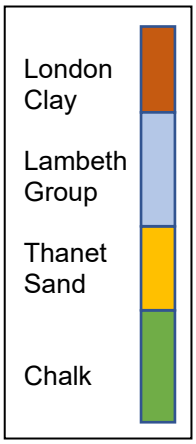
Geology of the London Basin - 100 Million Years in the Making on 16 November 2018

Mr Philip Laurie first showed a geological map of London produced in 1848 by Stanford – the first of its kind. The Earth is 46,000 million years old, so much had happened before the London area made an appearance.

The geological history of London started a hundred million years ago. For 60% of that time it has been under ice, causing sea levels to fall.

He lives near the Ravensbourne, which rises south of the North Downs, runs through them and north to the Thames, emerging at Deptford Creek. How did it, and other rivers such as the Wandle, Darent and Medway, come to flow through the North Downs? At one time it was thought that there were faults in the chalk which gave them a way through, but this has been discounted. The Weald is now low lying, but when tectonic plate movement, mainly caused by Africa colliding with Europe, raised not only the Alps but buckled strata in northern Europe, a Wealden ridge was formed. An underlying chalk stratum buckled with high ridges at the South and North Downs and a dip under the Weald, squeezing up the soft sedimentary rocks between them to form the Ridge. Fast flowing streams from the ridge soon eroded channels in the chalk on their way to the sea. The ridge has since been eroding away (reducing river flows). They are ancient rivers.



London is over a layer of cretaceous chalk about 40m down, which in turn is over gault clay. The chalk would have been formed in shallow seas (if deep, shells dissolve before sinking to the sea bed) when sea levels were 200m lower than now. Greatly simplifying, London clay (good for earthenware and brickmaking) is over the Lambeth Group of gravels, mudstones, chalk, etc some porous others impervious, then Thanet Sands.

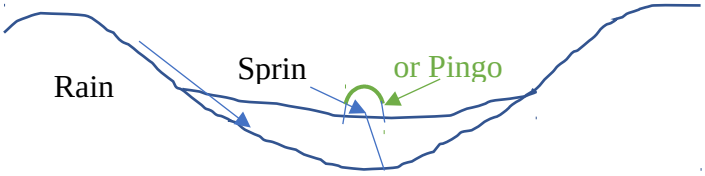
Blackheath pebbles were probably laid down in an estuary eroding Lambeth group material down to Thanet sand. Blackheath pebbles are not just local but can be found all across south east England.

In practice a bore hole drilled anywhere across London will find almost anything!

Mr Laurie showed a (vertical) time line starting 90 million years (Myr) ago with a period of 10 Myr when a couple of types of rock were formed, then a 40 Myr hiatus, with no geological signature; despite the disruption 65 Myr ago by the meteorite which wiped out the dinosaurs. Then came the Barton, Bracklesham and Bagshot beds (each a recognisable set of strata) appear, followed by a 6 Myr period of the formation of the Thames group, mostly London clay; then the Lambeth group (known locally as the Reading and Woolwich beds). Gilbert's Pit in Charlton exhibits a good cross section of them Another 25 Myr hiatus follows, then chalk is again laid down in the 10 Myr period to the present.

One feature of rock formation is that when water levels fall and air gets in the minerals present are oxidised, leaving trapped air deoxygenated.

Aquifers are in porous rocks over an impervious stratum, typically in London: chalk, sand or gravel over clay. A primary aquifer is one fed from the North Downs, under pressure due to their height, and beneath clay layers in the Lambeth group. A secondary aquifer would be from gravels above clay layers in the Lambeth group.



Faults do occur in the upper London layers. If water collects in a dip over an impervious layer with a fault in overlying clay a spring will form. If this happens towards the end of an ice-age then as the water nears the surface it will freeze and expand. And push up the surface layers - a small hill is formed with an ice core. This is a **Pingo** (an Inuit word for a small hill, perhaps 30m high, from a part of the world where they regularly occur). As temperatures continue to rise the core melts and a round hollow appears. This will fill with blown sand etc, but have none of the mechanical strength of the surrounding ground. It has been calculated that a limiting thickness for the overlying clay is 35m to provide sufficient pressure for this to occur. There is a pingo in Lewisham. Over 30 pingos are known in London, and cause problems for civil engineers.

Ladywell is named after a well fed by a secondary aquifer – which was in use until the mid-19th century when water extraction for a growing population reduced the water table in the Thames basin below the already polluted Thames which then polluted the London's wells. So extraction ceased until it was realised it had to be resumed so as not to affect the foundations of buildings built in the drier land – and some Underground tunnels which could become buoyant !

Even in Britain tectonic activity still continues - Africa is still moving – and from time to time there are tremors. These can affect tunnels; so can new man made installations as when piles are driven centimetres away from tunnel walls, or a second running tunnel is bored next to the first. Tunnels can flex, or even fracture.