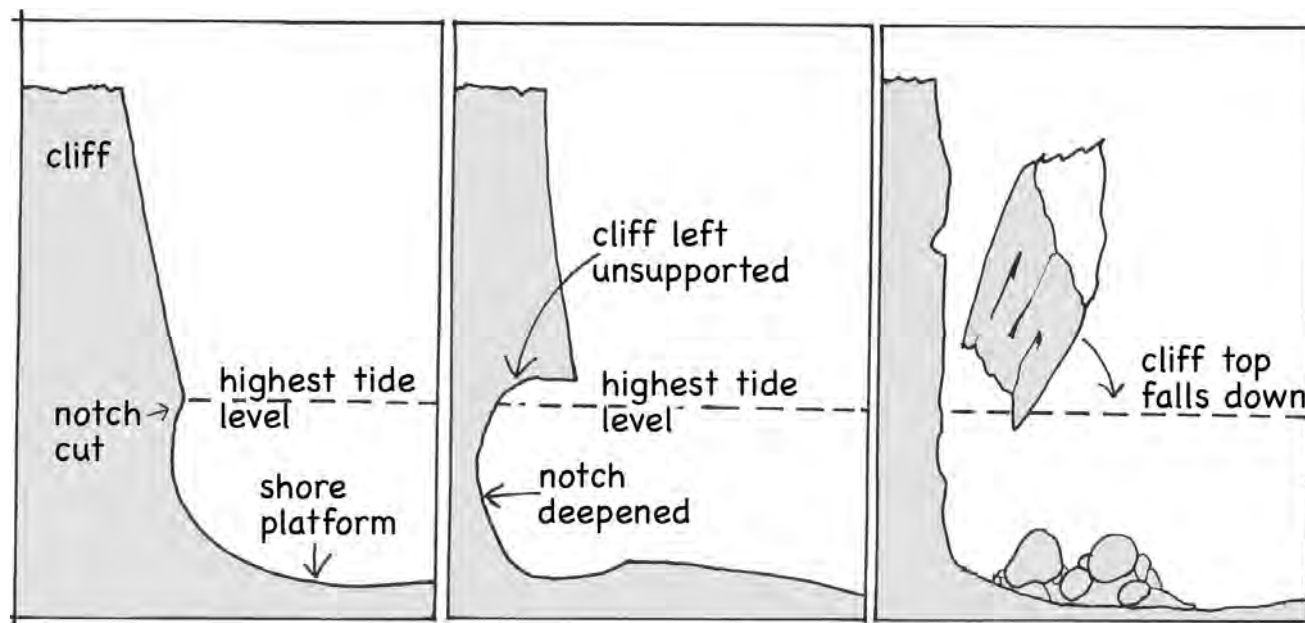


WHY DO CLIFFS COLLAPSE?

1. CLIFF COLLAPSE

a) Study the three diagrams, then fill in the missing words in the three paragraphs below, using the words shown in the box. Perhaps use pencil to begin with!



The sea _____ the base of the cliffs, by the processes of _____, hydraulic action and abrasion. This occurs mainly below the level to which the _____ reach, and leaves a _____ at the base of the cliffs. The upper part of the cliff is then left _____ by the erosion so that the cliff is top-heavy and not well supported.

The cliffs are also attacked by _____. For example rain and salt laden sea spray may soak into the _____ widening them, weakening the rocks and _____ attacking the minerals. In winter, this moisture trapped in the rocks may _____, expanding and widening the joints, and shattering the rock.

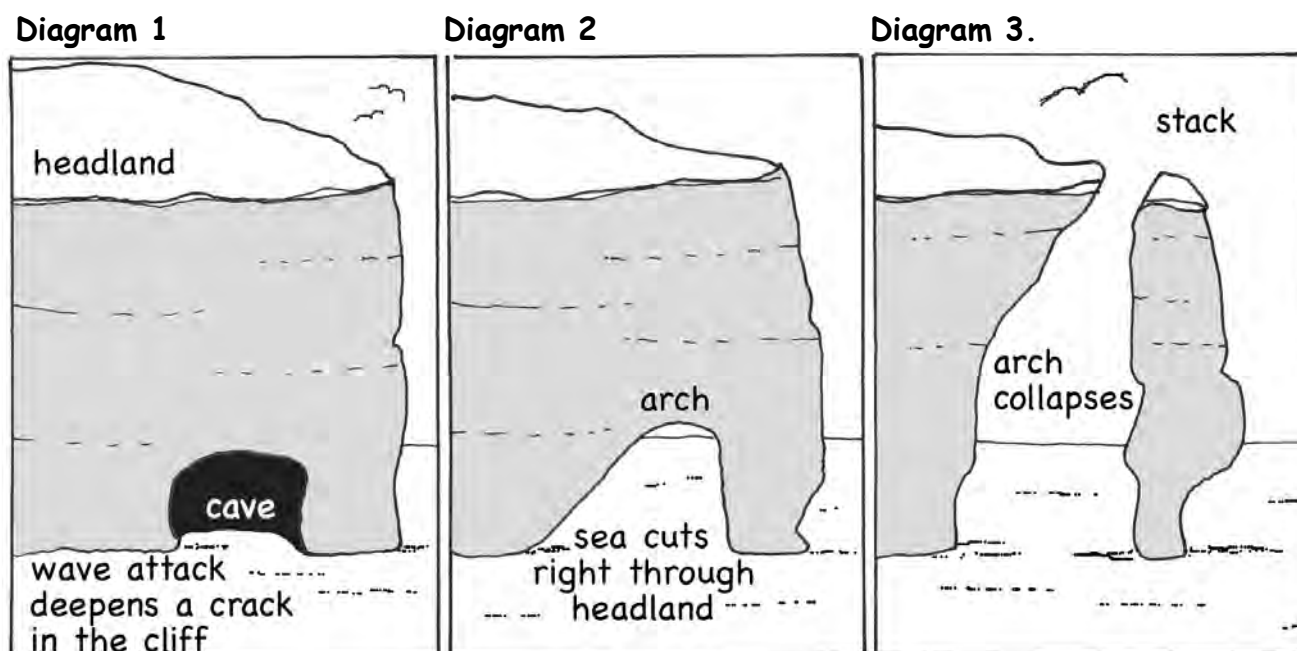
The erosion of the _____ and the weathering of the cliff- face result in _____, which can be massive, sudden and dangerous. As the falls occur, the cliffs are gradually worn backwards and _____ leaving a platform at their base, called the _____.

chemically, undercut, base of the cliff, wave-cut notch, shore platform or wave-cut platform, erodes, weathering, cracks and joints, abrasion, cliff falls, freeze into ice, retreat, wave pounding, highest tides or the storm waves



2. CAVES, STACKS, ARCHES AND STUMPS

In quite strong rocks that are well jointed such as chalk, rain and seawater may erode some joints and cracks in the rock much more severely than the others, creating a hole or hollow in the cliff face (**Diagram 1**). This happens particularly on exposed headlands where wave action is very strong.



The water swirls around in the hollow, quickly widening and deepening it, forming a cave. This cave may then be eroded backwards, and, if it is on a headland, it may meet a cave wearing in from the other side. An arch is then formed through the cliff (**Diagram 2**).

Eventually, the top of the arch or bridge collapses, leaving a stack (**Diagram 3**). This is exposed to erosion on all sides and is worn away and undercut until it collapses, leaving a stump. In time, wave action destroys much of the stump, leaving only its foundation or base well below wave level.

3. EVOLUTION OF THE CLIFFS AT ETRETAT IN NORMANDY

Spectacular examples of caves, arches, stacks and stumps can be seen at Etretat, on the Normandy coast, between Dieppe and Le Havre.

- Study the photograph, **IMAGE 3** and add explanatory labels and captions.
- Again adding labels and captions, produce **TWO** images (**IMAGES 1 & 2**) to show how this famous stretch of coast may have looked like in the distant past as it evolved into its present shape.



- For **IMAGE 1** assume that the coast was originally fairly straight, with few caves and arches. This may have been the situation 5000 years ago.
- **IMAGE 2** is when the caves were just starting to develop.

c) Finally, produce two more images (**IMAGES 4 & 5**) with labels and captions showing two possible future stages in the evolution of the coast. Remember that increased storminess and higher sea levels are predicted, due to global warming, and will probably accelerate erosion on all coasts.

You may wish simply to sketch the images using a pencil or crayons. Alternatively, scan **IMAGE 3** into your computer and using Photoshop or some other suitable programme produce the other four images by airbrushing out various parts of the photo or by making additions. Don't forget to add labels and captions. By morphing the images, you could create a short movie.

IMAGE 3 CLIFFS AT ETRETAT

