

Wye Valley 1 – an A' Level Palaeoenvironment Exercise

This is a full day exercise during which you will visit 10 locations across the wooded hills of the Little Doward area above the Wye valley. The locations introduce you to 8 rock units which you must describe and interpret in order to give an historical account of the major changes in environment that took place during the deposition of this succession of sedimentary rocks.

This day is designed to be a stand-alone exercise, OR it can be followed the next day or soon afterwards by the Wye Valley 2 Mapping exercise during which you will map the rock units you see today across a wider area of these hills. You must have completed this palaeoenvironment exercise in order to carry on to do the mapping work, as the locations visited today enable you to define your mapped rock units and become key locations on your map.

Both exercises require you to review your data back at base together with supplementary information on the deepTime website (www.deepTime.voyages) and then write up your work (from day 1) and draw a geological map (after day 2).

START / FINISH: It is recommended that you park or are dropped off at the Ganarew entrance to the Doward woodland. Your day ends near to the small car park between King Arthur's Cave and Doward campsite where you can be picked up or walk back to Ganarew. Both parking points are marked on the map.

AIM: To make observations and collect data that will enable you to reconstruct the changing environments of the area from Lower Devonian to Lower Carboniferous times.

EQUIPMENT: Tablet / phone, hand lens, notebook, pencil, rubber, compass-clinometer, grain size/sorting/shape card, ankle supporting boots having soles with good grip, weather-proof clothing.

N.B. It is helpful to have a geological hammer and a small dropper bottle of dilute HCl (0.5 mol / 10%) for this type of fieldwork. However, if these are not available to you, there are pictures of fresh rock surfaces and their reaction to dilute HCl throughout the exercise that will assist you instead. If ever a hammer is used it should be on a small area (a few cm) of exposure that will not spoil the appearance of the rock to public view.

PROCEDURE:

1. In the field

You will need to visit all 10 of the exposures located on the map, (WV1-WV10), each one of which will display one or more of the 8 rock units in this area (as defined by the British Geological Survey). The rock units consist of large numbers of beds lumped together because of a dominant or typical lithology that is thick enough to be mapped. Note that not all the beds in such a unit will be of the dominant lithology.

In effect, you will be working your way up a stratigraphic column. As you encounter each rock unit / type, use the GeoExplore toolbox. Select the tool called '**define a rock type**'. Here you can give the rock type a name, assign a mapping colour to it and make a full description of it (see below for details of what features you should describe).

When you have defined the rock type in this way, you should select the tool named '**assign rock to site**'. This will make the map marker for the site you are at become coloured with the colour that you assigned to that rock type.

Stratigraphic column

At present the rock units are referred to by letters A to H, but when you 'define the rock type' you can choose to give the units a name of your choice, or simply give them the letter names as on this column.

Rock unit:	Can be seen at location/s:	
H	youngest	WV10
G		WV7, WV8, WV9
F		WV6, WV7, WV9
E		WV5
D		WV4
C		WV3
B		WV2
A	oldest	WV1

At each location you will need to examine representative exposures (i.e. typical rather than unusual) of the rocks, and to record as many of the following features as possible, to provide the maximum amount of data that will enable you to assess the probable environment in which the sedimentary rocks were deposited.

Use the toolbox to record your observations. Everything that you record (as notes, photos, verbally or measurements) will be GPS located by the app. The toolbox also contains reference charts (e.g. for grain descriptions or naming rocks) and a glossary.

a) **Composition of the rock:** Use methods such as observation using a hand lens and assessment of mineral colour, cleavage and hardness to determine how much quartz, feldspar, rock fragments or clay is contained in the sediment, if it is a **siliciclastic** type. What does this tell us about the mineralogical maturity of the rock and thus its environment of deposition?

b) If it is a **carbonate** rock - is it made dominantly of calcite or dolomite? What does this tell us about the environment of deposition?

c) **Texture of the rock:**

- i) **Grain Size** (modal, apart from coarse - >25% of volume)- coarse, medium or fine
- ii) **Grain Shape** (modal) – angular, sub angular, sub rounded, rounded, well rounded
- iii) **Grain Sorting** – unsorted, poorly sorted, moderately sorted, well sorted, very well sorted

All these can be assessed using a hand lens and a grain size card or the grain size tool in the app, and give us very good information about sediment transport and the environment of deposition.

d) **Fossil content:** What fossils (if any) can you see in the rock? In what state are they? What information can this tell us about the environment of deposition?

e) **Sedimentary structures:**

- i) The presence of bedding, cross bedding, graded bedding, convolute bedding or slump bedding.
- ii) Total or partial destruction of such features by organisms – bioturbation.

iii) The presence of ripple marks, desiccation cracks, sole markings, load casts etc. on bedding plane surfaces.

What can these features tell us about the conditions in which the sediment was deposited?

f) Dip and strike:

If you intend to follow this exercise the next day with the related mapping exercise, then you should also take dip and strike readings wherever you are able to. The locations you visit today will become key locations on your map. There is a compass-clinometer in the app; if you use this, the readings will be recorded automatically in the app with the GPS location, and the strike and direction of dip will show at that location on the map. It is good to carry a traditional compass-clinometer as back up.

Finally, if there are features of the rock that you do not understand or recognise, that is OK – just describe and photograph them and look them up back at base.

2. Writing up

The aim is to arrive at an historical account of the major changes in environment that took place during the deposition of this succession of sedimentary rocks. Try to link each piece of data acquired by observation in the field to an interpretation of the conditions in which the sediment was laid down. You should consider the following aspects of the environment and what data could lead you to a possible conclusion, all based on the principle of Uniformitarianism:

- Land (terrestrial) or sea (marine)
- High, medium or low energy, or variable
- Clear or muddy water
- Tropical or temperate or cold
- Shallow, or deep water
- How quickly or slowly was the sediment deposited

This in turn should lead to consider the environments which will fit with your general conclusions – rivers, shallow/deep sea, aeolian desert, delta, lake etc..

You should then be able to summarise the changes of environment that took place during the deposition of the succession of rocks here from Lower Devonian to Lower Carboniferous times.