Chapter 8 Mass-movement sites in London Clay (Eocene) strata

R.G. Cooper

Introduction

London Clay is an Eocene deposit of stiff blue clay that weathers brown. It is uniform in lithology, although it becomes sandier to the west. It is more argillaceous in its middle beds than in its upper and lower ones (Sherlock, 1960). It is up to 1800 m thick in the eastern part of the London Basin, thinning to less than 900 m westwards.

According to Jones and Lee (1994), of the 465 landslides recorded in Eocene strata, 44% were not classified into any particular type. Of those that were classified, single rotational slides were the most frequently recorded type (43%), and 84% of these were in London Clay. Of the 356 slides in London Clay, 40.7% were of unspecified type. Of those which were classified, 45% were identified as single rotational, 15% as compound and 12% as complex. Two GCR sites are located in Eocene strata, High Halstow and Warden Point (see (Figure 8.1)).

These figures are as would be expected from the detailed work that has been carried out on mass movements in the London Clay, particularly in two series of papers, one series by Hutchinson (1967, 1973; summarized in Hutchinson, 1979), and the other series by Bromhead and Dixon (Bromhead, 1979; Bromhead and Dixon, 1984, 1986; Dixon and Bromhead, 1986, 1991). Hutchinson's 1967 paper made a distinction between slopes that are undergoing 'free degradation' and those that are undergoing erosion. Free degradation is the development of a slope from which no material is being removed at the toe, by fluvial, marine, human or any other agent (Figure 8.2). His 1973 paper introduced a further distinction: the ratio of the rate of erosion to the rate of weathering. He distinguishes three situations, each of which gives rise to a characteristic type or combination of types of mass movement:

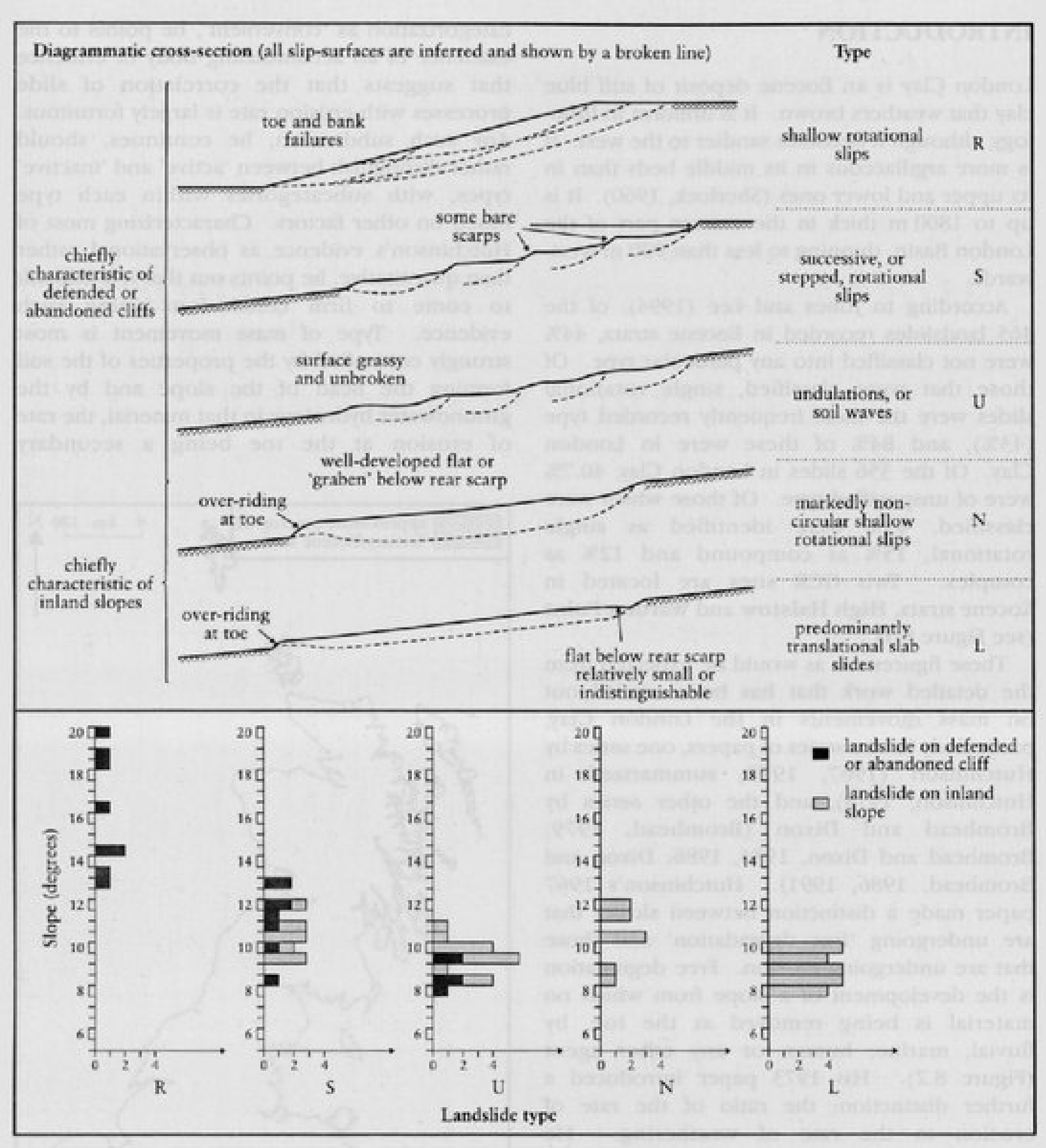
1. the rate of erosion is broadly in balance with the rate of weathering;
2. the rate of erosion exceeds the rate of weathering;
3. the rate of erosion is zero, for example on an abandoned cliff.

Bromhead (1979) has strongly challenged this view. Disparaging Hutchinson's tripartite categorization as 'convenient', he points to the existence of an accumulating body of evidence that suggests that the correlation of slide processes with erosion rate is largely fortuitous. Any such subdivision, he continues, should rather distinguish between 'active' and 'inactive' types, with subcategories within each type based on other factors. Characterizing most of Hutchinson's evidence as observational rather than quantitative, he points out that it is difficult to come to firm conclusions using such evidence. Type of mass movement is most strongly controlled by the properties of the soil forming the head of the slope and by the groundwater hydrology in that material, the rate of erosion at the toe being a secondary consideration. Hutchinson (1968b, 1973), he points out, ascribes control to the intensity of marine erosion. 'Unfortunately, [Hutchinson's] work is intended to apply only to cliffs of similar height, composed wholly of London Clay and subject to largely similar climatic conditions. This naturally leaves toe erosion intensity as the only remaining variable' (Bromhead, 1979).

Geotechnical characteristics of the London Clay deposit in the London Basin have been investigated by Burnett and Fookes (1974).

References

(Figure 8.1) Areas of London Clay (Eocene) strata (shaded) and the locations of the GCR sites described in the present chapter.



(Figure 8.2) Behaviour of London Clay cliffs following cessation of erosion at the toe. Cross-sections and slope-angle histograms illustrate the types of landslide found on slopes in London Clay as described by Hutchinson (1979).