Bringing geology into geography lessons: Make sense of *drift* geology

David R. Wright

Even though about 80 % of us live on drift geology, it is a much-neglected topic in schools. This article offers simple classifications of the types of drift geology – clay, sand and gravel, river terraces, silt and peat – and suggests that drift geology can be viewed as 'icing on the cake'. Teachers are encouraged to explain the distinctiveness of the drift geology in their local area to consolidate students' learning.

Introduction

I discussed solid geology in the Autumn 2009 issue of *Teaching Geography*. Since then, there have been important developments in making geology accessible: the British Geological Survey has resolved to 'make much more information available for non-commercial use'. This information includes maps and diagrams, and is available free to schools. You can find all these resources at *www.bgs.ac.uk*. Perhaps, at last, some of the barriers for accessing geology are being broken down?

In this article, I will focus on drift geology, the millions of tonnes of material, spread by ice sheets, over much of Britain. Imagine solid geology as a layer cake (the layers are the strata). Drift geology is **the icing on the cake**, added to the cake after the cake has been made.

Drift geology is not as dramatic as some solid geology: drift has neither the drama of volcanoes, nor the beauty of igneous mountains or limestone escarpments – but so few of us live in these spectacular landscapes. Probably about 80 % of us live on drift geology. Most homes and most schools are built on drift geology, so for school students an understanding of this much-neglected topic must be a key element in understanding our own local environment.

The photographs in Figure 1 emphasise the huge areas covered by glacial deposits. They show four different landscapes with varying amounts of solid geology and drift geology. Flamborough Head (Figure 1b) shows the contrast between the vertical chalk cliffs and the 45° angle of the boulder clay on top. The solid chalk at the base of these cliffs, as with the chalk base at Weybourne (Figure 1c), provides a good foundation which helps prevent slumping. This contrasts with the unstable, boulder clay cliffs at Holderness (Figure 1d).

Drift or SD or Quaternary deposits? A question of terminology

In academic texts 'drift' is now generally replaced by 'superficial deposits' (SD). However, to avoid some confusion for school students, 'drift 'may be a clearer term to use. The term 'drift' was first proposed by Murchison in 1839, and has been widely used ever since.

An analogy: icing on a cake

We need a bright, simple, memorable analogy – try the one shown in Figure 2 – and improve on it if you can:

1. Think of solid geology as a layer cake: several layers of sponge cake – sometimes a bit crooked – separated by thin layers of icing and jam.
2. Think of drift geology as the 'cream icing' put on by a six-year-old; mostly quite thin, but thicker in some parts and missing in a few other parts – quite a mess!
3. Then imagine that the lovely cake is decorated by a six-year-old, who adds grated chocolate on top. This represents the soil, and is *not* drift geology.
4. Cut some valley shapes in the cake, and notice how the drift geology (the icing) is still present on the plateau, while the layers of solid geology are visible on the valley sides.

No analogy is ever perfect – on my cake I have not managed to put alluvium onto flat valley floors.

A classification of 'drift' geology

Because this journal goes nationwide, I need to mention briefly the main types of 'recent' deposits. It may be appropriate to omit some of them in teaching. However, everyone should know about the major types of glacial deposits. The 1:625 000 Quaternary Geology map has a helpful but complex 13-point classification and explanation of the deposits. Here is a suggested simpler classification, to be supplemented locally.

Clay

Clay is the single most important item, and needs to be distinguished clearly from the clays of solid geology (Oxford Clay, Weald Clay, London Clay etc.). Many students get confused here. North of about 52 degrees north (Worcester – Oxford – Colchester), most drift clay is glacial boulder clay ('till'). There are local variations in 'till' – e.g. East Anglia has 'chalky boulder clay', with lumps of chalk dredged up from the frozen North Sea floor. Clay is acid; chalk is alkaline – a good recipe for making fertile soils!

The boulders were brought from faraway places by the ice sheets, and can make a fascinating study. The soils are heavy and sticky – check the playing-field in winter! Vast areas of Britain are covered by boulder clay: the blue colour on the two 1:625 000 drift geological maps dominates both maps. South of 52 degrees, clay-with-flints is important on chalk; other clays are of local importance. If you have a local drift clay, it is well worth finding out more – was it the key building material until 100 years ago? Today, however, almost all modern bricks come from solid geology.

Sand and gravel

Sand and gravel are vital in industry, and this is a multi-million pound industry. Again, north of 52 degrees, most are of glacial or fluvio-glacial origin, and in some areas dominate the landscape. River gravels are also important. Sand dunes – whether active or not – need to be mentioned too.

Figure 1a: Swyre Head, Dorset: there is only solid geology (chalk cliffs), no drift geology. **Photo:** Ruth Totterdell.

Figure 1b: Flamborough Head, East Yorkshire: there is thick boulder clay on top of the chalk cliffs. Photo: David Gardner.

Figure 1c: Weybourne, Norfolk: mostly boulder clay, with chalk at the base of the cliffs which helps prevent the boulder clay from slumping. **Photo:** Alan Parkinson.

Figure 1d: Barmston, Holderness: boulder clay cliffs which are very unstable. **Photo:** Ruth Totterdell.

River terraces

River terraces above the level of the flood plain are a vital topic for understanding early settlement – and yet another theme which only makes sense if people understand the geology and geomorphology.

Silt

Silt – as in the silt fens – is locally important, especially on flood plains.

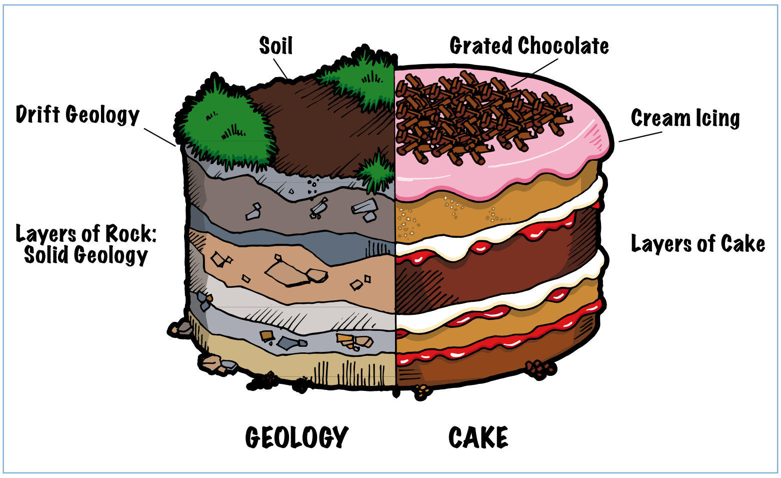

Figure 2: Drift geology: the icing on the cake.

Peat

Peat – as in the peat fens – is of organic origin. The lowland peat areas, which became some of Britain's best soil for farming when drained, need to be distinguished from acid moorland peat.

We need to show the location of these drift deposits on maps, in a manner that helps understanding, and does not add to confusion and complexity – this topic is discussed below.

Develop a local example

The above simplified classification will remain as 'superficial school knowledge' – and vanish from memory soon – unless it can be tied into a local example. Inevitably one example will not fit everywhere, but this attempt will fit several places.

Many of us teach in an area of modest plateaus and broad valleys – such as Stevenage or Norwich. On the daily journey to school, many students will encounter alluvium, clay and the local solid geology – and probably not be aware of what they see unless this is pointed out to them. There is a pattern to be discovered. The cross-section is likely to look like the one shown in Figure 3a. The geology map will confirm that there is clay on the 'plateau', solid geology on the valley sides, and alluvium (silt or peat) on the flood

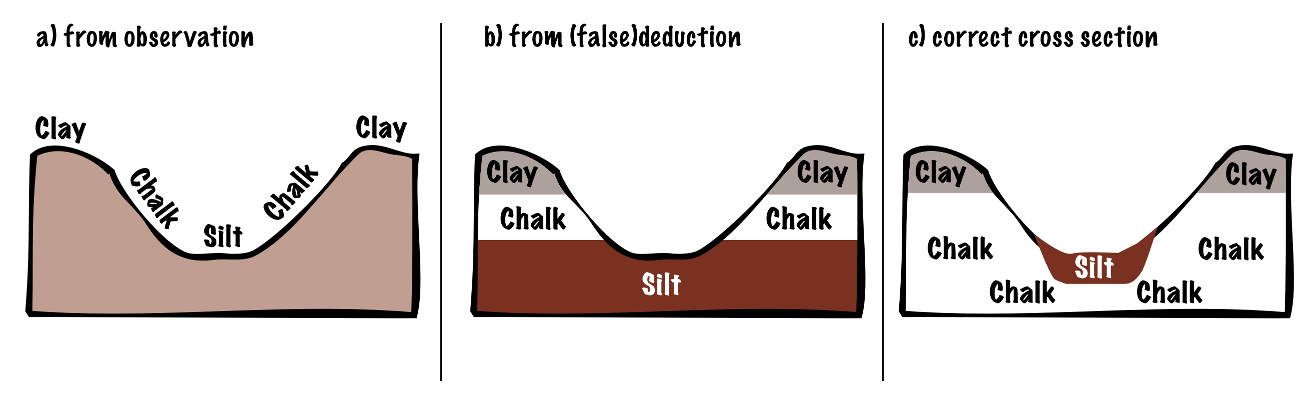

Figure 3: Understanding a typical lowland glaciated landscape. Chalk is the oldest by far; clay is glacial boulder clay and silt is post-glacial – i.e. newest.

plain. The harder the solid rock, the steeper the slopes will be, and the solid rock will be more visible and recognisable. This is illustrated in Figure 3.

But this may make no sense to some students: while they will be willing to try to 'work it all out', their textbook knowledge of layers of rock may produce some intelligent but wrong deductions (see Figure 3b). We need something different from the solid geology principle of 'lowest equals oldest'. On the layer cake, we need to place the icing – the glacial deposits – on the plateaus. We need to realise that the boulder clay has long ago been eroded from the valley sides. And we need to put post-glacial material on the valley floor. So – perhaps surprisingly – newest is lowest; glacial is highest; solid geology is in between (see Figure 3c).

Study the drift geology map

To support students' understanding of geology, the relevant 1:625 000 Quaternary Geological Map for your area would be a valuable addition to the geography department's resources. Laminate the map, display it next to the solid geology map discussed in my article in the previous issue and allow students to see for themselves the multiple layers of rock and other materials that are right under their feet. There are many other surprises too – for example, I was unaware that there was so much 'blown sand' in Lancashire, or that there was such a big area of lake deposits around York. It is now available online from BGS, and is also linked to the Google Earth site.

Solid-with-drift maps

These are ideal for geographers. They show the drift on the solid geology by using dots, dashes etc. Maps combining solid and drift help students to make sense of most landscapes. However, these maps are hard to find, even in this computer age. Hopefully, the wonders of technology will soon give us more solid-with-drift maps.

A starting point: something more practical

We want our students to make sense of their local area. 'Are games cancelled?' is a good link between geography and PE. Whether outdoor PE is loved or hated, it is an excellent introduction to the local geology, and probably this will be drift geology.

If there is a playing-field, is it

- on a flood plain?
- on boulder clay?

(The latter is by far the most common lowland feature north of 52 degrees north.)

In these two cases, we have already discovered why it is very muddy in winter!

Or is the playing-field

- on a river terrace?
- on glacial sands and gravels?

In these two cases, the field is well drained and in little danger of being waterlogged.

Or is it on solid geology, and if so, what rock?

In conclusion

These two articles on geology seek to raise the profile of geology in geography lessons, without adding another big burden to students, to teachers and to the curriculum. Geology is another dimension in our attempt to understand our world, our own country, and the local distinctiveness of our immediate area. There are still many challenges in trying to 'find one's way around' geology, but the rapid development of web-based resources could lead to a breakthrough. We now need geographers to highlight the most useful parts, to add geographical interpretations and – the hardest bit to organise – to explain the local area. | **TG**

Shortly before the publication of this article, **David R. Wright** passed away. He was a geography education lecturer at UEA, Norwich and the author of *Maps with Latitude* and *Philip's Children's Atlas*. A full obituary will appear in *Geography* shortly.

References
Murchison, R. (1839) *The Silurian System*. London: John Murray.