Funded by Defra's Aggregates Levy Sustainability Fund, administered by English Nature.

Contact: info@ukrigs.org.uk

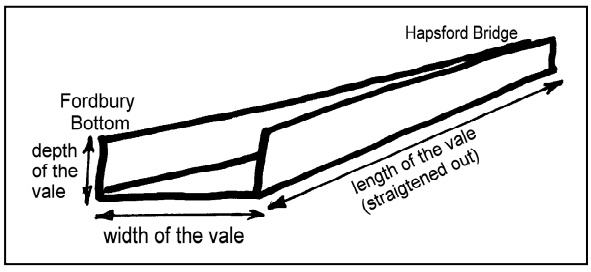
PUPIL WORKSHEET 1: COMPARING TWO ROCK TYPES.

Use the table below to record your observations about the two rock types you will see today at Vallis Vale and later at Tedbury Camp.

	AT VALLIS VALE (the lower rocks)	AT TEDBURY CAMP (the upper rocks)
Colour of rock:	**GREY**	**YELLOW**
Are they bedded?	**YES**	**YES**
Horizontal or not?	**NO, DIPPING**	**YES**
Are they jointed?	**YES**	**YES**
Grains or inter-locking crystals?	**FINE GRAINS AND FOSSILS**	**1MM OOLITH GRAINS AND FOSSILS**
Are they porous?	**NO**	**YES**
Contain fossils?	**YES, CORALS & BRACHIOPODS**	**YES, BIVALVES**
Were the fossils broken (washed around)?	**YES**	**YES**
Do the rocks react with dilute HCl?	**YES**	**YES**
The rock name is:	**LIMESTONE**	**LIMESTONE**
In what environment was it probably formed?	**MARINE**	**MARINE**
Which of these two rocks is harder (physically resistant)?	**THIS IS MORE RESISTANT**	**THIS IS LESS RESISTANT**

ESTIMATING THE AMOUNT OF EROSION IN VALLIS VALE

Estimate the volume of rock removed by the river to cut the Vale, between Fordbury Bottom and Hapsford Bridge.



Approx. average depth = 25m;
Approx. average width = 250 m;
Approx. average length = 2500 m
You may use a calculator.
Volume = 25 x 250 x 2500 = 1,625,000 m^3

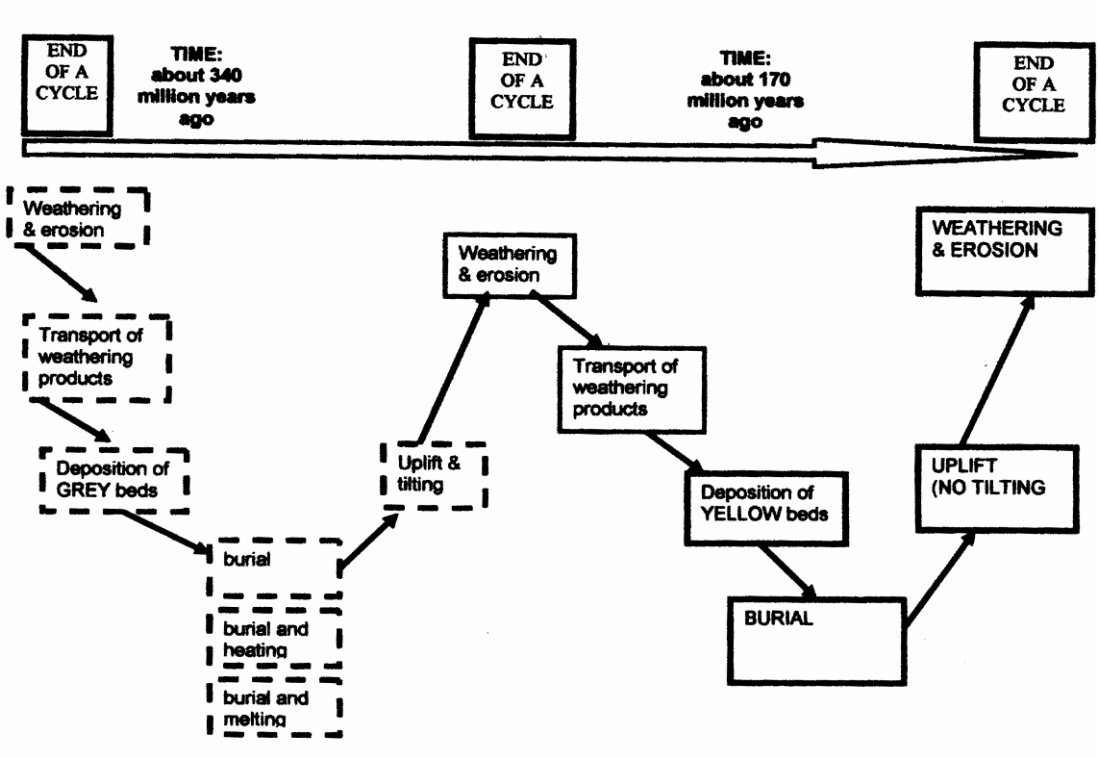
ANSWER **1,625,000** CUBIC METRES OF ROCK.

What do you think has happened to all of this rock, removed by the river?

IT HAS PROBABLY BEEN TRANSPORTED BY THE R. MELLS TO THE SEVERN ESTUARY AND DEPOSITED TO FORM NEW SEDIMENTARY ROCKS

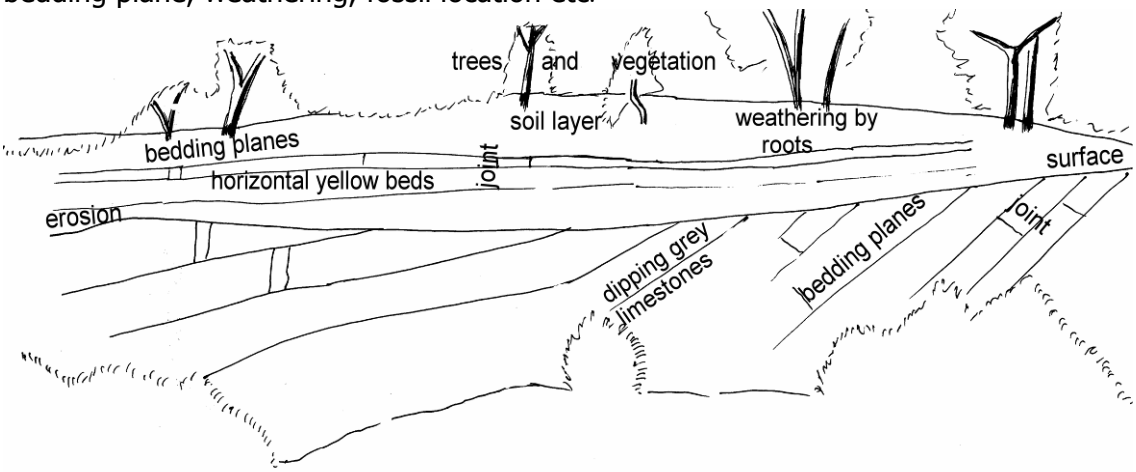
PUPIL WORKSHEET 2: TRACKING THE ROCK CYCLE.

Use the flow diagram below to help you work out the rock cycle events at Vallis Vale. Draw in the two missing arrows and fill in the three empty boxes**.**

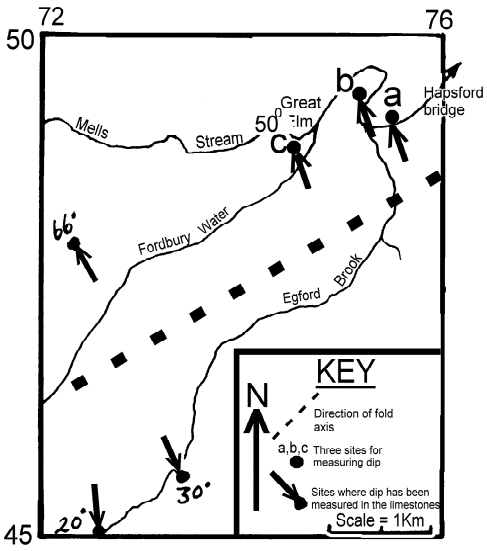


SKETCH OF THE EXPOSURE AT VALLIS VALE

Draw in the bedding and joint planes above the erosion surface, and below it, on the right hand side. Then identify and label any important features, such as dip, joint, bedding plane, weathering, fossil location etc.



PUPIL WORKSHEET 3: INVESTIGATING LOST MOUNTAINS



MAP OF THE AREA. Plot your first dip measurement arrow at Vallis Vale, point "**a**". (Some other dips have been drawn already in the Vallis limestones in other parts of the area).

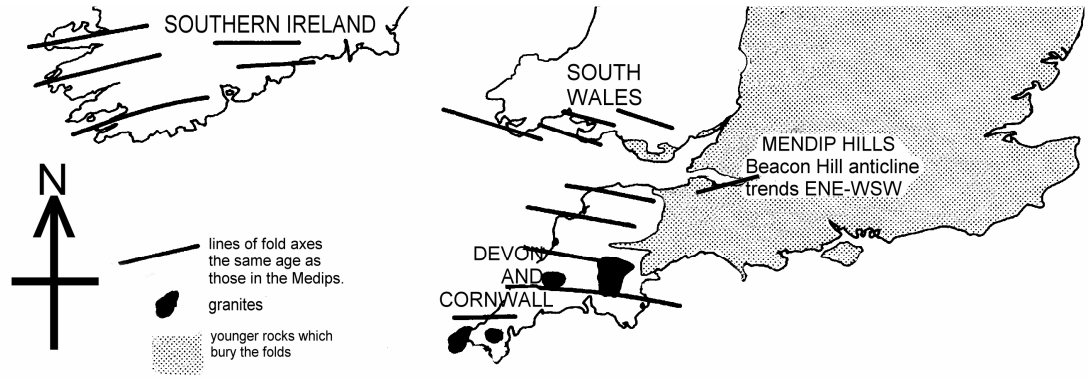
Then, plot the other dip arrows at "**b**" and "**c**" (Tedbury Camp) as you make them.

Using what you know about folds, predict where you think the anticline fold axis will be and draw it on the map as a dashed line.

FOLDS ACROSS S.W. BRITISH ISLES.

The map below shows the lines of anticline folds created at the same time that the grey rocks in Vallis Vale were folded. At the time they formed a large fold mountain range which has now been eroded way. In the east they are buried by younger rocks (like the yellow beds you have just seen).

Draw a line in the Mendip area to show the direction of your fold axis. (Use the dip measurements you have taken to help guide you).



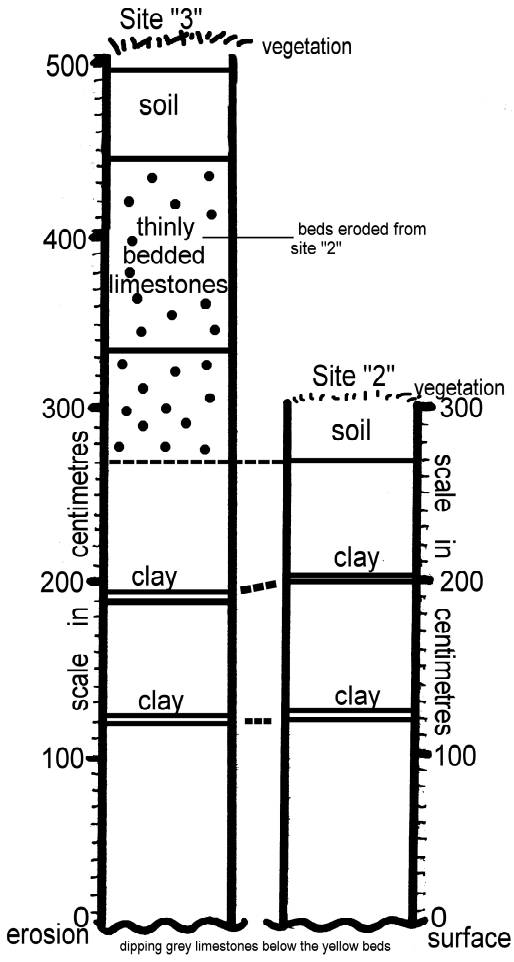
Describe the folding. What do the lines of the folds across this part of The British Isles tell you about the Plate Tectonic forces creating this period of folding?

THE FOLDS LIE IN A CURVE FROM S. IRELAND TO CORNWALL.
THE MENDIP FOLD IS NOT PARALLEL TO THE CORNISH OR S. WALES FOLDS.
THERE WAS COMPRESSION IN A ROUGHLY NORTH- SOUTH DIRECTION.
FOLDS ON THIS SCALE ARE CAUSED BY CLOSING OCEANS AT DESTRUCTIVE MARGINS

PUPIL WORKSHEET 4: Measuring Rock Thicknesses.

Measure the thicknesses of the beds (in centimetres) at sites 2 and 3 and record them in the table. Then plot them on the two columns below.

ROCK TYPE	Bed thickness at Site 3	Bed thickness at Site 2
Thinly bedded limestone (too high to measure, so estimate the thickness)	Soil thickness= 50cm 100cm	Soil thickness = 30cm (Thinly bedded limestones not present)
Thick bedded limestone	150cm	69cm
Clay	5cm	5cm
Limestone	66cm	75cm
Clay	5cm	5cm
Limestone (with some pebbles).	120cm	120cm



Label on your measured columns:

i) beds which "match up" between the two exposures? (use a dotted line between the two columns)

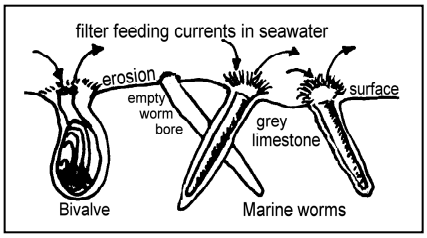
ii) shade in the beds at exposure 3, which used to lie above exposure 2 and label them.

iii) Approximately how much of the top limestone bed at site 2 has already been eroded away?

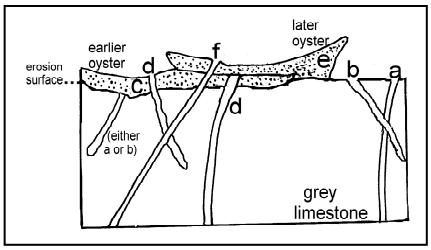
_____**60**___cm approximately.

MAPPING THE COLONISATION OF THE EROSION SURFACE

Use the table and diagram to help you find examples of the sequence that these animals colonised the rock surface 170 million years ago.
Then tick off the ones you can find



a = bore cutting erosion surface FIRST COLONISER
b = worm bore cutting "a"
c = oyster over top of "a" & "b"
d = worm bore cutting "c"
e = oyster over the top of "c" and "d"
f = worm bore cutting "e" LAST COLONISER



ESTIMATING THE DENSITY OF THE COLONY

TASK: Measure out a square centimetre of the rock surface and count each of the small "dimples" in the surface. Each is the top of a filled-in bore. Then put 4 zeros on the end to estimate the number of marine worms per square metre.

ANSWER ___**10**_(APPROX) __0,000 per square metre.

QUESTION: What does this kind of density of animals tell you about the conditions in which they were living?
THERE WAS PLENTY OF FOOD AND OXYGEN AND THE WATER WAS OF NORMAL SALINITY.

MAPPING A FOODWEB

As you find examples of the Jurassic (170 million year old) ecosystem which lived in, on and above the erosion surface, tick them off on the table below.

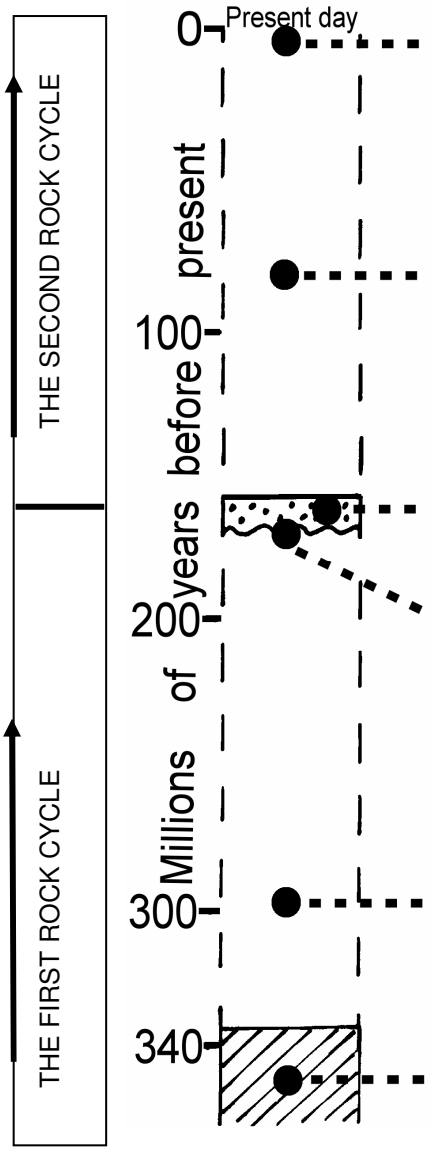
PRIMARY PRODUCERS	**PRIMARY CONSUMERS** (bottom living filter feeders & grazers)	**PREDATORS** (swimmers and floaters)	**TOP PREDATORS.** (Powerful swimmers and hunters)
Algae and Plankton	Boring worms	**Belemnites**	**Aquatic reptiles** Eg. Ichthyosaurs, Plesiosaurs Pliosaurs
	Boring bivalves	**Ammonites**	
	Encrusting bivalves	Fish	
	Other bivalves		
	Corals	e.g.Octopus	**Sharks**
	Gastropods	e.g.Squid	e.g.Seal/Dolphin
	Echinoids		e.g.Killer whales

Why do you think you have not been able to find examples of all parts of the table?
SOFT BODIED ANIMALS (PLANKTON) DO NOT BECOME FOSSILISED.
LARGER SKELETONS BECOME BROKEN UP BY WAVE ACTION.

TASK: Using the foodweb table above, **underline the ones now extinct**.
Then write into the shaded boxes the names of some **modern** predators and top predators

PUPIL WORKSHEET 6: Summary of Events Column.

Write the sentences below into the correct boxes to show the sequence of events from 340 million years ago.



Weathering and erosion of Vallis Vale by River Mells.

Uplift of the rocks. Extinction of many marine reptiles and dinosaurs.

Deposition of yellow limestone in a marine environment.

Flooding of the erosion surface by the sea. Colonisation by marine animals.

Period of uplift, tilting, folding and erosion of the rocks. Large evolutionary changes in the fossil record.

Deposition of grey limestones in a marine environment.

A) Period of uplift, tilting, folding and erosion of the rocks. Large evolutionary changes in the fossil record;
B) Uplift of the rocks. Extinction of many marine reptiles and dinosaurs;
C) Deposition of yellow limestone in a marine environment;
D) Deposition of grey limestones in a marine environment;
E) Flooding of the erosion surface by the sea. Colonisation by marine animals;
F) Weathering and erosion of Vallis Vale by River Mells.

Draw a line across the column on the left marking the **end of the first Rock Cycle** and the **start of the second Rock Cycle.**

PUPIL WORKSHEET 7: Quarrying Limestone

(This may be useful in a guided visit to Whatley Quarry).

My calculation of the volume of rock removed from Tedbury Camp Quarry. (HINT l x w x h = v)	**Its about 50m x 70m = 3500 square metres. (This is a low estimate, ignoring the corners)** **3500 x 2 = 7,000 cubic metres**
My estimate of the value of the limestone taken from Tedbury Camp quarry	**7,000 x £2 = £14,000 (i.e. not a huge amount really).**
A list of possible uses of resistant limestone	**Roadstone, coastal defences, walls, buildings, etc.**
A list of disadvantages of quarrying in an area.	**Dust, noise, traffic, spoiling landscape and disturbing natural history.**
A list of possible advantages of quarrying in to an area.	**Jobs, improved rural economy,**
A list of possible uses for a quarry when it is no longer used.	**Restored and landscaped to agricultural land; Left as a quarry, but landscaped; Leisure use (mountain biking, dog walking, adventure playground etc); educational or research use; as a tip for domestic waste (but be careful of contaminating the water table); and many others.**