ROCKS AND THE COAST

1. GEOLOGY AND DISTRIBUTION

Look carefully at the map that shows the geology of the area and the distribution of cliffs.

a) What are the THREE main types of rock in the area?

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b) On which types of rocks are cliffs found?

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c) Are cliffs formed on high or low ground?

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d) So which types of rock generally give rise to low lying coasts that have sand or shingle beaches?

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2. ORIGIN OF THE CHALK, SANDSTONE AND CLAY

Chalk is a soft limestone that was laid down on the bed of the Cretaceous sea, which covered north-west Europe from 100 to 60 million years ago, during the latter part of the "Age of Dinosaurs". The sea was warm, tropical and very clear. Planktonic algae, fish and other forms of marine life flourished. Many of the algae contained tiny disc-like structures made of calcium carbonate, called coccoliths. Coccoliths from the algae dropped to the sea bed, forming a white calcareous mud. As more and more mud accumulated, the water became squeezed out and the mud gradually hardened into chalk. Trapped within the mud were the remains of other marine organisms, such as fish, sea urchins and shellfish, which now form fossils in the chalk.

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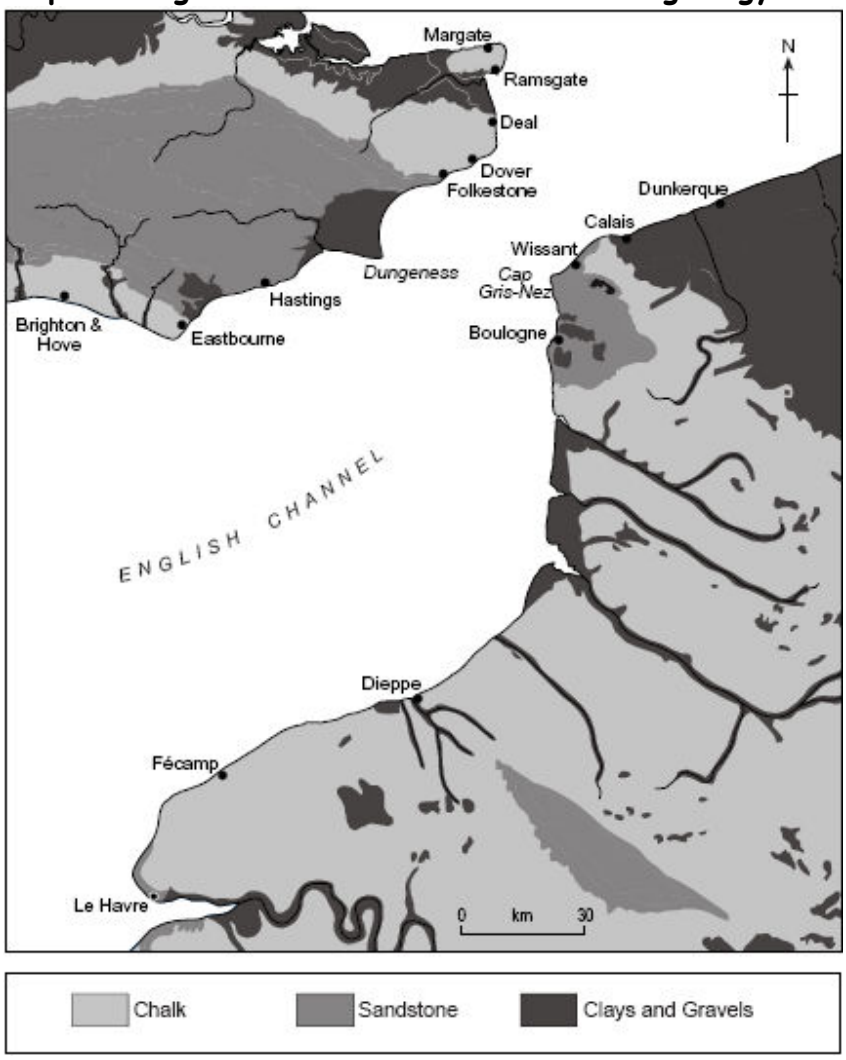
The Chalk was mainly laid down very regularly in thick layers called beds. Occasionally the sedimentation (or laying down of mud) stopped for some reason. This left slight breaks or lines of weakness called bedding planes, in which flint accumulated.

Map showing the location of cliffs and the geology of the eastern Channel area.



The sandstones of South East England were laid down as beds of sand (quartz) often by rivers, at an earlier stage in the Cretaceous Period. The sand grains are held together by iron or silica cement, which gives the rock much of its strength. Some of the beds were very thick, while others were much narrower and weaker, which affects their strength and resistance to weathering and erosion.

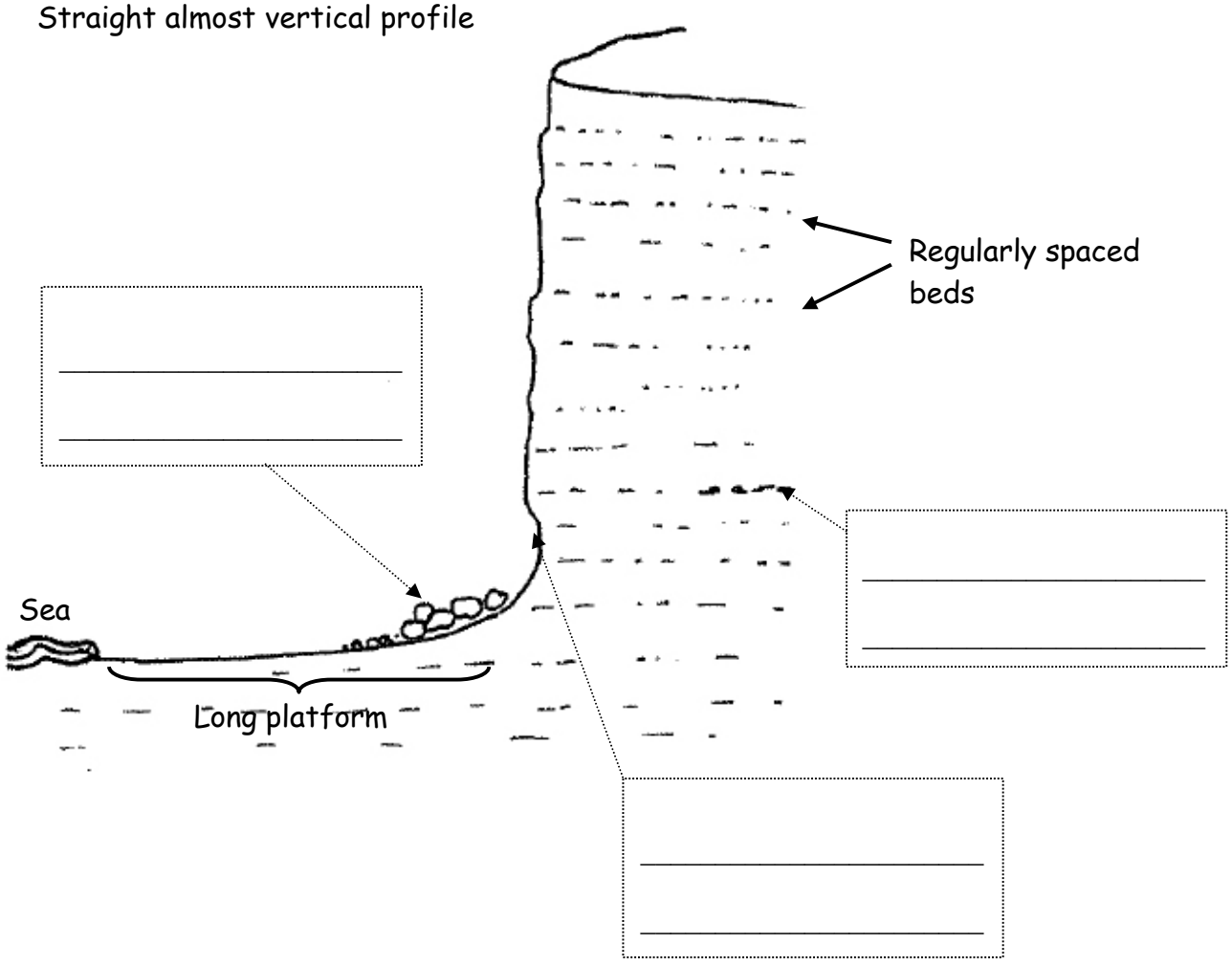
Clays were laid down in huge estuaries or river mouths, often as mudflats. They are much softer and less strong than chalk and sandstone. They consist of flattish minerals ('clay minerals'), which tend to slide against each other. Clays can become very waterlogged and slippery. Steep slopes, including sea cliffs have a tendency to landslip, where great blocks of the cliff rotate outwards.

3. DIFFERENT ROCKS—DIFFERENT CLIFF PROFILES

a) Study the three following diagrams. Which shows a sandstone cliff, a clay cliff and a chalk cliff? Add the following extra labels to the diagrams:

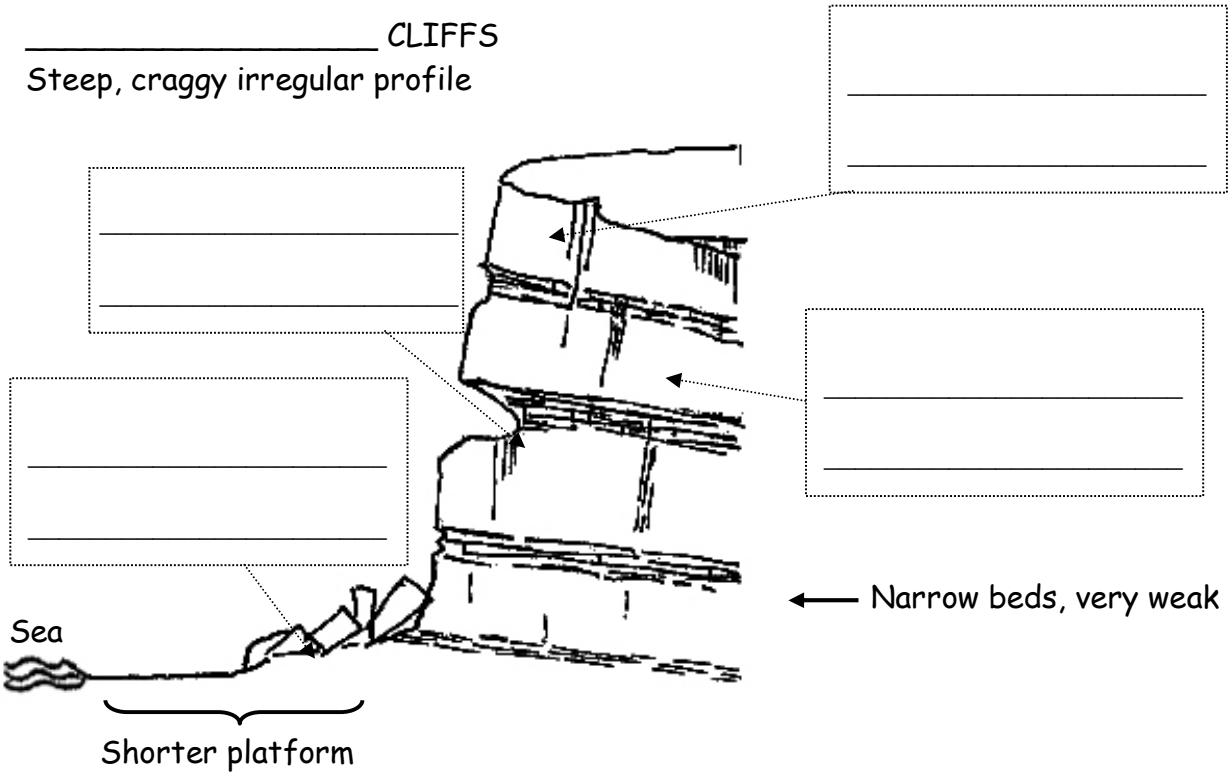
1) Massive thick beds, not easily eroded,
2) Basal notch,
3) Weak narrow beds more easily eroded,
4) Successive rotational slips,
5) Flints along bedding planes,
6) Vertical joints or cracks,
7) Clay covered by sand or shingle,
8) Rounded white boulders,
9) Waterlogged, badly drained 'step',
10) Angular boulders.

_____ CLIFFS
Straight almost vertical profile



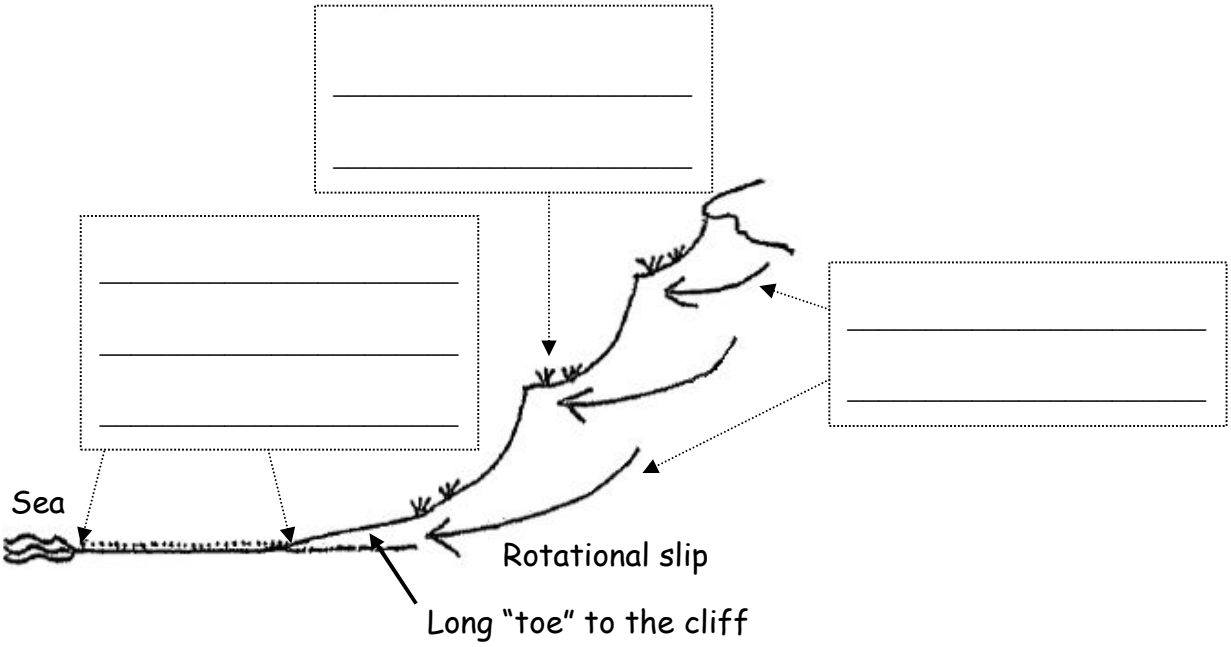
_____ CLIFFS

Steep, craggy irregular profile



_____ CLIFFS

stepped profile due to landslips



4. SANDY BEACHES

Sadly, for many of us, beaches that consist purely of sand are rare in South East England (the beach at Camber is a wonderful exception). They are much more common in North France and in Belgium and Holland. Many of the shingle beaches of South East England, however, contain sand, and the sand is often revealed below the shingle at low tide (which is often a good time to swim).

WHAT DO WE KNOW ABOUT SAND?

Sand grains are made of silica, or quartz. Remarkably indestructible, they are generally many millions of years old. It is usually impossible to say exactly where an individual grain of sand originated.

SO CAN WE DEDUCE WHERE THE SAND IN OUR BEACHES CAME FROM?

This is in some ways a more difficult problem than that for the shingle because the sand has many more possible sources. Eroding sandstone cliffs yield sand, but so do some Ice Age deposits, including ancient river deposits.
The geological map shows a small outcrop of sandstone along the coast at Hastings. This sandstone is formed of 125 to 130 million year old (Cretaceous) sand deposits, cemented together by extra silica and iron salts.

a) How has the action of the sea converted the sandstones in the cliffs into beach sand?

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b) Why is it unlikely that the sands that occur on the beach at Eastbourne were formed from the Hastings Sandstone?

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c) Some of the beach sand in South East England may have originated from 50-57 million year old sands (of Tertiary age) that lie on the Chalk in some areas and often show as bright orange deposits on top of the cliffs. How did they then become beach sand?

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