

## OUTCROP PATTERNS

### Wooden blocks

D and to be examined by students [E](#)

These are very good for showing geological structures in three dimensions so that students can relate the geological map (top view) to the underlying structure. [Click on F](#) for instructions on making these blocks.

### Horizontal and dipping strata

Blocks with sloping tops or valleys, or hills, to show how topography effects outcrop pattern. Vary the true thickness of the strata to show how angle of slope and thickness of strata affect the outcrop width.



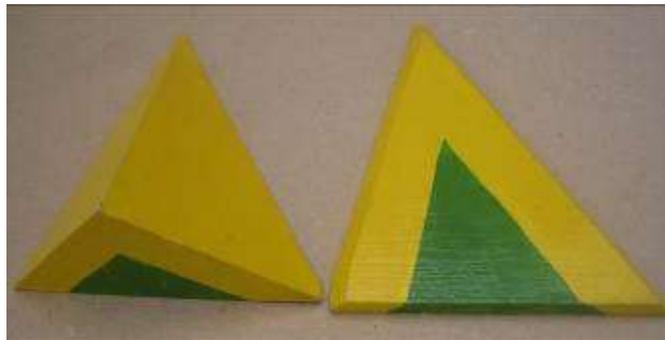
### Folded strata

Paint on symmetrical and asymmetrical anticlines and synclines to show the outcrop patterns of each, paint both plunging and not plunging folds.



### ***Anticline***

***A wooden block has the top rounded so that the top surface is parallel to the bedding in the anticline. It is cut through to show the outcrop pattern after erosion. This can also be done with a plunging anticline.***



### ***Faults***

***Painted blocks to show the effects of normal, reverse, thrust and wrench faulting on outcrop patterns,***

### ***Moving faults***

***Blocks showing strata, horizontal, dipping and folded are cut so that the one half can move upwards relative to the other. One of the halves is sliced horizontally to show the effects on the outcrop pattern of erosion after fault movement.***



### ***Wrench fault***

***A block showing strata with a vertical dyke is cut vertically in half. The one side is moved and students can then see that the sense of movement, dextral or sinistral, is the same which ever side one is looking from.***



### ***Blocks for description***

***Blocks with folds, faults, dykes and unconformities for student to describe.***

***Student draw the top surface and then put on to it dip arrows, downthrown side etc.***

### ***Demonstration block model***

***D***

***Make a box about 20cm by 15cm by 10cm and cover it with thin sheets of melamine (white board material). You can then draw outcrop patterns and structures on it.***

### ***Outcrop width using layered cake***

***D or P 3 min***

***A layered cake is used to show that if the land surface and the strata are horizontal then only the top bed is visible. By slicing the cake at an angle the lower strata are exposed and the outcrop widths will vary with the angle of the cut.***



### **Outcrop width**

**D**

*Coloured cards are tilted to show how outcrop width on a horizontal surface varies with dip of the strata and true thickness of the beds.*



### **Outcrop width**

**I 10 min**

*A horizontal line is drawn across the page which represents the land surface. A ruler representing a bed is placed across the line. A line is drawn along both sides of the ruler and the distance between the intercepts = (outcrop width) on the horizontal line is measured. The angle of ruler is changed and another pair of lines is drawn. Students must deduce how angle of dip affects the outcrop width. Students then draw lines across the page representing land sloping at different angles. Now they keep the angle of the ruler (= dip of beds) constant and must see how the slope of the land affects outcrop width.*

### **Orientation of faults**

**A P 15 min**

*Students measure the orientation faults on a geological map and then plot them on a rose diagram.*

### **3D diagrams**

**I 5 min each**

*Students are given outlines of a 3D block and must draw on them various structures. The lines showing the structures should be made lightly in pencil because they may need to be rubbed out. You should also provide spare diagrams.*

### **Topography and outcrop pattern**

**D**

*This demonstration is to show the variety of outcrop patterns that can result from the interplay of topography and structure. Make a model of a valley and ridge using plywood cut along the contour lines. Smooth the edges with plaster. Get your Art or Technology department or a commercial company to make vacuum formed copies. These can then be painted.*



### **Topography and outcrop pattern using pebbles**

**A P 5 min each**

*Choose pebbles at least 10cm long with a rounded top and flattish bottom which show prominent bedding or veins, some should show horizontal bedding, others vertical or dipping. Students sketch the pebble viewed from above and from the side.*



### **Outcrop patterns of periclinal**

**TE**

*Get students to imagine a rowing boat for a synclinal pericline or an upturned boat or submarine for an anticlinal form.*

*Idea from*

*Chris Bedford*

### **Domes and basins**

**D**

*To demonstrate the outcrop pattern on a basin slice an onion in half and for a dome an onion sliced in half and then slice the top off.*

### **Youngest strata on downthrown side**

**A I 10 min**

*This paper exercise gets students to work out that the youngest strata are always on the down thrown side of a fault. Students are given an A4 sheet of paper with horizontal strata a to k marked on. Students cut the paper along a line representing a fault. They move one side to make a fault and then "erode" the upstanding side by folding it over. They then record which side has the youngest strata at the surface.*

### **Omission and repetition**

**E P 20 min for 4 sets**

*This activity is to discover how the dip direction and type of fault determine if omission or repetition of strata occur on the surface and in boreholes. Students are provided with A4 sheets with dipping strata marked on. These are cut and moved as in the activity above.*

### **Effect of normal faulting on an anticline**

**TE**

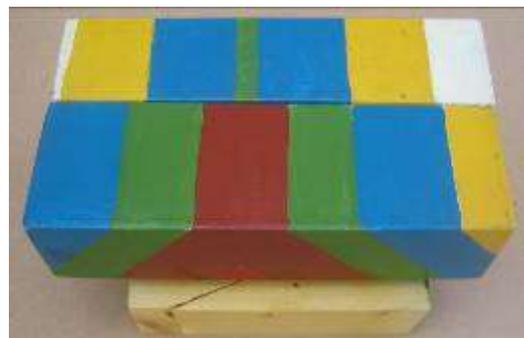
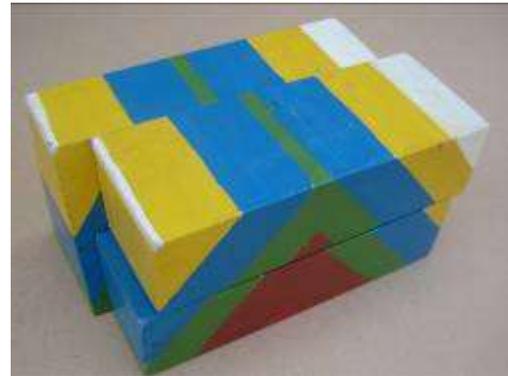
*Imagine looking down on a submarine and seeing its outline in the sea. As it submerges its outline gets narrower. Think of the submarine as an anticline, its outcrop will get narrower on the downthrown side of the fault.*

*Idea taken from C. Bedford*

### **The effects of normal and wrench faulting on dipping and folded strata**

**D**  
*Dipping strata: A block of wood 10cm by 10cm by 20cm is cut in half lengthways and then one half is again cut in half along a horizontal plane. It is painted with dipping strata with the strike parallel to the short side.  
Folded strata: A second block of wood the same size and cut in the same way and is painted with folds whose axis is parallel to the short side.*

*For both blocks the side with two parts is moved up and any upstanding part "eroded" to show the effects on the outcrop pattern normal faulting. Or one side is moved sideways to show the effects of wrench faulting.*



### ***Faulted syncline***

**D**

*To illustrate the widening of the syncline on the down thrown side use two pieces of round guttering each about 20cm long. Place them in line and then move one side down. Two pieces of folded A4 paper also works.*



### ***Strata beneath an unconformity***

**Pa I F 10 min**

*Students are given an A4 map of the outcrop pattern of folded and faulted strata but half is covered by an unconformity and is left empty. They must complete the pattern of the older strata as it would be under the unconformity. One can also make a painted wooden block representing*

*eroded folded strata and a separate piece for the overlying strata which is held on by magnets.*



*Map of strata at depth*

*Pa I 15 min*

*Students are given a map of a fold cut by a vertical dyke and a dipping fault and must draw a map of the distribution of strata at 100m below the surface.*

*This is a good exercise in 3D thinking.*

*Swiss rolls and folds*

*D*

*Swiss rolls can be used to demonstrate the outcrop patterns of both plunging and non-plunging folds. First cut it in half so you have a syncline and an anticline. To show the outcrop pattern of an anticline cut a thin slice from the top to expose the layers underneath. To show the outcrop pattern of plunging folds cut the sponge roll obliquely.*



*Doubly plunging fold patterns in a table*

*A P 1 minute*

*Students find folds in the grain in the wood of a table top. Weathered board, or board sandblasted by the sea is good because one can distinguish anticlines from synclines.*

### **Sketch maps**

**D**

**Over lay the map with a large sheet of acetate. Draw the sketch map using different coloured pens for strata, fold axes, faults etc. Then remove the acetate and place it on plain paper. If your white board is magnetic you can hold the sheets up with magnets so the students can see you draw it and you can talk to them at the same time. Alternatively clip the map and acetate to a piece of hardboard using bull dog clips. The hardboard can then be hung up vertically.**

### **Outcrop cards**

**A I 2 min each**

**Simple structures are painted onto cards and must be identified and described by students.**

### **Segments of Geological maps**

**A I 5 min**

**Small pieces are cut or colour photocopied from published geological maps to show just one feature such as a fold or fault. Students must describe it.**

### **Artificial outcrops inside**

**A P F 2 min per outcrop**

**Boards or books at a variety of angles are set up around the classroom to represent outcrops and are colour coded for lithology. Students are provided with a map of the classroom and must locate the "outcrops" on it.**

**Students measure the dip angle and direction and the strike of each.**

**Click on F for making classroom outcrops. Beware compasses will not give the correct reading if the desks or tables have steel parts.**



### **Artificial outcrops outside**

**A P F 4 min per outcrop**

**Coloured pieces of concrete slabs are set up in the school grounds so that students can practise mapping.**

*Map interpretation of Leornian*

*Leicester University have produced a geological map of an imaginary area which is very useful for teaching map interpretation. The strata on the map range from simple dipping strata in the north, folded and faulted strata in the centre to complex folds in the south. One can buy the maps.*