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CONSOLIDATION OF SEDIMENTS

SIR,—During consolidation a linear relationship is often found between void ratio (e) and consolidation pressure (p) over a moderate range of pressure. In such cases, rearrangement of the water-ionic complex may be the predominant mechanism involved.

If slipping or breaking of particles is of more importance, it may be postulated that there are in the soil a number (n) of locations, at each of which it is possible for an irreversible volume reducing event to occur, and that, on average, each such event allows the volume (V) to reduce by the same amount, i.e.

$$\frac{dV}{dn} = A, \text{ where } A = \text{constant.}$$

Since the weaker locations will tend to collapse first, there will be a tendency for the rate of collapse to decrease as consolidation proceeds. At the same time, the ability of the soil structure to bridge points of weakness may increase as these points become fewer and more widely separated. It is therefore postulated that volume-reducing events occur at a rate with stress proportional to their number, i.e.

$$\frac{dn}{dp} = -Bn, \text{ where } B = \text{constant.}$$

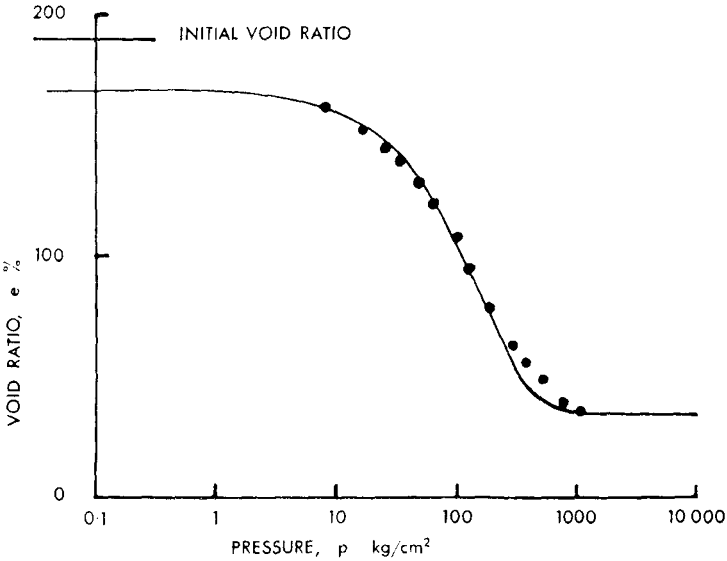
It follows that

$$\log (e - a) = b - cp, \text{ where } a, b, \text{ and } c \text{ are constants} \quad . \quad . \quad (1)$$

In the figure, the full line is calculated from equation (1), and the points are experimental results for calcareous ooze, cited by Laughton.[1] The initial void ratio was 190 per cent, and the lack of agreement at low pressures may be due to closure of cracks in the specimen or to elastic effects.

It is of course possible to generalize this approach to allow for more than one phenomenon (e.g. slipping and breaking) "centered" at different pressures, but this aspect is beyond the scope of the data available at present.

[1] A. S. LAUGHTON: Compaction of ocean sediments. Ph.D Thesis. Cambridge Univ., 1955.



CONSOLIDATION OF CALCAREOUS OOZE

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THE MALVERN LINE

SIR,—I should like to add the following observations to the controversy on the relationship of Upper Llandoverian strata to the Pre-Cambrian basement in the Gullet Quarry, Southern Malverns, as described by Reading and Poole (1961, 1962), Butcher (1962), Whitworth (1962), and now revived by Phipps and Reeve, and Ziegler in a recent issue of your journal.

In early 1962 I had the opportunity of examining a fresh exposure of the contact zone between the Upper Llandoverian and the Pre-Cambrian, immediately after some blasting operations. The slightly undulating Pre-Cambrian surface exposed, dipped at about 55 to 60 degrees to the west, and the associated Llandoverian showed an inclination of 70 degrees on a magnetic bearing of 275 degrees. There was evidence of slickensiding but this was confined to the Pre-Cambrian. Only one such surface actually intercepted the interface, and this almost at right-angles to it, with the striations fading out and showing general evidence of a smoothing-off immediately under the overlying Llandoverian sediments, compatible with the development of an erosion surface.

On this occasion the section showed no well-defined conglomeratic base to the Upper Llandoverian. Instead, within small hollows on the Pre-Cambrian surface there occurred at most about 1½ inches of brown and red-stained " earthy " clay with small vein quartz and Malvernian pebbles. Overlapping this material on to the higher parts of the hollows was a slightly " soapy " grey shale. The latter completely covered all that was visible of the slightly undulating Malvernian surface, except at one point where the base of the following stratum, a decalcified limestone (" rottenstone "), was in contact

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