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# Cadh'-An-Righ, Ross-Shire

[NH 849 723]-[NH 853 733]

K.N. Page

## Introduction

The sections at Cadh'-an-Righ represent a remarkably thinner and more muddy lateral equivalent of the classic Callovian succession at Brora (see Brora (Callovian) GCR site report, this volume, and (Figure 6.7)), c. 30 km to the north. Callovian rocks are exposed on the beach at Cadh'-an-Righ, 3.2 km south of Balintore, but they can be seen, dipping c. 70° seawards, only at low tides (Sykes, 1975). The GCR site extends for c. 1 km immediately south of Port an Righ. The sections were already known to Murchison (1829a) and were also mentioned by Judd (1873). Both Buckman (1924) and Lee (1925) described the succession in terms of the units recognized at Brora. Sykes (1975) formally defined the current lithostratigraphical units, as briefly reviewed by Duff (1980), and, more recently, the section was included in a palaeoenvironmental study by MacLennan and Trewin (1989). The site includes the type sections of the Cadh'-an-Righ Shale and Shandwick Clay members of the Brora Argillaceous Formation [NH 851 728] and [NC 853 733] respectively).

## Description

The following section of the Callovian succession is based mainly on Sykes (1975) with additional notes from MacLennan and Trewin (1989).

Thickness (m)

### Brora Argillaceous Formation

**Shandwick Clay Member**(part) Grey-green clays with pyritic burrows; bands of carbonaceous debris in upper part with c. 4 m of sandy silt at top; bands of limestone nodules inc. 11.0 lower part; low-diversity fauna with relatively common *Nuculoma* and ammonites; interburrowed junction with

### Cadhcan-Righ Shale Member

Bituminous shale with thin beds of glauconitic silt; band of calcitic concretions, 0.05–0.30 m thick with cone-in-cone margin in places, 1.3 m above base and enclosing smaller phosphatic nodules with sponge spicules; otherwise poorly fossiliferous with *Lingula*, *Cylindroteuthis* (concentrated in silts), fish debris and occasional ammonites (*Kosmoceras*); basal 0.05 m with laminae of reworked sand from the underlying Brora Roof Bed together with glauconite

3.7

### Brora Roof Bed

Intensely bioturbated, medium-grained sandstone; band of belemnites (*Cylindroteuthis*) at top with large coalified wood-clasts up to 0.20 m diameter; poorly preserved bivalves below, including *Pleuromya uniformis* (J. Sowerby), *Ctenostreon* sp. and pectinids

0.5

At the top of the underlying Brora Coal Formation, the 'Brora Coal' coal seam, which is not now exposed on the foreshore at Brora, can be seen.

## Interpretation

The ammonite fauna allows the recognition of the standard Callovian zones and subzones. Just above the Brora Roof Bed, *Kosmoceras (Gulielmiceras) medea* Callomon, in the Cadh'-an-Righ Shale Member, indicates the (Middle Callovian) Medea Subzone, Jason Zone, and *K. (Zugokosmokeras) grossouvrei* R. Douvillé and *K. (Lobokosmokeras) phaeinum* S.S. Buckman, immediately above the calcitic concretions, indicate a level close to the Coronatum-Athleta zonal boundary (= Middle-Upper Callovian substage boundary). These ammonite occurrences suggest that the concretionary horizon marks a non-sequence (Sykes, 1975).

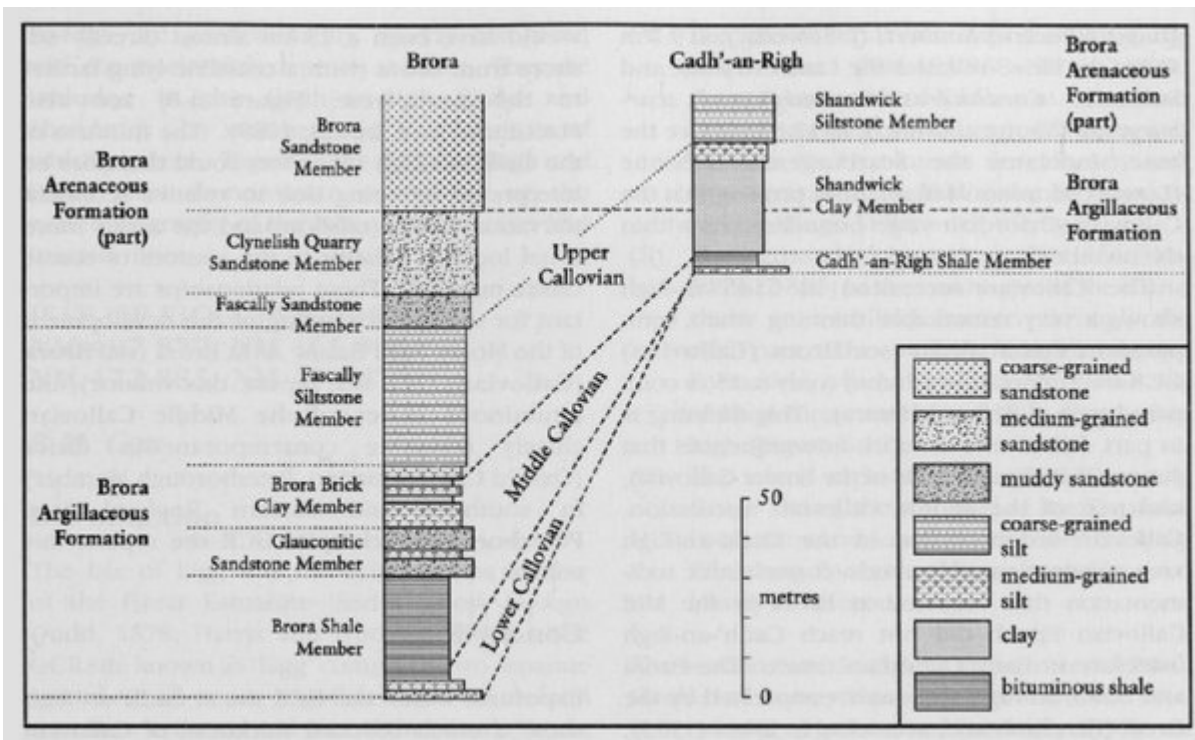
In the Shandwick Clay Member, *Kosmoceras (K.) cf. tidmoorensis* Arkell, at 3.5 m above the base, indicates the Spinosum Subzone (Athleta Zone)-Henrici Subzone (Lamberti Zone), and *Quenstedtoceras lamberti* (J. Sowerby), at 9.7 m above the base, indicates the Lamberti Zone and Subzone. *Cardioceras (Scarburgiceras) scarburgense* (Young and Bird), at 12.3 m above the base, indicates the Scarburgense Subzone (Lower Oxfordian Mariae Zone) proving that the Callovian–Oxfordian stage boundary lies within the member.

The Callovian succession at Cadh'-an-Righ shows a very remarkable thinning when compared to that at Brora (see Brora (Callovian) GCR site report, this volume) (only c. 15 m compared with c. 115 m at Brora). This thinning is in part due to one or more non-sequences that cut out the younger beds of the Lower Callovian, and part of the Middle Callovian, succession. Callovian sedimentation in the Cadh'-an-Righ area was dominated by muds; coarse elastic sedimentation that occurred at Brora in the Mid Callovian Epoch did not reach Cadh'-an-Righ until late in Early Oxfordian times. The Brora and Cadh'-an-Righ sections are separated by the Great Glen Fault and, according to Sykes (1975), reconstruction of the relationship between the two sites, prior to c. 29 km of lateral movement on the fault, shows that the Cadh'-an-Righ area would have been c. 15 km almost directly offshore from Brora (with a coastline lying farther to the north-west; (Figure 6.8); see also MacLennan and Trewin, 1989). The thinness of the Cadh'-an-Righ sequences could therefore be interpreted as being due to relative sediment starvation farther offshore and the area's more distal location relative to the sources of coarse elastic material. These relationships are important for the understanding of the development of the Moray Firth Basin. As at Brora (see Brora (Callovian) GCR site report, this volume), the bituminous shales of the Middle Callovian closely resemble contemporaneous facies (Oxford Clay Formation, Peterborough Member) in southern and eastern England (see Peterborough Brickpits GCR site report, this volume).

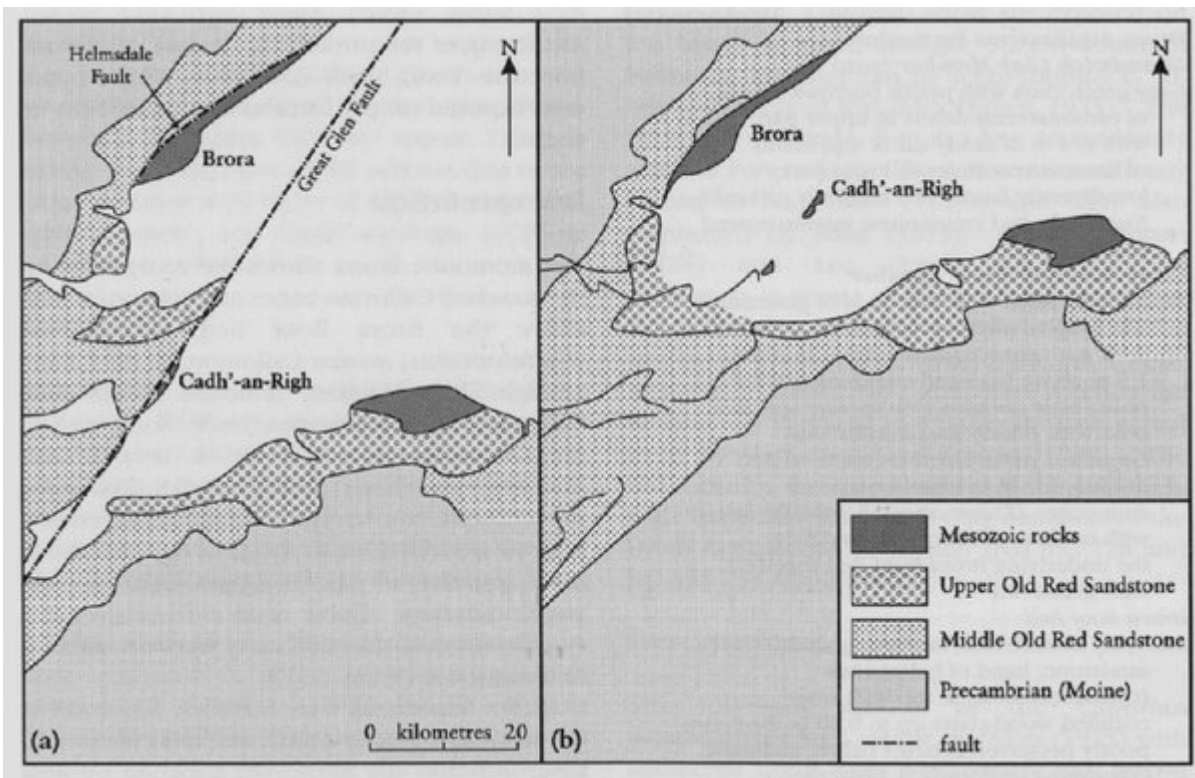
## Conclusions

Exposures within the GCR site at Cadh'-an-Righ show a much reduced thickness of Callovian strata compared with those at Brora (see Brora (Callovian) GCR site report, this volume), c. 30 km farther north. The lithologies at Cadh'-an-Righ are predominantly muddy compared (A) with the more sandy deposits at Brora. They are included in the Cadh'-an-Righ Shale and Shandwick Clay members, the type localities of which are here. Together, the Cadh'-an-Righ and Brora sites demonstrate something of the palaeogeography of the Moray Firth area in Mid Jurassic times. (B)

## [References](#)



(Figure 6.7) Correlation between the Callovian sections at the Brora (Callovian) and Cadh'-an-Righ GCR sites. (After Sykes, 1975, fig. 7.)



(Figure 6.8) Sketch maps showing the relative positions of the Brora and Cadh'-an-Righ outcrops (a) after, and (b) before post-Jurassic movement along the Great Glen Fault. (After Sykes, 1975, fig. 2.)