Tenants' Cliff Member was laid down during a period when subsidence of the Cleveland Basin failed to keep pace with the accumulation of sediment. The result was a gradual shallowing producing the transition from Oxford Clay into the spiculites of the Tenants' Cliff Member. These were laid down in a gentle, offshore marine environment that was favourable to the growth of siliceous sponges, most of whose spicules are now calcified. Evidence suggests that the Yorkshire spiculites were deposited in a regime of gentle to moderate agitation, as unre-crystallized *Rhaxella* spicules with well-preserved internal structure show signs of substantial abrasion in thin section (Wright, 1983). The well-preserved bivalve fauna of the Lower Calcareous Grit is an early variant of the *Pleuromya uniformis* association of Fürsich (1977). The gentle accumulation of fine-grained sand with minimal current winnowing results in the burrowing *Pleuromya uniformis* and *Myophorella triquetra* (Seebach) and free-swimming *Chlamys* spp. frequently being found with the two valves attached.

Ammonites that originated in the Tethyan Realm seem to have found such conditions inimical as they comprise only 5–6% of the fauna (Figure 4.13)A, B, whereas during accumulation of the Oxford Clay they had dominated the fauna (Wright, 1983). Boreal cardioceratids (Figure 4.13)C seem to have thrived on and above a sea floor carpeted with sponges. Thus, the three units where *Rhaxella* is prolific — Lower Calcareous Grit, Birdsall Calcareous Grit and Upper Calcareous Grit — also have prolific cardioceratid faunas (Wright, 1983, 1996b). However, though ammonites undoubtedly thrived in these periods, it was vital to have the correct conditions for preservation, particularly the growth of calcareous concretions soon after the sediment had been laid down. Only three sites in Yorkshire are known to yield such concretions (Wright, 1983), and of these, Tenants' Cliff has by far the most varied and prolific fauna. The exceptional preservation of the Tenants' Cliff fauna is illustrated in (Figure 4.13) and (Figure 4.5) L–N, the cardioceratids figured here being representative of the *Cardioceras* fauna cited by Arkell (1941a) in the definition of the Bukowskii Subzone.

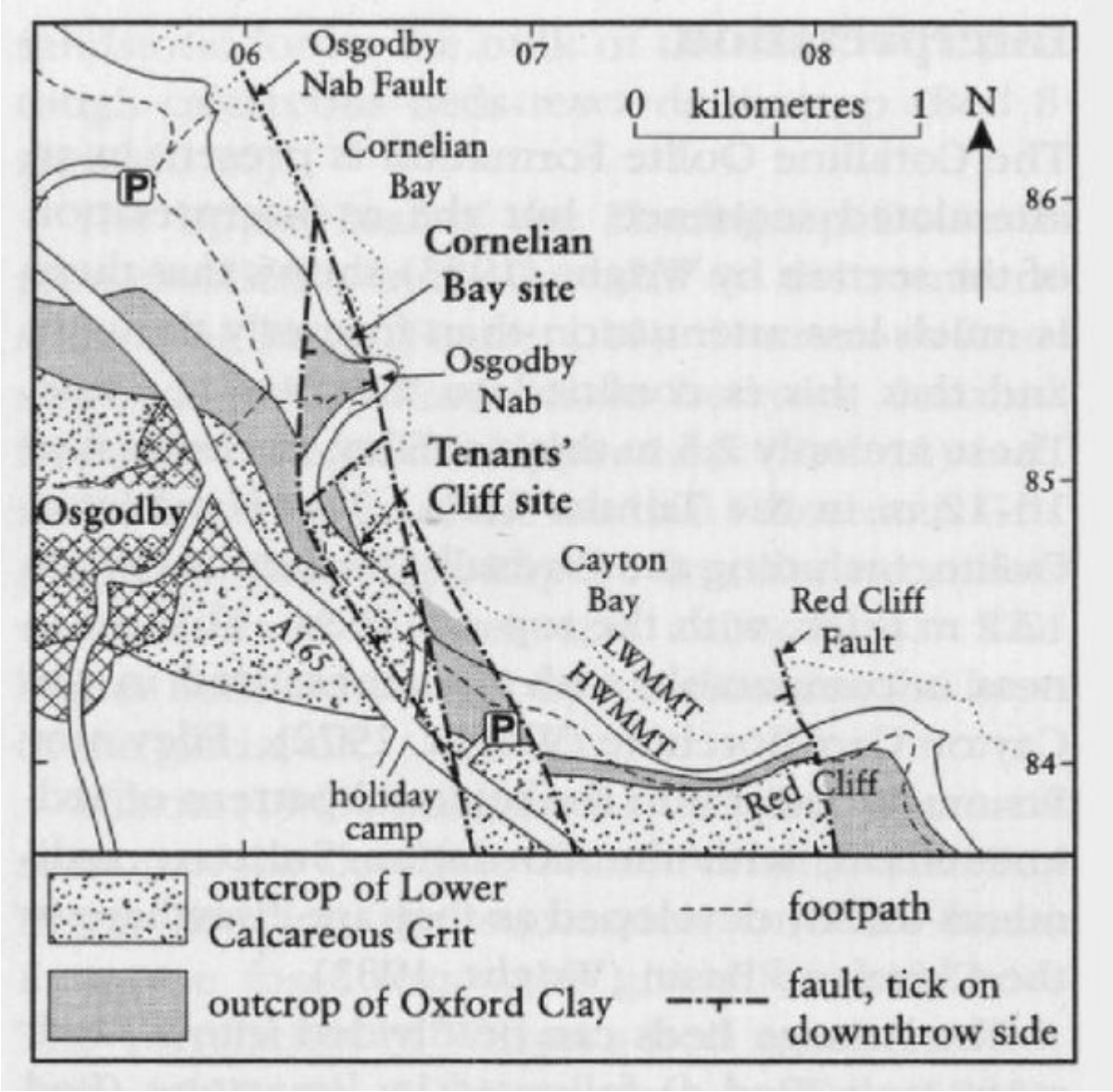
Arkell (1935–1948) described the ammonites of Bed 2 and Bed 3 as 'massed together and superbly preserved in hard grey, non-oolitic limestone. Many were obtained by the early collectors, and are to be seen in many museums'.

Arkell figured many of the ammonites, despite the fact that no one, at the time of his writing, had any real idea where this fauna had been collected, other than in the Scarborough district. Arkell visited Scarborough several times (Arkell, 1936b), but was unable to discover the site. His failure to do so can be attributed to the fact that the exposures at Tenants' Cliff had been virtually ignored in descriptions of Yorkshire Jurassic geology until the map of the area was published by Wright in 1968. Thus, for example, as recently as 1949, Wilson stated that there are no exposures of Corallian beds between Red Cliff, Cayton Bay, and Scarborough Castle Hill. However, the site was rediscovered during a Geologists' Association visit in 1967, Penney and Rawson (1969) recording '*Cardioceras* nucleii' from the site.

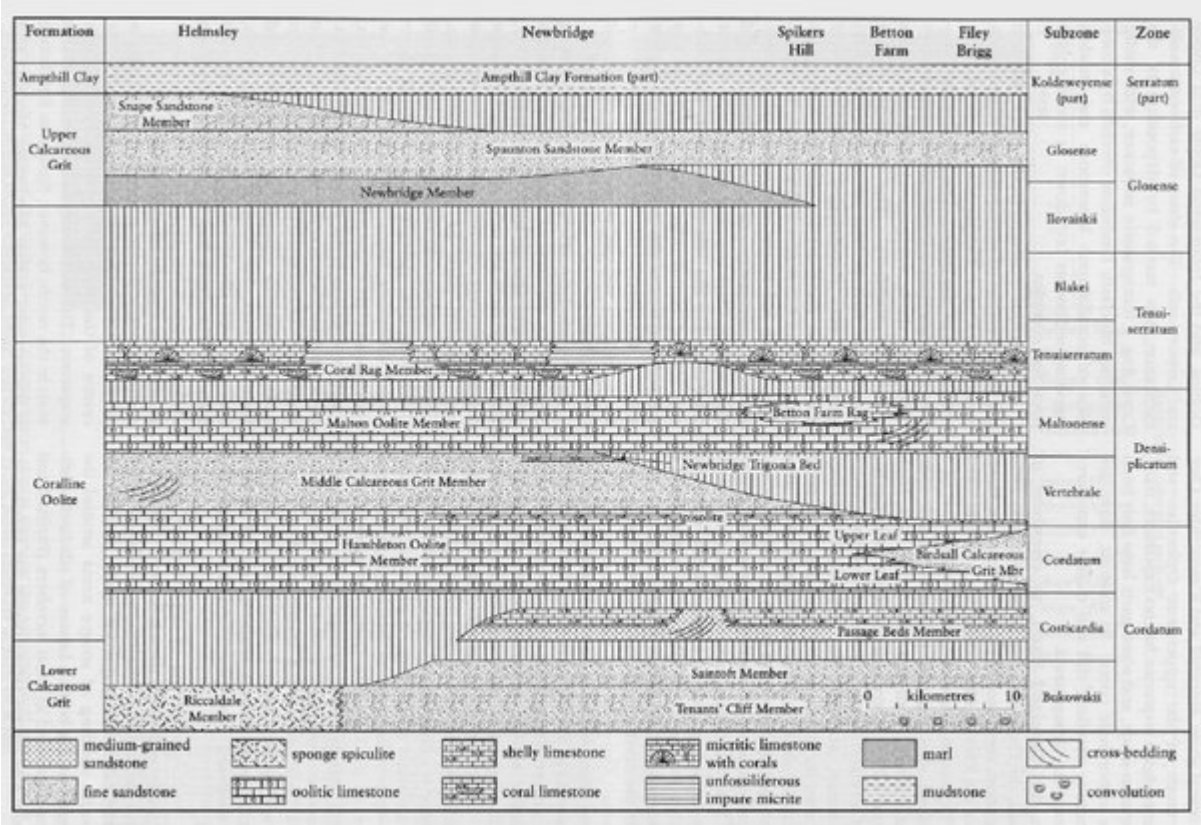
Conclusions

The distinctive feature of the site is the occurrence of the prolific Bukowskii Subzone ammonite–bivalve–gastropo–brachiopod fauna beautifully preserved in calcareous concretions. The moderate amount of coastal erosion present here means that new exposures of fossiliferous concretions are continually becoming available. Tenants' Cliff is the type locality for the Bukowskii Subzone, and hence for the definition of the base of the Cordatum Zone. The importance of this zone was emphasized by Arkell (1956). It can be recognized over a large part of the northern hemisphere and the typical cardioceratid genera and subgenera have been found as far apart as Alaska, Canada, Idaho and Wyoming in the west and Moscow, Siberia, the Caucasas, Poland, Saxony and France. Southwards across France, the cardioceratids disappear, but the characteristic *Perisphinctes, Peltoceras* and *Aspidoceras* of the Tenants' Cliff section can be found at many places in the Tethyan Realm, including North Africa, and as far afield as Madagascar.

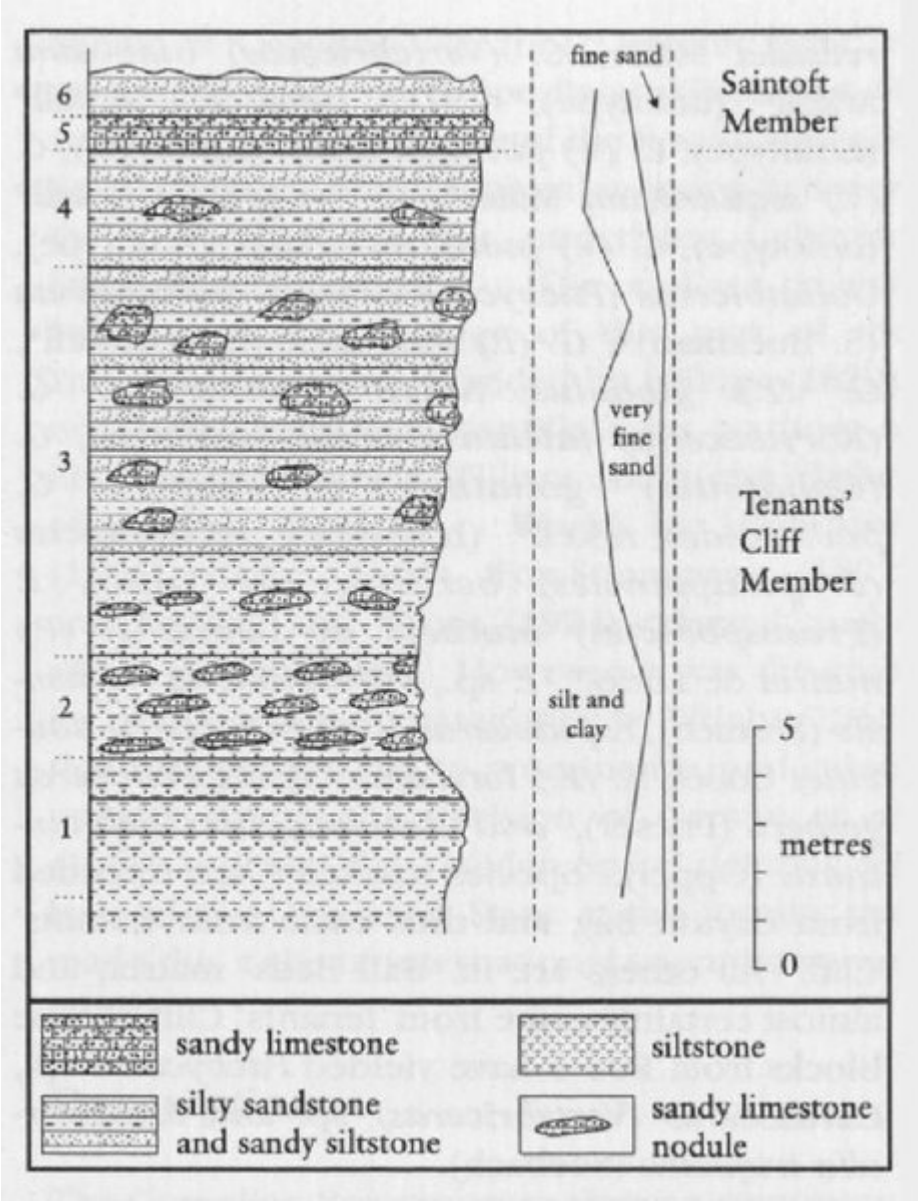
References



(Figure 4.11) Locality map of the Tenants' Cliff and Cornelian Bay GCR sites. Outcrop of the Oxford Clay and Lower Calcareous Grit from Wright (1968, fig. 9).



(Figure 4.3) Stratigraphical cross-section of the Yorkshire Corallian Group on the north side of the Vale of Pickering from Helmsley to Filey (after Rawson and Wright, 1995, fig. 15).



(Figure 4.12) Log of the Lower Calcareous Grit succession at Tenants' Cliff; as measured by J.K. Wright in 1982.

(Figure 4.13) Exceptionally well-preserved ammonites from the Tenants' Cliff Member. (A) Mirosphinctes frickensis (Moesch) (Tethyan), LG744; (B) Neocampylites delmontanus (Oppel) (Tethyan), LG742; (C) Cardioceras (Scarburgiceras) bukowskii Maire (Boreal), LG736. (Photos: K. D'Souza. Specimens in the J.K. Wright Collection. Natural size.)

(Figure 4.5) P Selection of ammonites from the Corallian Group of the Cleveland Basin. (A) Amoeboceras nunningtonense Wright (holotype), Spaunton Sandstone, Leysthorpe Quarry, m27, x 1. (B) A. glosense (Bigot and Brasil), Newbridge Member, Leysthorpe Quarry, U/1/14, x 1. (C) A. transitorium Spath, Newbridge Member, Leysthorpe Quarry, U/1/5, x 1. (D) A. ilovaiskii (M. Sokolov), Spaunton Sandstone, Newbridge Quarry, U/2/38, x1. (E) A. newbridgense Sykes and Callomon, Spaunton Sandstone, Newbridge Quarry, U/2/20, x 1. (F) Perisphinctes (Pseudarisphinctes) pachachii Arkell, Spaunton Sandstone, Spaunton Moor Quarry, U/3/63, x0.33. (G) P. (Dichotomosphinctes) sp. Newbridge Beds, Leysthorpe Quarry, U/1/103, x0.7. (H) Cardioceras (Cardioceras)persecans S. Buckman, Birdsall Calcareous Grit, Filey Brigg, YM1983/45F, x 1. (I) C. (C.) cordatum (J. Sowerby), Birdsall Calcareous Grit, Flassen Gill, YM1983/36F, x 1. (1) C. (Vertebriceras) aff. dorsale S. Buckman, Hambleton Oolite, Spikers Hill Quarry, C/2/17, x 1. (K) C. (Plasmatoceras)popilaniense Boden, Hambleton Oolite, Spikers Hill Quarry, C/2/59, x 1. (L) C. (Scarburgiceras) harmonicum Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/17F, x 1. (M) C. (S.)reesidei Maire, Tenants' Cliff Member, Tenants' Cliff, YM1983/20F, x 1. (N) C. (Vertebriceras) aff. phillipsi Arkell, Tenants' Cliff Member, Tenants' Cliff, YM1983/23F, x 1. (O) C. (S.)praecordatum (Douvillé), Weymouth Member, Cayton Bay Waterworks, YM1983/9F, x 1. (P) C. (S.)scarburgense (Young and Bird), Weymouth Member, Cornelian Bay, YM1983/3F, x 1. (Photos: (A-E), (H, I), (L–P), J.K Wright; (F, G), K. D'Souza; (J, K) K. Denyer. Collections: Prefixes 'U', 'C', J.K. Wright Collection; 'YM', Yorkshire Museum Collection, York; 'm', Woodend Museum, Scarborough.)