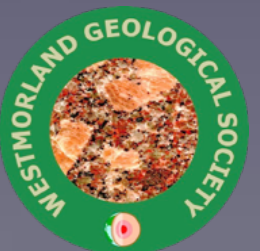


# Kendal Limestone Geotrail



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**Disclaimer:** The sites described in this guide are in abandoned quarries, woodland and open fell locations on public ground. The author and Westmorland Geological Society cannot be responsible in any way for accidents or injuries sustained if you visit these places.

**Acknowledgements:** Particular thanks to various members of Westmorland Geological Society and several independent reviewers whose insightful comments and suggestions improved the Guide.

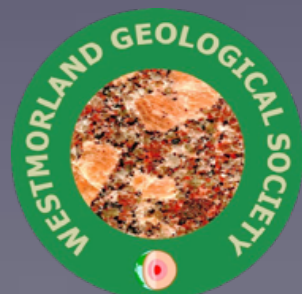
Westmorland Geological Society is a friendly local geology group and welcomes everyone who is interested in Earth Science; no prior knowledge of the subject is required. We host a winter programme of lectures in Kendal on the third Wednesday of each month and tutorials on the fourth Tuesday of the month. In the summer we organise field excursions to places of geological interest within a reasonable distance of Kendal.

For more details of the Society and events please visit our website or Facebook page.

<https://www.westmorlandgeolsoc.co.uk>



Bedding surface Dalton Formation, Cunswick Scar



# Introduction

Carboniferous Limestone outcrops west of Kendal on Scout Scar, Cunswick Scar and Kendal Fell. This guide illustrates a selection of outcrops accessible on walks from Kendal town centre with location map and grid reference provided for each outcrop. Strong footwear and suitable outdoor clothing are recommended.

The BGS Kendal Solid Geology Map (available to view free) and the BGS Geology of Britain app (IOS and Android) are useful additional resources to have. The self-guided walk leaflet 'A Geological Walk from Kendal' is also recommended.



Bioturbated Pseudobreccia with interbedded mudstone, Serpentine Woods



# Background

The Carboniferous Limestones of Kendal form part of the the Great Scar Limestone Group (GSLG). The early Carboniferous marine transgression (sea level rise) began 347 million years ago. The UK was located in equatorial latitudes for much of the Carboniferous Period and during Viséan times a carbonate ramp/slope complex developed in south Cumbria onto which up to 800 metres of carbonate sediment were deposited in a tectonically active, fault bounded basin. The calcareous mud, sand, shell fragments, corals, crinoids and other marine organisms were lithified into limestone through burial and compression by later sediments.

In late Viséan times glaciation in the southern hemisphere resulted in repeated sea level fluctuations producing a cyclicity with periods of shallow water deposition and periods of emergence when palaeosols (fossil soil horizons) and tree growth developed. Thirty to forty sea level fluctuations occurred over 3.5-4.5 million years suggesting cycle intervals of 100,000 to 120,000 years. The exposed surfaces were subjected to weathering; the limestone dissolved forming karstic surfaces that were subsequently buried by younger sediments. The resulting limestone pavements are referred to as 'palaeokarst'.

Chrono stratigraphy		Ma	Stage		Lithostratigraphy	
Early Carboniferous	Mississippian	Viséan	331	Asbian	Great Scar Limestone Group	Urswick Limestone Formation
			328	Holkerian		Park Limestone Formation
			328	Arundian		Dalton Formation
						Red Hill Limestone Fm
			325	Chadian		Martin Limestone Formation
			347	Courceyan		

The Red Hill Limestone Formations does not outcrop near to Kendal.



# Local Stratigraphy

The oldest Carboniferous deposits, the **Martin Limestone Formation**, are named after Martin Quarry, Dalton-in-Furness. Grey or greenish grey carbonate mudstones deposited in shallow water. Although present east of Kendal Fell there are no outcrops. The nearest outcrops are below Barrowfield Farm on the west side of Scout Scar.

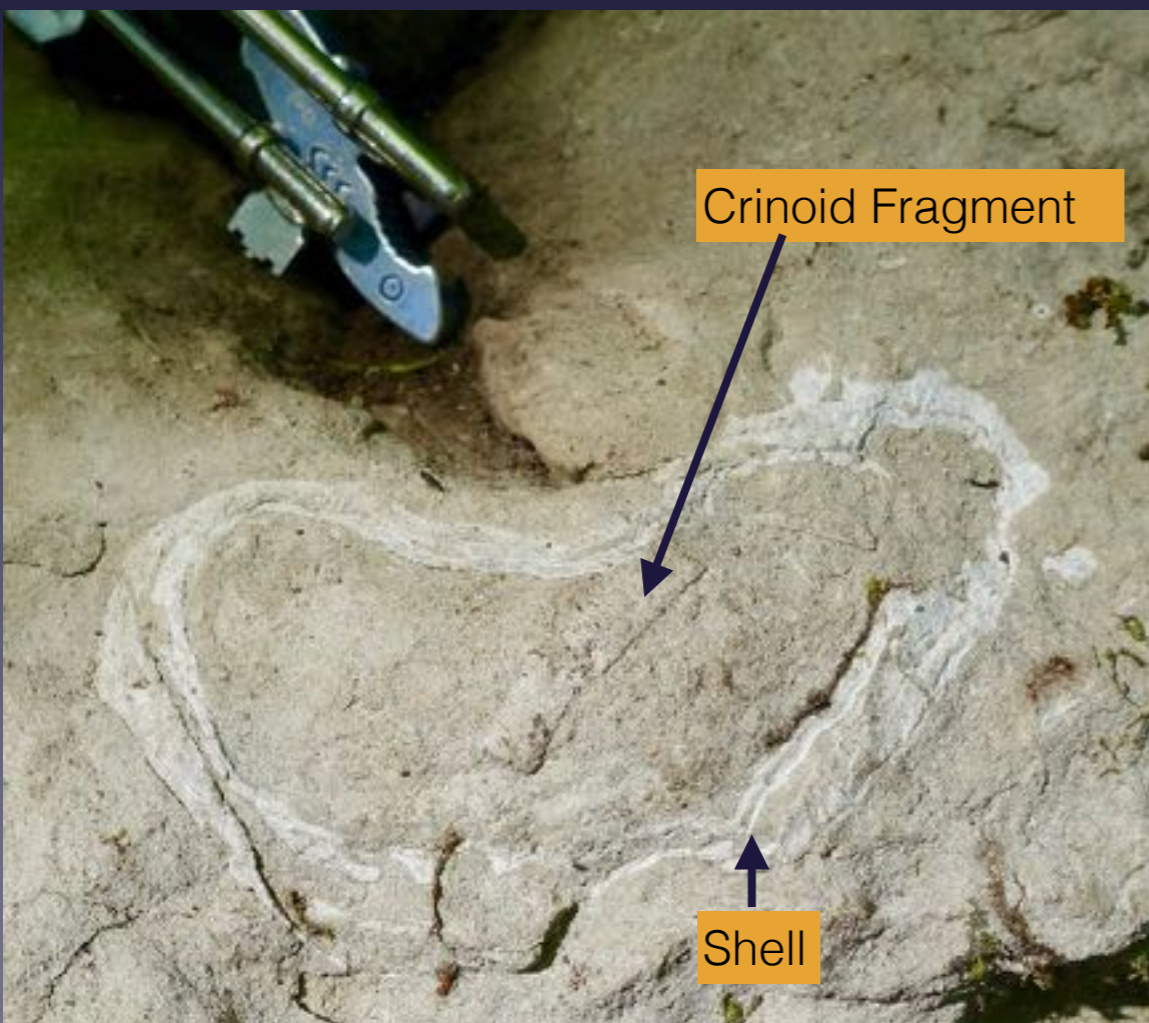
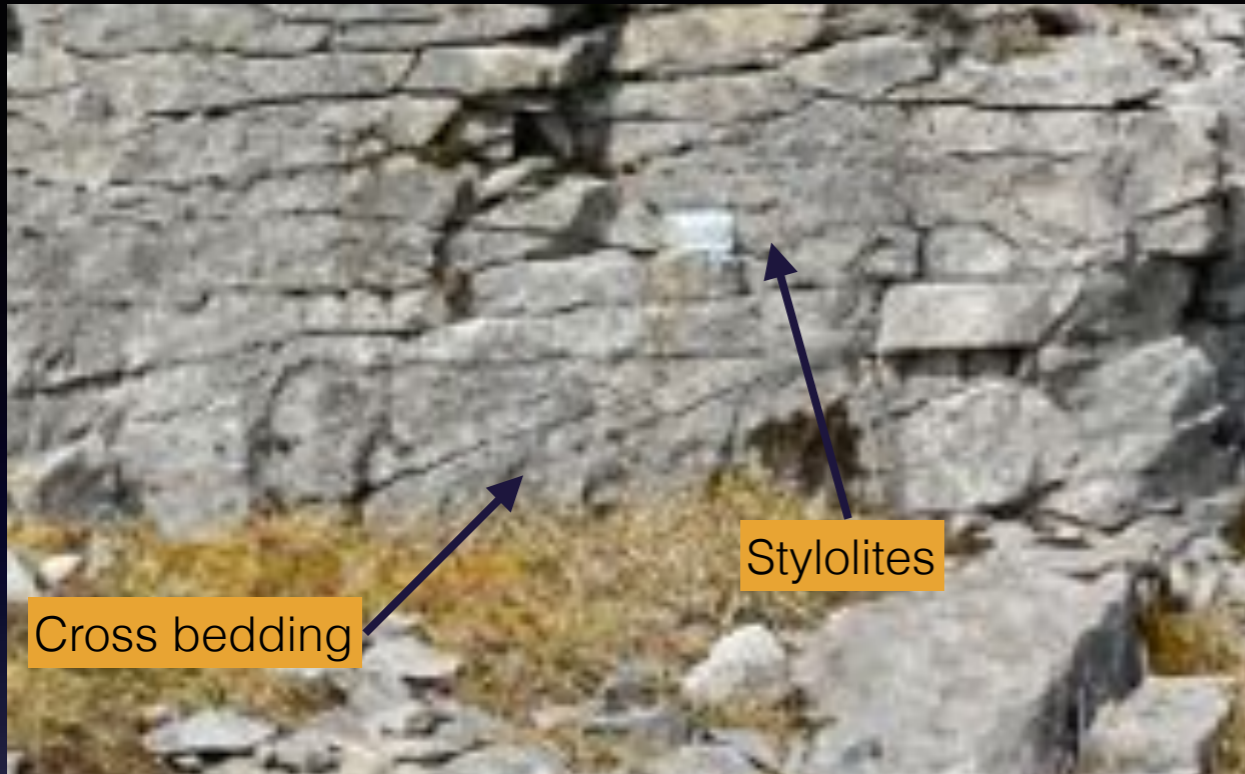
The **Dalton Formation** is named after Dalton-in-Furness, Cumbria. The limestones are dark grey, bituminous, well bedded with siltstone horizons. Fine to medium grained sediment deposited in a subsiding basin in water depths below storm wave base, probably greater than 100m. Important economically; extensively quarried around Kendal Fell.

The **Park Limestone Formation** is named from Park Sop hematite mine. Pale grey limestone, medium to coarse grained, comprising calcareous sand (calcareenite) in a mud matrix deposited in water depths of 10-30m. Poorly bedded with irregular jointing creates a rubble appearance often forming frost shattered scree as on Scout Scar.

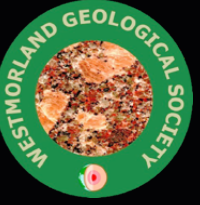
The **Urswick Limestone Formation** is named from outcrops around the villages of Great and Little Urswick, Low Furness. It rests on a palaeokarst surface developed at the top of the Park Limestone. Pale grey limestone, rhythmically bedded, deposited in shallow water above wave base. Often has a mottled appearance caused by bioturbation (burrowing) forming pseudobreccia and displays stylolitic partings. Palaeokarst surfaces are common at cycle tops overlain by thin bentonite (volcanic) mudstone beds. Fossils are relatively prolific with corals and bi-valves. Fault bounded outcrop in Serpentine Woods.

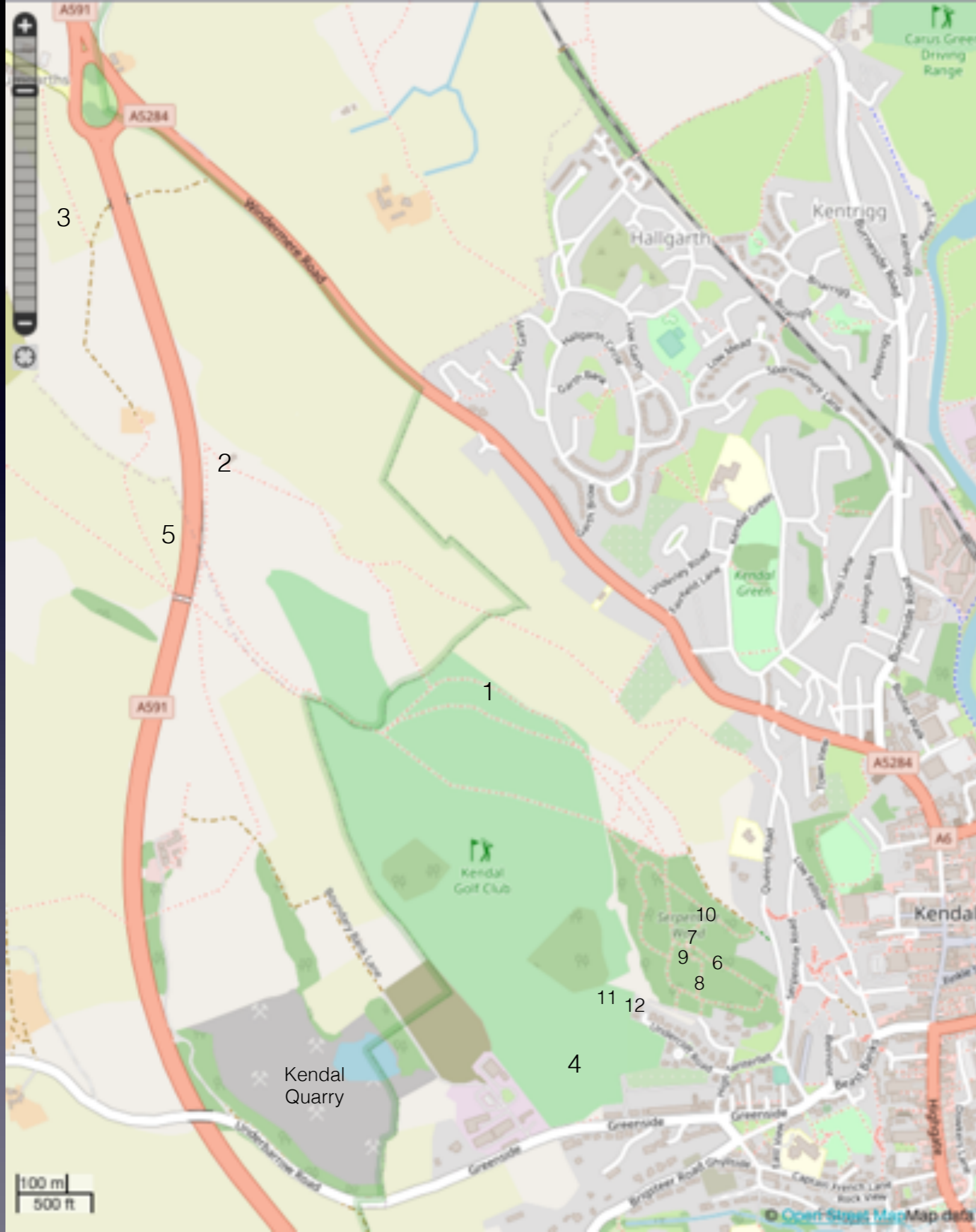


# Some features to look for

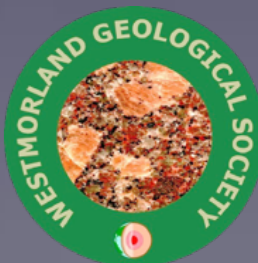


# Some features to look for





Locations numbered in stratigraphic order







Mudstone

Bedding

## 1 Kettlewell Crags - SD 504 934 Dalton Formation

Disused quarry located at the end of the Tram; dark grey, bituminous limestone with thin interbedded mudstone. Deposited in quiet conditions below wave base in water depths around 100 metres. Well developed bedding gives a strong, blocky building stone that was quarried and exported down the Tram to Queens Road for building in Kendal. Several smaller quarries are located along the Tram have abandoned quarried blocks.





**2 Helsfell Nab - SD 499 945**

**Dalton Formation**

Medium grey limestone, thin bedded and jointed.





### 3 Cunswick Scar, east side - SD 495 944

#### Dalton Formation

Medium to pale grey limestone, bedded, jointed with stylolite horizons and occasional crinoid fragments. Minor examples of cross bedding in the upper section suggests a shallow water environment. There are several exposed bedding planes with etched surfaces. Upper part of the Dalton Formation capped by Park Limestone on the top of Cunswick Scar.





#### **4 Kendal Golf Club - SD 506 926**

#### **Dalton Formation**

The lower part of the golf club, a former quarry, has two remnant blocks of Dalton Formation. Dark grey, bituminous limestone, well bedded and contains isolated crinoids. You can measure the dip and strike on the bedding plane surfaces and compare the results at Location 8. Known locally as the battleship.





**5 Kendal by-pass - SD 498 936**  
**Park Limestone Formation**

Pale grey-cream limestone, poorly bedded, jointed and fractured giving a characteristically rubbly appearance. There are several large scale bedding surfaces; possibly channels and is there a small fault?





## 6 Serpentine Woods - SD 511 927

### Urswick Limestone Formation

From the Queens Road entrance, the lower of two paths to the right above Dog Kennel Wood follows the base of a limestone cliff with several examples of pseudobreccia beds. At the top of the path the cliff has a sequence of lenticular beds with erosive bases and bed thickness variations (1), bioturbated (burrowed) beds form a pseudobreccia (2), evidence of emergence (top surface of 2) and interbedded mudstone horizons (palaeosols) (3). A shallow water depositional environment with wave action and emergence.





## **7 Serpentine Woods - SD 510 928**

### **Urswick Limestone Formation**

Located opposite the Gate Sculpture on the Alphabet Trail is an east dipping, palaeokarst surface showing deep runnels (karren) formed by dissolution of the limestone by acidic fluids.





Coral, crinoid fragments, shells



Grykes

Kamenitza

Clints

## 8 Serpentine Woods - SD 509 927 Urswick Limestone Formation

Near to the Summer House are two dipping beds with palaeokarst surfaces.

Upper bed is pale, grey to white, has a sandy matrix with corals, shells and crinoid fragments.

Lower bed is medium grey, has a muddy matrix with clints, grykes and kamenitzas (hollows).

It is possible to measure the dip and strike and compare with Location 4.

Quarried for ornamental stone with many examples in garden walls in Kendal.





## 9 Serpentine Woods - SD 510 928

### Urswick Limestone Formation

The 'Dancing Green' was formerly a small quarry where bioturbated (burrowed) limestones (pseudobreccia) provided a strong building stone used for lintels and door steps in Kendal.





**10 Serpentine Woods - SD 511 928**

**Urswick Limestone Formation**

After heavy rain, springs emerge from the limestone where impermeable mudstone beds (palaeosols) occur.





### **11 Kendal Golf Club - SD 507 927**

During periods of heavy rain streams emerge from several interbedded limestone and mudstone intervals in Little Wood. Water cascades over the Dalton Limestone and flows across the lower part of the golf course before seeping into the permeable limestone, eventually emerging in Blind Beck.

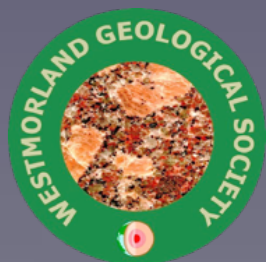




## **12 Kendal Golf Club - SD 508 927**

### **Recent Deposit**

Tufa is deposited on the back wall of the lower golf course. Calcium carbonate is precipitated from percolating calcium rich water from springs emerging higher up on Kendal Fell, and flowing down the rock face.



## References

Adams, A E, Horbury, A D & Abdel Azziz, A A, 1990. Controls on Dinantian sedimentation in south Cumbria and surrounding areas of northwest England. *Proc Geol Ass*, 181 (1), 19-30.

BGS, Kendal Solid Geology Map, <https://www.bgs.ac.uk/data/maps/maps.cfc?method=viewRecord&mapId=9103>

Dean, M T, Browne, M A E, Waters, C N, & Powell, J H. 2011. A lithostratigraphical framework for the Carboniferous successions of northern Great Britain (Onshore). *British Geological Survey Research Report, RR/10/07*.

Dewey, G, Dewey, M. A Geological Walk from Kendal. *Cumbria GeoConservation*, [https://www.cbdc.org.uk/CumbriaLGS/Leaflets/7\\_128.pdf](https://www.cbdc.org.uk/CumbriaLGS/Leaflets/7_128.pdf)

Horbury, A D & Adams, A E, 1996. Microfacies associations in Asbian carbonates: an example from the Urswick Limestone Formation of the southern Lake District, Northern England. In *Strogen, P, Somerville, I D & Jones, G LL (eds), Recent Advances in Lower Carboniferous Geology, Geological Society Special Publication No. 107, 221-237*.

Stone, P, Millward, D, Young, B, Merritt, J W, Clarke, S M, McCormac, M, & Lawrence, D J D. 2010. *British Regional Geology: Northern England (Fifth edition)*.

Vanstone, S D, 1998. Late Dinantian palaeokarst of England and Wales: implications for exposure surface development. *Sedimentology*, 45, 19-37.

Vincent, P, 1995. Limestone Pavements in the British Isles: A Review. *The Geographical Journal*, 161 (3), 265-274.

