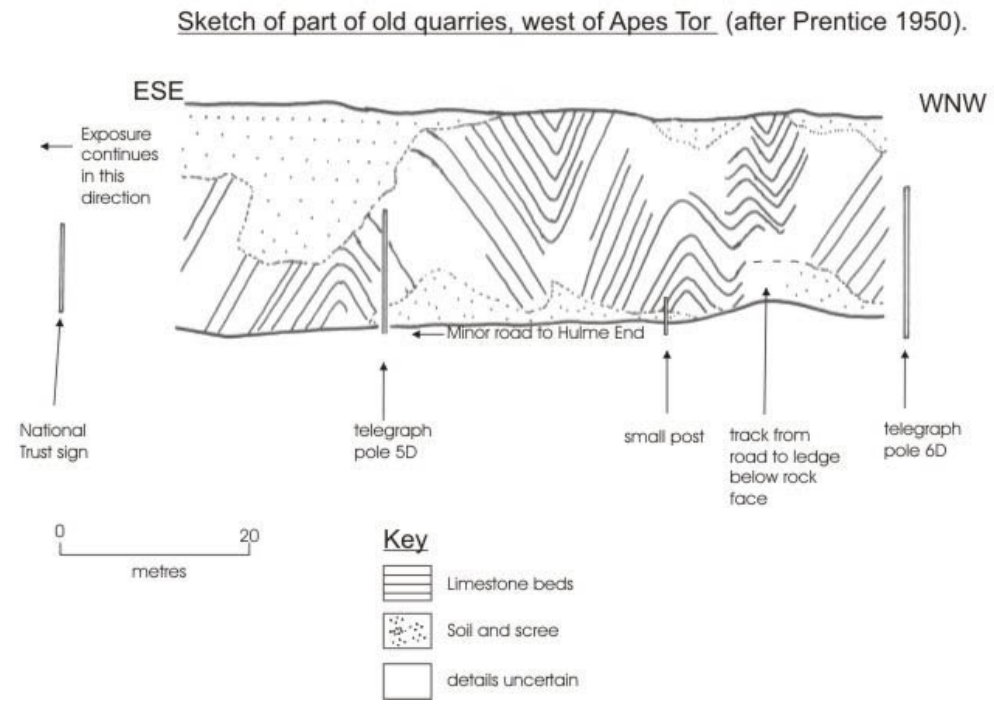
APES TOR: SITE F

Site F (Apes Tor) **between 45 and 60 minutes**

☛ Site F is on a ledge two metres above road level. It is reached by a short steep path just east of (beyond) the telegraph pole numbered 6D. Point out the red iron oxide staining of the rocks, and reassure pupils they are limestones and will fizz with dilute HCl. See **Figure 1**.
Additional materials to demonstrate folding at this site, prepared by the teacher before the visit, are required to complete all of these activities and demonstrate the folding to pupils. See pages 2 & 3 below.

Figure 1. Sketch of Part of Quarries West of Apes Tor



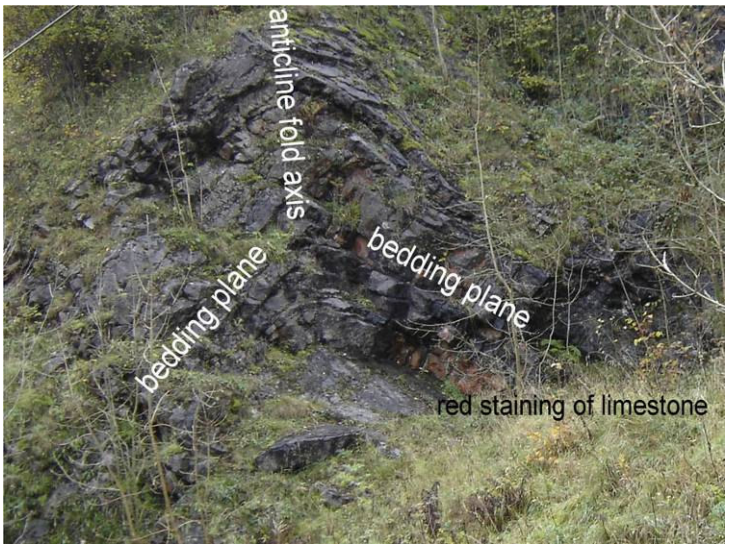
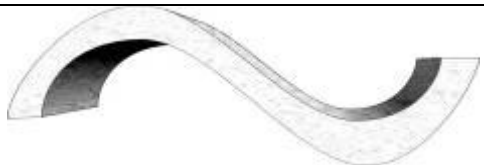
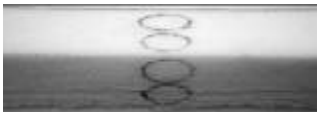
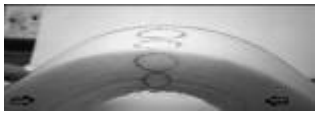
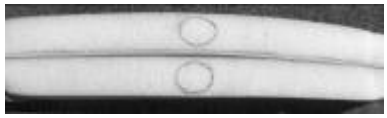
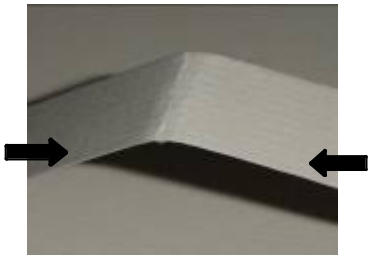
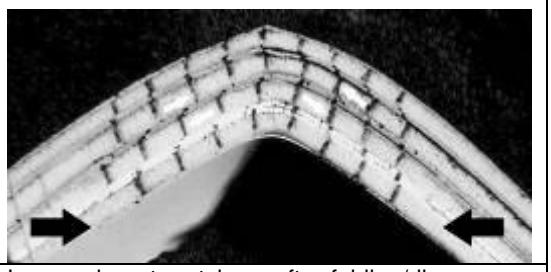


Figure 2: Folding close to site F

	Possible questions	***Possible answers***
Q1	Are the beds horizontal here like they were at location E?	No
Q2	How are the rocks similar?	Thick & thin beds in both places. Both sites are of limestone.
Q3	What is different about the beds in this location?	-None are horizontal at Apes Tor -Beds are tilted in different directions -More layers here, some stained red by iron oxides. -Some beds much thicker/bigger differences in bed thickness
Activity Q4	Encourage students to find & put a hand on: a bed, a bedding plane, a crack (joint), a thin bed, a thick bed	
Activity Q5	Ask students to put hands on thick bed (at least 20 cm thick) and a thin bed (<1 cm thick). What do they notice about (a) the different feel of the beds (b) what the beds look like?	(a) Thinner beds feels slimy/ slippery/ damper/ muddier (b) Thicker beds stand out more (not weathered as much) - Thicker beds show cracks (joints) - Thinner beds look darker
Explain	Explain that the thick beds are limestones, thin beds are shales	
Activity Q6	Ask students to identify (a) a bed that is nearly vertical or tilted at a steep angle and (b) a bed that is tilted at a shallow angle Ask students to estimate the angle of tilt of the beds at a) & b) nb) the angle of tilt measured from the horizontal is usually called the **angle of dip**.	(a) Steep beds tilted at about 70º (b) Shallow beds tilted at about 35º
Explain	Explain that the beds have been bent/ folded	
Demo 1	Demonstrate basic folding with a strip of foam rubber about 2 cm thick and 30 cm long. Use terms **anticline** (upfold) and **syncline** (downfold)	
Q7	What kind of forces do I have to use to form these folds?	Compression forces / pushing together forces
Demo 2	Demonstrate 3-dimensional structure at Apes Tor with a model of the quarry. The rock faces in the quarry are cut at different angles and so for the model use a copy of the student worksheet (enlarged to A3 size) and stuck on a piece of card and folded as shown	

	Possible questions	***Possible answers***
Activity Q8	Students asked to estimate the height of the quarry and to complete and label the field sketch on the Student Worksheet. (Clue for students: the average height of a teacher is 1.7m) (Clue for teacher: the long line on the right of the quarry drawing shows the position of telegraph pole 6 and the short lines on the left represent the roadside post)	Estimated height = 9 to 12 m A completed worksheet for teacher reference is shown at the end of this document Students to label on the worksheet: bed, anticline, syncline, fold limb, bedding plane, fold axis, scale, joint
Demo 3	Demonstrations of folding with i) foam piece 2cm thick with circles drawn on the strip. (Refer back to Demo1). Bend the foam piece to form an anticline. Bring students' attention to the shapes of the circles.	 
Q9	What do you notice about the shapes of the circles?	Circles change shape /are stretched out at the top of the fold
Demo 4	ii) two foam pieces 1 cm thick with circles drawn on the strips	 
Q10	What do you notice about (a) the shapes of the circles & (b) the shapes of the folds?	(a) Circles in the top foam strip show bigger changes in shape/ more stretching (b) Both strips form rounded shapes but the top layer forms a wider arch
Demo 5	iii)one layer of card at least 1mm thick bent into a fold	
Q11	What do you notice about the shape of the strip?	Strip of card bends. When the card layer is compressed more the card cracks at the hinge.

Demo 6	iv) two foam pieces 1cm thick separated by two strips of card. Use rubber bands to hold the ends of the foam pieces & card strips together. Hold layers horizontally & draw vertical lines on the foam pieces & card strips and then bend the foam & card layers.	 
Q12	What do you notice when the layers are bent?	Layers do not match up after folding/ lines move away from each other The thick foam layers bend into rounded shapes The thin strips of card slide over each other Gaps appear between the card layers & the foam strips
Q13	How can these three models help to explain the folds they've seen in the quarry?	-the folding was caused by compression - there are different fold shapes -the rocks behave as plastic materials -there is some evidence that in the deformed material layers have also broken along joints (fracture has taken place) -the thick and thin beds have bent differently (thin layers at top of fold have fractured -there was slip along the bedding planes in the muddy layers
Activity Q14	Use clinometers and measure the angle of tilt of at least two layers. Mark the places where you took the measurements on the field sketch & write in your answers	(Refer back to Q6)
Activity Q15	Ask students to draw arrows on the field sketch to show the directions of the forces that caused the fold	
Activity Q16	Measure bed thicknesses for different beds over a 2m stretch on the western edge of the quarry	

☛ Allow 45-60 minutes to complete questions and activities before returning to your transport. The best way to the Manifold Valley Visitors' Center is back the way you came, being careful of the traffic along the road.