British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Geoscience for urban development

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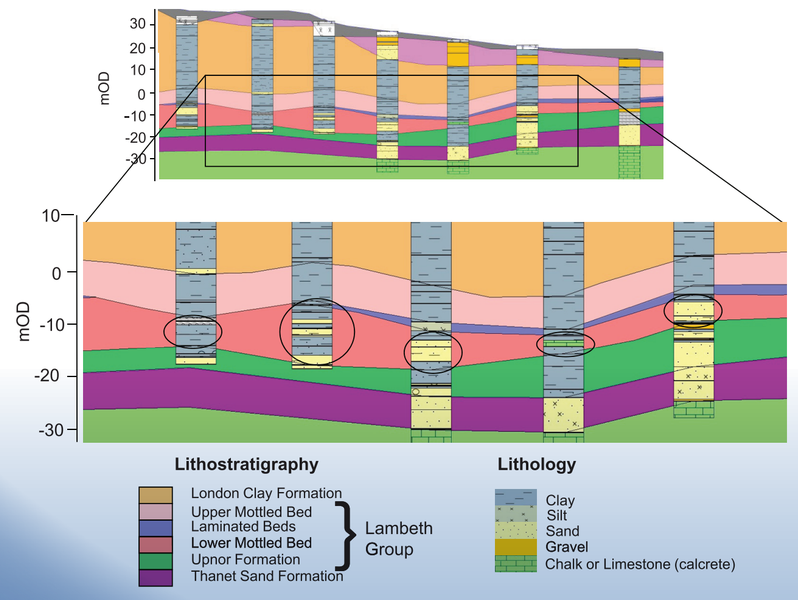
Introduction

The population of London is around seven million. The infrastructure to support this requires London's ground conditions to be thoroughly investigated and understood. Countless boreholes have been drilled for ground investigation and water supplies. Yet subterranean construction work in London continues to reveal the presence of 'anomalous' ground conditions. These occurrences have been discovered in isolation, with no further work to explain them, yet such conditions can prove costly if not predicted by initial site surveys. Thus there is a need to establish a refined geological framework for London, within which these 'anomalies' can be explained.

Engineering work being carried out at the Olympic stadium, March 28th 2011.

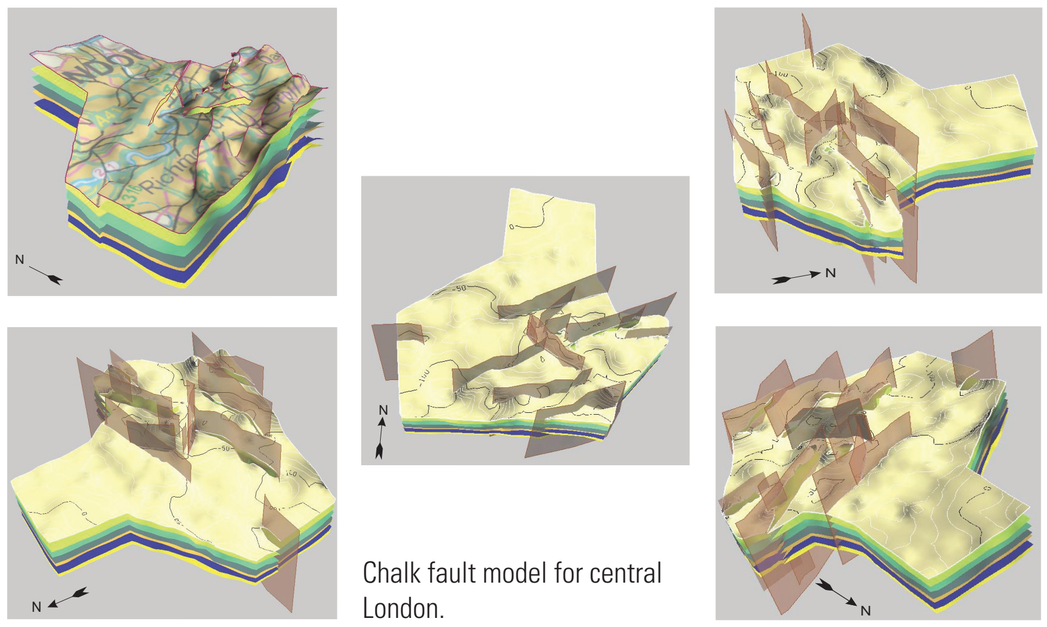
Variability of Lambeth Group sediments

The Lambeth Group is a complex assemblage of clay, silt, sand, gravel and lignite, some of which may be shelly, deposited during the Paleocene in a subtropical climate. This complexity is due to the range of depositional environments including nearshore marine, estuarine, lagoon and broad floodplains, which moved in response to changing sea level. During an extended period of low sea level, subtropical weathering altered the deposits to form duricrusts including calcretes, silcretes and ferricretes. Although relatively thin (often between 10 and 20 m thick), the Lambeth Group's lithological variability and position in London significantly affects the investigation and construction of deep excavations and tunnels.

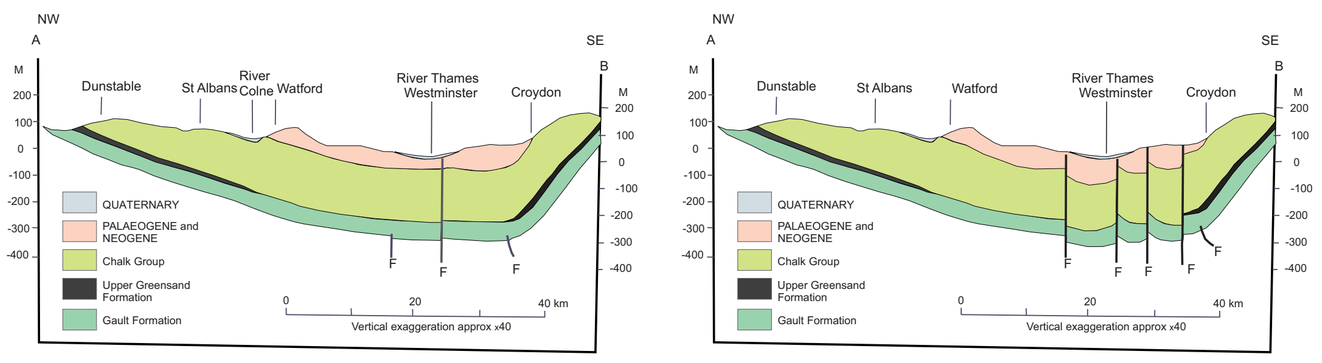


Cross-section illustrating the rapid lithological changes within the Lambeth Group.

Traditionally the London Basin has been considered to be 'relatively simple' for example, on the current geological maps for the region only two faults are shown. However, there is growing evidence from recent site investigations suggesting that the structure of the basin is more complex. The nature and extent of faulting within the London Basin is difficult to determine because the majority of the basement is at subcrop level, buried beneath thick superficial deposits related to the development of the River Thames.



Chalk fault model for central London.



Cross-sections showing how faulting in reality is a lot more common than previously thought.

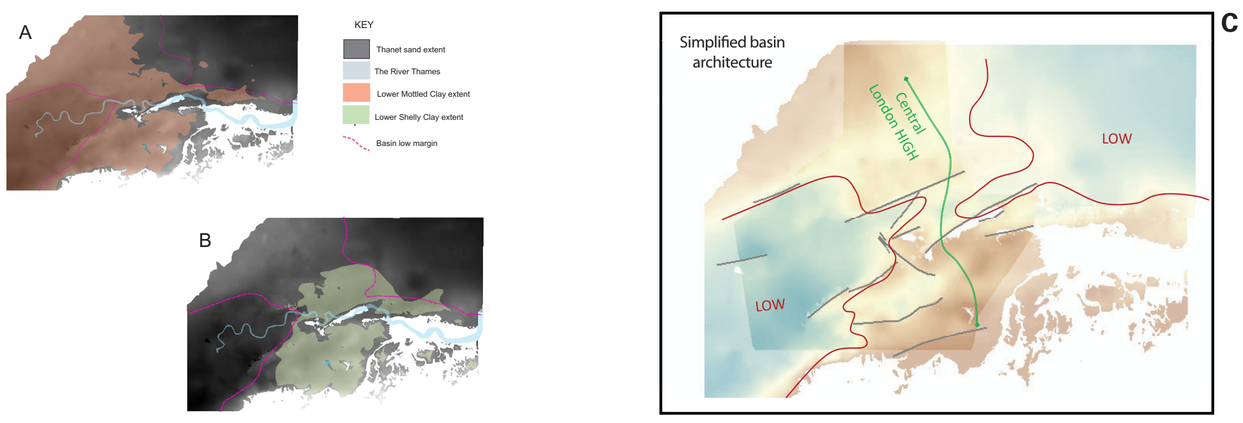
New 3D models of Lambeth Group and new distribution plots

The variability of the Lambeth Group can give rise to difficult ground conditions for civil engineering works. The detailed distribution of the component units and their associated properties is so poorly understood that these sediments are amongst the most difficult to engineer in the United Kingdom.

The Lambeth Group appears to be most complex under central London, where it occurs widely at shallow depth.

Understanding these deposits is crucial for major civil engineering projects, particularly those involving tunnelling, such as the Jubilee Line Extension, the Channel Tunnel Rail Link and the development of the CrossRail network.

Therefore there is a need for a better understanding of the group's heterogeneity, physical characteristics and distribution. Researchers at BGS are using innovative 3D modelling techniques to understand the distribution of these sediments better throughout central London.



A and B Facies distribution plots.

C Simplified basin architecture.

D and E Lower Lea valley 3D model — whole model showing alluvium *(yellow)* down to the Chalk *(green)* and second image with the superficial deposits removed showing the London clay *(brown)* and the Lambeth group *(blues, reds and greens)*.

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