SNOWDON HILL QUARRY

OS Grid Reference: ST312089

Introduction

Snowdon Hill Quarry and an adjacent mine, known as 'Snowdon Caves', were last worked over 100 years ago for building materials and lime. At their maximum extent, the workings exposed a continuous section (Figure 3.32), cut by several small faults, through the highest part of the Upper Greensand (Whitecliff Chert and Eggardon Grit of the modern lithostratigraphical scheme), a Cenomanian 'Basement Bed' and overlying white chalks with siliceous nodules ('Lower Chalk') (Jukes-Browne and Hill, 1903, fig. 28). The beds dip at 5º to the west, and the main face shows two parallel north–south-trending faults, 9 m apart, with the block between them being upthrown by nearly 2 m. The faulted nature of the section can be seen in the engraving from Jukes-Browne and Hill (1903, fig. 28; Figure 3.33). The rich phosphatized ammonite fauna from the Basement Bed has provided much illustrated material, including type and figured specimens.

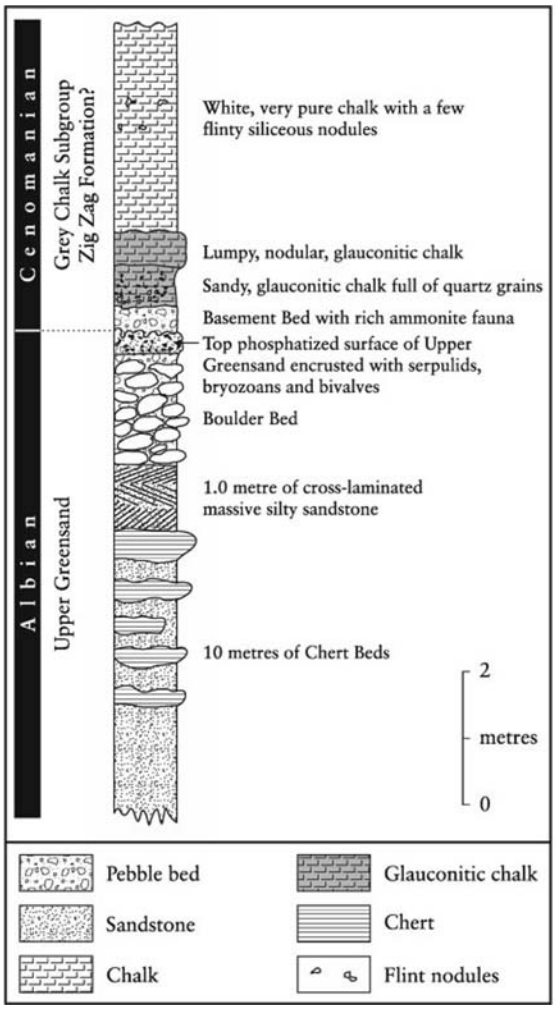

Figure 3.32: Snowdon Hill Quarry, Chard, Somerset. The most important Chalk Basement Bed assemblage of fossils in south-west England.

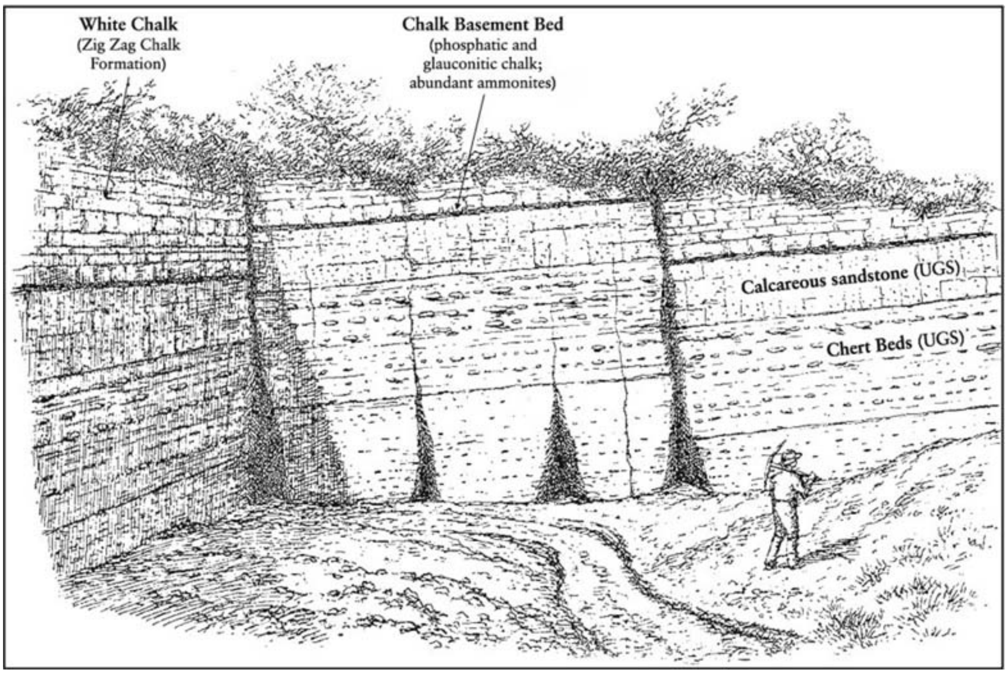

Figure 3.33: Snowdon Hill Quarry, Chard, Somerset, as seen in 1892 (UGS = Upper Greensand). (From Jukes-Browne and Hill, 1903, fig. 28, p. 118.)

Description

The sections were first documented by Wiest (1852), who recognized three beds above the Upper Greensand, of which the lowest (his 'Scaphites Bed') was described as 'a compact accumulation of fossils'. Wiest carefully recorded the brachiopod faunas from each of his three beds. The Upper Cretaceous succession was described in detail by Jukes-Browne and Hill (1903, pp. 118–20), who recorded 101 species in a faunal assemblage that was dominated by ammonites (40 species), bivalves and brachiopods with common gastropods, echinoderms, serpulids and crustaceans. The Cenomanian part of the succession was also described by Kennedy (1970). Many of the phosphatized ammonites from the basement bed were figured by Kennedy (1971) and by Wright and Kennedy (1984).

Despite the 100 years since excavation ceased the tough Whitecliff Chert is still well exposed, but the overlying chert-free calcarenites and calcareous sandstones (Eggardon Grit facies of the Upper Greensand) and the Cenomanian deposits were largely overgrown at the time of writing.

Lithostratigraphy

The succession summarized in Figure 3.32 is based on the descriptions byJukes-Browne and Hill (1903) and by Kennedy (1970). The oldest Cenomanian deposits consist of calcarenites and calcareous sandstones that infill crevices in an irregular mineralized complex hardground surface that formed on the top of the sandy Upper Greensand calcarenites. The highest part of the Upper Greensand is complexly fractured to produce a 'cobble conglomerate' similar to that described by Ali (1976) at the top of the Upper Greensand on the Devon coast at Beer. The Upper Greensand and Lower Cenomanian infillings within it appear to have been planed off by erosion and are overlain by the 'Basement Bed', an intensely reworked, highly bioturbated chalky sandstone crowded with phosphatized pebbles and the phosphatized moulds of fossils. Above the 'Basement Bed,' highly bioturbated glauconitic chalks pass up into gritty and nodular chalks with a sparse fauna, which are in turn overlain by white chalks containing sparse flinty siliceous nodules.

Biostratigraphy

The sandy limestone that separates the Upper Greensand from the 'Basement Bed' was reported by Smith and Drummond (1962) to be rich in rather poorly preserved crustacean remains and to contain the rhynchonellid brachiopods *Cyclothyris schloenbachi* (Davidson) and *Grasirhynchia grasiana* (d'Orbigny), and the echinoids *Catopygus columbarius* (Lamarck) and *Discoides subuculus* (Leske).

The pebbles of sandy limestone in the Basement Bed contain poorly preserved, glauconitized Lower Cenomanian ammonites (Kennedy, 1970): *Hyphoplites curvatus* (Mantell), *H. falcatus* (Mantell), *Mantelliceras* ex gr. *saxbii* (Sharpe) as well as (Wright and Kennedy, 1996, pl. 105, figs 4, 20) the rare species *Mesoturrilites boerssumensis* (Schlüter).

The phosphatic pebbles in the 'Basement Bed' contain a diverse ammonite assemblage that is indicative of the *Turrilites acutus* Subzone of the Middle Cenomanian *Acanthoceras rhotomagense* Zone, including *Acanthoceras rhotomagense* (Brongniart), *Anagaudryceras involvulum* (Stoliczka), *Anisoceras plicatile* (J. Sowerby), *Calycoceras* (*Gentoniceras*) *gentoni* (Brongniart), *C.* (*G.*) *subgentoni* (Spath), *C.* (*Calycoceras*) *bathyomphalum* (Kossmat), *C.* (*Newboldiceras*) *asiaticum asiaticum* (Jimbo), *C.* (*N.*) *a. spinosum* (Kossmat), *C.* (*N.*) *a. hunteri* (Kossmat), *C.* (*N.*) *tunetanum* (Pervinquière), *C.* (*N.*) *vergonsense* (Collignon), *C.* (*Proeucalycoceras*) *picteti* Wright and Kennedy, *Desmoceras latidorsatum* (Michelin), *Eoscaphites chardensis* Wright and Kennedy, *Eucalycoceras gothicum* (Kossmat), *Forbesiceras obtectum* (Sharpe), *F. largilliertianum* (d'Orbigny), *Hamites subvirgulatus* Spath, *Parapuzosia* (*Austiniceras*) *austeni* (Sharpe), *Protacanthoceras arkelli verrucosum* Wright and Kennedy, *P. tuberculatum tuberculatum* Thomel, *Puzosia mayoriana* (d'Orbigny), *Scaphites equalis* J. Sowerby, *S. obliquus* J. Sowerby, *Schloenbachia coupei* (Brongniart), *Sciponoceras baculoides* (Mantell), *Turrilites acutus* Passy, *T. costatus* Lamarck and *Worthoceras* sp.. Snowdon Hill Quarry is the type locality for *Eoscaphites chardensis* and provided paratypes for *Calycoceras* (*Proeucalycoceras*) *picteti* and *Protacanthoceras arkelli verrucosum.*

The chalk with branching nodular concretions, immediately above the 'Basement Bed', contains a weakly or non-phosphatized *Acanthoceras jukesbrownei* Zone fauna which includes *A. jukesbrownei* (Spath), *Calycoceras* (*Proeucalycoceras*) *picteti*, *C.* (*Newboldiceras*) *asiaticum spinosum*, *Eucalycoceras gothicum* (Kossmat), *Lotzeites* sp., *Parapuzosia (Austiniceras)* sp. and *Puzosia* sp..

Interpretation

The relationship of the 'Basement Bed' to the Upper Greensand is complex, and this has led to varying descriptions of the section. It is clear, however, that the oldest Cenomanian deposit is the sandy limestone that infills crevices in the Upper Greensand and is intercalated between the Upper Greensand and the Basement Bed. The similarity of the lithologies of the infillings and the host rock led some early authors to assign a Cenomanian age to this highest part of the Upper Greensand. The top surface of the Upper Greensand is phosphatized and glauconitized and has phosphatized bivalves, serpulids and bryozoans adhering to it (Kennedy, 1970). The fauna of small brachiopods and echinoids from this sandy limestone bed, particularly *Cyclothyris schloenbachi*, suggests possible correlation with the Pounds Pool Member (Bed A1) of the Beer Head Limestone Formation of the coastal sections. However, the characteristic coralline sponge *Acanthochaetetes ramulosus* (Michelin) has not been recorded.

The overlying Basement Bed reveals a complex depositional history of repeated sediment reworking. The poorly preserved glauconitized ammonite assemblage, which includes *Mesoturrilites boerssumensis*, as well as species of *Hyphoplites* and *Mantelliceras*, is broadly indicative of the Lower Cenomanian Substage and correlates with the undivided Pounds Pool and Hooken members (Bed A). However, the occurrence (Wright and Kennedy, 1996, pl. 105, figs 4, 20) of *Mesoturrilites boerssumensis* as a pebble-fossil strongly suggests reworking of the *dixoni* Zone, since this species is particularly characteristic of the higher part of that zone (*Mesoturrilites boerssumensis* Subzone of Kaplan *et al.*, 1998) in marl facies (e.g. **Southerham Grey Pit** – cf. Gale, 1996; see GCR site report, this volume). The derived Lower Cenomanian ammonites in the Basement Bed are therefore not necessarily of the same age as the non-ammonite fossils recorded from the sandy limestone below the Basement Bed, but they could have been derived from an equivalent of the *dixoni* Zone 'Grizzle' at the top of the Wilmington Sand, i.e. the equivalent of the Hooken Member (Bed A2). Some of the other pebbles may have been reworked from the sandy limestone that underlies the 'Basement Bed'. Corresponding to the non-sequence elsewhere between the Hooken and Little Beach members of the Beer Head Limestone, there is no evidence in the phosphatized assemblage of the Basement Bed for the basal Middle Cenomanian *Cunningtoniceras inerme* Zone. The phosphatized *acutus* Subzone ammonite assemblage of the Basement Bed, together with the presence of abundant *Holaster subglobosus*, suggest correlation with the lower part of the Little Beach Member (Bed B), above the level with phosphatized *costatus* Subzone ammonites. The partially phosphatized *jukesbrownei* assemblage above the Basement Bed is represented as an indigenous fauna in the higher part of the Little Beach Member of the coastal sections and (sparingly) in the derived phosphatized assemblage at the base of the Pinnacles Member (Bed C) of the Holywell Nodular Chalk Formation. The Basement Bed and the overlying chalk with branching nodules are therefore effectively a proximal expression of the Little Beach Member of the Beer Head Limestone Formation. The highly condensed Middle Cenomanian succession here points to structural control of sedimentation. There is no evidence here that the Pinnacles Member is represented above this level.

The white chalks with flinty siliceous nodules at the top of the formerly visible section were assigned by Jukes-Browne and Hill (1903) to the 'Lower Chalk', although they recorded no faunal evidence. However, their interpretation is strongly supported by the record (Jukes-Browne and Hill, 1903, fig. 29) of similar chalks in a quarry, 2 miles (3.2 km) north-west of Chard, and well to the north of Snowdon Hill. These beds were overlain by marly sediments from which several specimens of the belemnite *Praeactinocamax plenus* (Blainville) were collected by Hill (Jukes-Browne, unpublished manuscript). This clearly proves the existence of Plenus Marls in the vicinity of Chard. If this interpretation of the highest part of the Snowdon Hill Quarry succession is correct, these white chalks with siliceous nodules would be partially time-equivalent to the derived phosphatized *Calycoceras guerangeri* Zone ammonites at the base of the Pinnacles Member (Bed C) of the Holywell Nodular Chalk Formation, and to the higher part of the Zig Zag Chalk Formation of the Grey Chalk Subgroup in sections to the east. The foraminiferal evidence (Carter and Hart, 1977a, fig. 34) provides some support for this interpretation, in that the highest sample, *c*. 1 m above the Basement Bed, is suggestive of a horizon in the *guerangeri* Zone. The Snowdon Hill Quarry succession would then differ significantly from that at **Furley Chalk Pit** (see GCR site report, this volume) in the Membury outlier, where the Pinnacles Member (i.e. Plenus Marls equivalent) is represented directly above the Chalk Basement Bed. On the other hand, in view of the intensely faulted nature of the Cretaceous outcrop in the vicinity of Chard, it may be that the highest part of the Snowdon Hill Quarry succession correlates with the Chalk above the Basement Bed at Furley Chalk Pit. This intriguing question remains unresolved.

Jukes-Browne and Hill (1903, p. 429) also recorded Melbourn Rock, as well as nodular flinty 'Middle Chalk' with flints and *Inoceramus* (i.e. *Mytiloides*) *mytiloides* (Mantell), from other pits in the same general area. These observations show that elements of the normal succession appear here for the first time and demonstrate the fundamental importance of structural control on Cretaceous sedimentation in this zone of closely-spaced north–south faults and associated half-grabens.

A similar section to that at Snowdon Hill Quarry was formerly exposed at Storridge Hill (ST 318 048), 4 km to the south and within the same fault block. Here, 1.3 m of sandstones, resting with erosive contact on Chert Beds, are sharply overlain by an intensely hard, fossiliferous conglomeratic sandy limestone, up to 0.3 m thick, that is lithologically similar to the thin, condensed developments of the Hooken Member (Bed A2) of the coastal sections (Smith and Drummond, 1962, p. 347; Kennedy, 1970, p. 651). The top of this limestone has a thin chocolate-brown veneer of shiny phosphate with adnate fossils including serpulids, bryozoans and bivalves. The overlying Basement Bed contains pebbles reworked from the underlying limestone, phosphatized *acutus* Subzone ammonites, abundant *Holaster subglobosus* (some phosphatized), and non-phosphatized ammonites from the *jukesbrownei* Zone. The Chalk above the Basement Bed contains a foraminiferal fauna (Carter and Hart, 1977a, fig. 35) suggestive of the *guerangeri* Zone, as at Snowdon Hill. This key succession is thus intermediate in character between the coast sections and the inland sections on the one hand, and the basinal successions to the east, on the other.

Conclusions

Snowdon Hill Quarry contains the most northerly exposure of Cenomanian deposits within the fault-bounded Upper Cretaceous outliers of south-west England. The highly condensed and richly fossiliferous nature of the Cenomanian deposits and their complex relationship to the underlying Albian Upper Greensand make it a key locality for understanding the Cenomanian history of the area. The Middle Cenomanian ammonites from the Basement Bed are critical for international correlation.

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