Kellaways–West Tytherton, Wiltshire

[ST 947 757]–[ST 943 744]

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Introduction

The Kellaways–West Tytherton GCR site comprises small exposures in the banks of the River Avon, to the west and south of Kellaways [ST 947 757], Wiltshire (Figure 3.11). The main stratum exposed there is the 'Kelloway Rock' of Townsend (1813) or 'Kelloways Stone' of William Smith (1817), more recently known as the 'Kellaways Rock'. This is a relatively local calcareous sandstone facies of a unit that elsewhere in southern and central England is developed as softer, mainly uncemented sands and silts. Together these comprise the Kellaways Sand Member of which the GCR site is the type locality (Page, 1989). The underlying Kellaways Clay Member is also seen here; the Bristol Avon River Authority Tytherton No. 3 Borehole (Cave and Cox, 1975), sited at [ST 9440 7445] on the eastern side of the river adjacent to the GCR site, is its proposed type section as well as that of the parent Kellaways Formation (Page, 1989). As well as these lithostratigraphical units, the locality gives its name (in latinized form) to the ammonite *Sigaloceras calloviense* (J. Sowerby) (Figure 3.12) which itself gives its name to the Caboviense Zone and Subzone, and to the Callovian Stage. The GCR site includes the type sections, as defined by their bases, of both these zonal units, and the site and its vicinity have yielded the type specimens of a number of fossil taxa. The overlying Oxford Clay Formation is exposed at the southern end of the site (Page, 1988).

Description

The geology of the site was first recorded by Townsend (1813) and later by Lonsdale (1832) and Woodward (1895). It was included in the [British] Geological Survey memoir of White (1925) and, subsequently, Cave and Cox (1975) provided the only complete record of the Kellaways Clay Member hereabouts based on cored boreholes. The succession is shown graphically in (Figure 3.13).

As proved in the Tytherton No. 3 Borehole, the Kellaways Clay Member is a predominantly pale to medium greenish-grey, silty and, in part, sandy clay in which bivalves, including *Chlamys, Entolium, Grammatodon, Meleagrinella, Modiolus, Myophorella, Oxytoma, Pleuromya, Protocardia, Thracia* and small oysters, are common. The gastropod *Procerithium* is also present as well as the ammonites *Kepplerites, Macrocephalites* and *Proplanulites.* In the Tytherton No. 3 Borehole, the Kellaways Clay Member is 17.32 m thick; the basal 1.87 m correlate with the Cayton Clay Formation of the Cleveland Basin (see Chapter 5), and Page (1988, 1989) assigned them to that unit. White (1925) and Cave and Cox (1975) recorded ammonitiferous 'blue sandy clay with septaria' belonging to this member in a side stream at *c.* [ST 945 748], and at least 2.25 m of bluish-grey sandy clay (= Bed 1 of Page, 1988) are exposed above water level in the west bank of the river near the footbridge at [ST 944 749].

At the base of the overlying Kellaways Sand Member, a *c.* 0.15 m-thick shelly sand infills burrows in the top of the Kellaways Clay Member, and passes up into thinly bedded sandstone (Bed 2 of Page, 1988) with occasional harder, cemented shelly lenses. The fauna includes abundant *Gryphaea* (*Bilobissa*) *dilobotes* Duff (first appearing at this level) with *Microthyridina* cf. *ornithocephala* auctt. as well as *Oxytoma, Pleuromya* and the belemnite *Cylindroteuthis.* The bed is capped by a thin, flaggy calcareous sandstone (0.10–0.15 m thick) with occasional shelly lenses (= Bed 3a) but generally with fewer fossils than the bed below. The ammonite fauna of beds 2 and 3a comprises *Sigaloceras* (*S.*) *calloviense* (J. Sowerby) (including the lectotype; (Figure 3.12)), *Sigaloceras quinqueplicata* (S.S. Buckman) (including the holotype), *Cadoceras sublaeve* (J. Sowerby) trans. a of Callomon and Page (in Callomon *et al.,* 1989), *Proplanulites* ex gr. *petrosus* S.S. Buckman, *P. crassicosta* (S.S. Buckman) and *Parapatoceras calloviense* (Morris). The overlying *c.* 0.6–0.65 m of calcareous sandstone contains, in its lowest part, a *c.* 0.15 m-thick bed (Bed 3b) with common shelly lenses rich in well-preserved fossils that often weather out at the surface. The fauna is rich in bivalves (including *Isocyprina, Oxytoma, Trautscholdia* and small oysters) with gastropods (*Dicroloma* and *Procerithium*), rhynchonellid

brachiopods, scapho-pods and ammonites. The latter include *Sigaloceras* (*S.*)*micans* S.S. Buckman, *Cadoceras sublaeve* trans. p Callomon and Page (in Callomon *et al.,* 1989), and *Proplanulites* ex gr. *petrosus* S.S. Buckman and *P. crassicosta* (S.S. Buckman). Most of the early collections of fossils probably came from a few shallow excavations and the adjacent river bank exposures south of Mauds Causeway (e.g. Woodward, 1895); a small exposure still exists in the west bank of the river at *c.* [ST 946 756]. However, the best exposures are farther south, west of West Tytherton, and these and the adjoining fields are likely to have been the source of most of the known Kellaways Rock material collected from the late 19th century onwards (Page, 1988). In addition, excavations for a flood-control channel around [ST 944 749]–[ST 938 744] are likely to have been a key source of museum material (J.H. Callomon, pers. comm., 1996).

Higher parts of the Kellaways Sand Member are poorly exposed. Loose blocks around [ST 942 745], apparently dredged from the river, are presumably from a higher level than seen in the above exposures and comprise a grey sandstone with poorly preserved *S.* (*S.*) cf. *micans, P.* ex gr. *petrosus, Gryphaea dilobotes, Microthyridina* cf. *calloviensis* (d'Orbigny), rhynchonellids, *Oxytoma, Pleuromya, Trautscholdia* and other bivalves. A similar bed is seen *in situ* at the base of the river bank on a bend at [ST 945 745]; it is overlain by the Oxford Clay Formation, comprising 0.4 m of grey-weathered clay with fragments of indeterminate kosmocer-atid ammonites, which is overlain by alluvium. An exposure in the base of a nearby ditch, around 2–3 m higher, showed about 0.3 m of bluish-grey clay with crushed aragonitic ammonites including *Kosmoceras* (*Gulielmiceras*) and a perisphinctid, and the bivalves *Gryphaea* and *Trautscholdia* (Page, 1988). Loose shelly micritic limestone nodules with *Meleagrinella,* rhynchonellid brachiopods, *Sigaloceras* (*Catasigaloceras*) ex gr. *enodatum* (Nikitin), *Cadoceras* sp. and a perisphinctid are also reported from the basal beds of the Oxford Clay Formation hereabouts (Page, 1988).

Interpretation

From the early days of descriptive palaeontology (e.g. Sowerby, 1812–1822) up to the time of S.S. Buckman (1909–1930), this area of Wiltshire has yielded the type specimens of many fossil taxa of which the ammonites are of particular importance, notably the stratigraphical index species *Kepplerites* (*Gowericeras*)*galilaeii* (Oppel) (the lectotype coming from nearby Chippenham), *Sigaloceras* (*S.*) *calloviense* and *S.* (*S.*) *micans.* Many species *of Proplanulites* were proposed by Buckman (1909–1930) based on specimens from the Kellaways district; many of these are likely to be synonymized when the fauna is reviewed but, in the meantime, *P. petrosus* and *P. crassicosta* are typical microconch and macroconch forms, and their names have therefore been used in the site description above.

Macrocephalites, Proplanulites and *Kepplerites* in the lower part of the Kellaways Clay Member in the Tytherton No. 3 Borehole probably represent the classic fauna of the Lower Callovian Koenigi Zone, Gowerianus Subzone known from nearby Chippenham. The fauna of *Proplanulites* and *Kepplerites* in the top part of the member is probably equivalent to the fauna known from calcareous concretions excavated from the upper part of the member in the area and occasionally found on the river banks. According to Page (1988), the latter includes *Kepplerites* (*Gowericeras*) ex gr. *galilaeii, Cadoceras* sp. nov. D (of Callomon and Page in Callomon *et al., 1989*), *Parapatoceras distans* (Baugier and Sauze) (abundant), *Proplanulites* aff. *petrosus* and rare *Macrocephalites.* This fauna is indicative of the *galilaeii* Biohorizon of the Koenigi Zone, Galilaeii Subzone (see (Figure 1.4), Chapter 1). The pale bluish-grey calcareous matrix and white shell preservation are unmistakable.

The ammonite fauna of the lower part of the Kellaways Sand Member (Bed 2 of Page, 1988) indicates the *calloviense* Biohorizon of the Calloviense Zone and Subzone. The base of Bed 2 was designated by Page (1989) as a reference for the base of this zone and subzone, and beds 2 and 3a are the type section for the *calloviense* Biohorizon of Page (1988) and Callomon and Page (in Callomon *et al.,* 1989). The ammonites of Bed 3b represent the *micans* Biohorizon of the Calloviense Zone and Subzone, of which the bed is the stratotype. The ammonite faunas reported from the overlying Oxford Clay Formation indicate the Calloviense Zone, Enodatum Subzone and the Jason Zone.

The site was used by d'Orbigny (1850a) as the basis of his sixth division of the Jurassic System (etage Callovien/Callovian Stage). Later, Oppel (1857), who first established a sequence of zones based on ammonite faunas for use in the correlation of Jurassic rocks, divided his 'Kellowaygruppe' (d'Orbigny's 'etage Callovien') into three zones, the lowest of which, the 'Zone der *Ammonites macrocephalus*'included in its upper part a 'Zone der *Ammonites*

calloviensis' represented by the 'Kellaway-Stone von Kelloway Mill'. The site has thus played a key role in the history of Callovian stratigraphy but, despite this, it cannot be proposed as a GSSP for the Callovian Stage because the basal boundary with the Bathonian Stage is not exposed there.

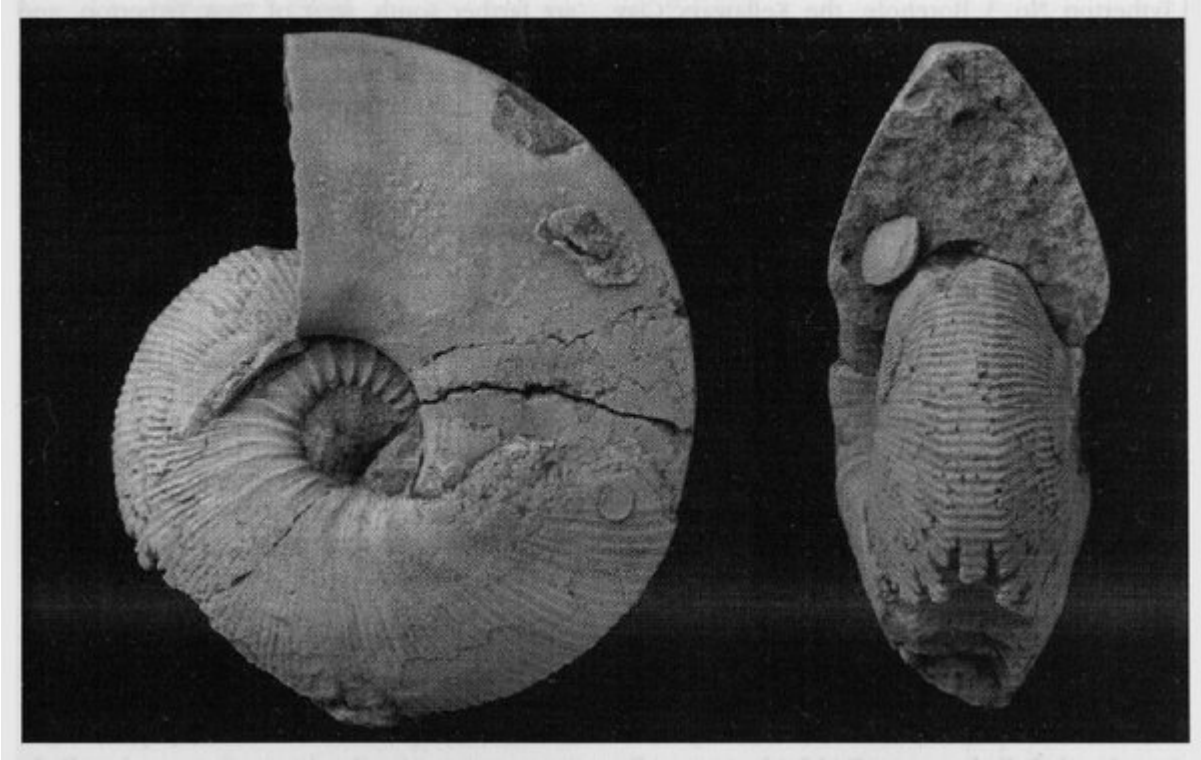
The thickness of the Kellaways Formation in Wiltshire is much greater than in counties farther north and east. Thickening occurs over a narrow zone in the neighbourhood of Cricklade, *c.* 25 km north-east of Kellaways, near the southward extension of the structure known as the 'Moreton Axis', which marks the eastern edge of the Worcester Basin (see (Figure 1.6)d, Chapter 1) (Sumbler, 1996).

Conclusions

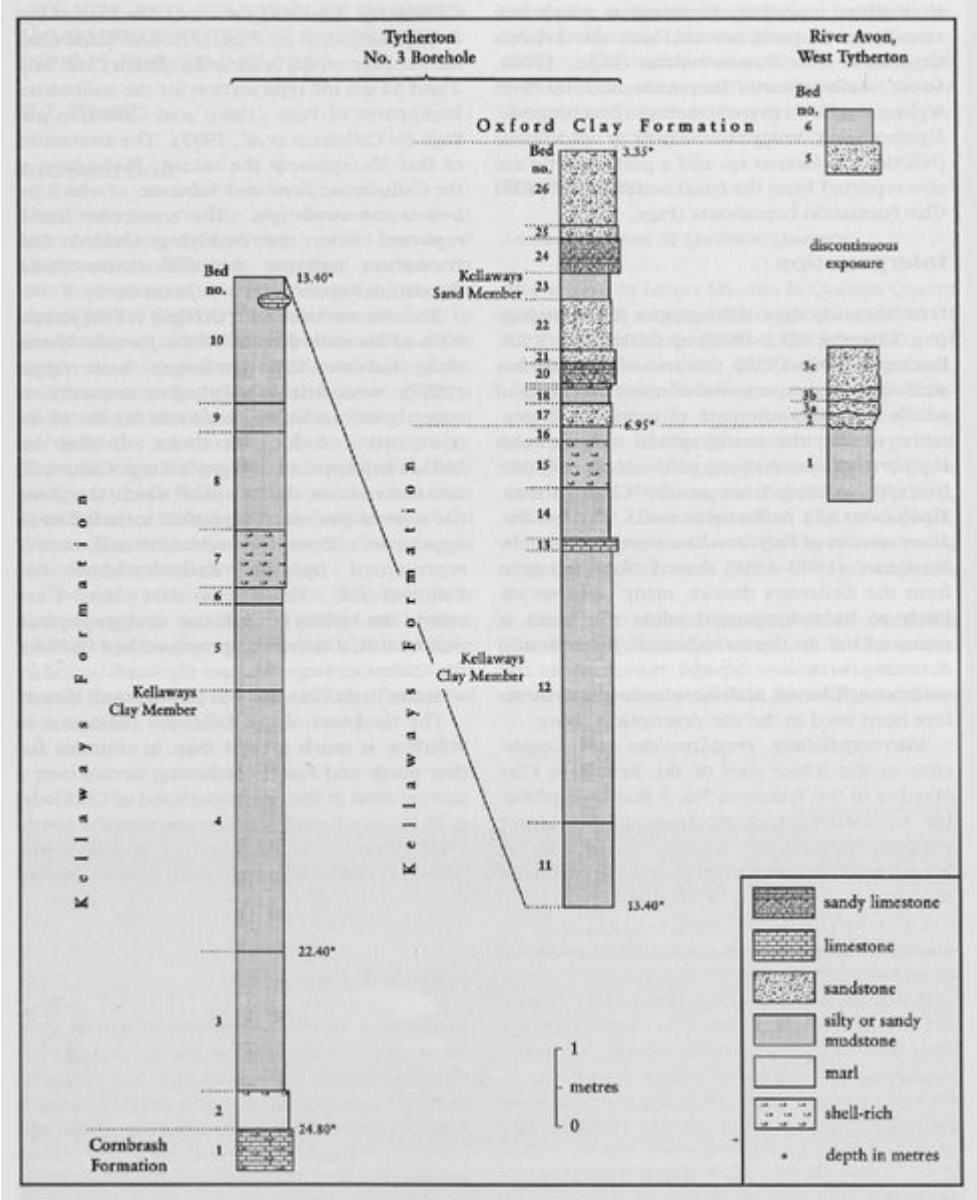
Historically, the Kellaways–West Tytherton GCR site is probably the most important and famous Callovian locality in the world because it gives its name, in latinized form, to this division of Earth history. A cored borehole adjacent to the site provides valuable additional data and stratigraphical control. Several Lower Callovian lithostratigraphical, biostratigraphical and chronostratigraphical units, as well as fossil taxa, have their type localities here; in particular, the ammonite faunas, on which stratal subdivisions used in correlation are based, are of international importance.

References

(Figure 3.11) The Kellaways Sand Member exposed in the banks of the River Avon west of West Tytherton (Kellaways–West Tytherton GCR site). (Photo: B.M. Cox, 1970.))

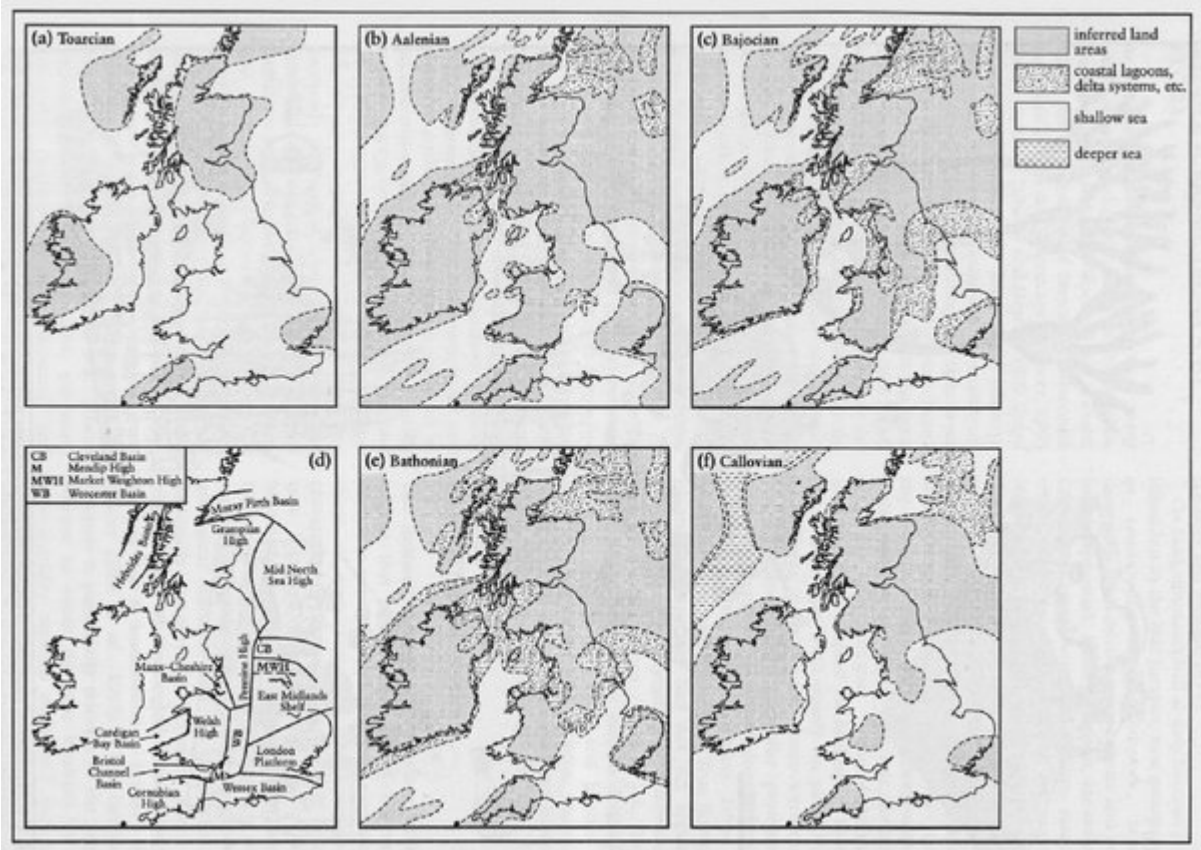


(Figure 3.12) Lectotype of Sigaloceras calloviense (J. Sowerby); The Natural History Museum, London, specimen No. 43924a; c. 95% natural size. (Photo: © The Natural History Museum.))



(Figure 3.13) Graphic section showing the correlation between the cored Tytherton No. 3 Borehole and the exposures in the banks of the River Avon, west of West Tytherton (Kellaways–West Tytherton GCR site). (After Page, 1988.) Bed numbers follow Page (1988).)

(Figure 1.4) Ammonite biohorizons recognized in the British Middle Jurassic Series (for sources, see text).)



(Figure 1.6) (a–c,e,f) Palaeogeographical reconstructions for the British area during the late Early and Mid Jurassic (slightly modified from Cope, 1995); (d) main structural elements affecting sedimentation in the British area in the Mid Jurassic (terminology as used in this volume). The 'London Platform' is a structural high, the limits of which remained generally constant. The emergent part of the Platform, the position and limits of which varied, is referred to as the 'London Landmass'. (Compiled from various sources.))