initial porosity. Again, the small decrease in volume which precedes predominantly dilatant behaviour is probably largely elastic. Again, also, specimens which dilated during deformation were observed to be notably barrelled whereas specimens which had deformed with no change or a decrease in volume were almost cylindrical.

4. The increases in volume during pressure release, while similar in trend, were significantly smaller in magnitude than in the limestone.

Gosford sandstone

The stress–strain and volume change results for the sandstone are given in Figs 5(a), (c) and (d). Measurements were made only to 6 kb because the loads required to deform the sandstone at higher pressures might have overloaded the dilatometer. Also only compression tests were done on this and the subsequent materials.

All the stress–strain curves reached or passed through a maximum and the flow stress increased markedly with pressure over the whole pressure range. A brittle–ductile transition is less clearly defined in terms of specimen appearance than in the calcite rocks but the absence of a single discrete shear fracture places the behaviour as ductile. After 20 per cent deformation, however, all specimens showed some degree of non-uniform deformation, in addition to localized end effects. At 1-kb broad conjugate shear bands appeared, while at higher confining pressures specimens barrelled in a somewhat irregular manner without showing distinct shear zones. However, specimens strained only 10 per cent at 4 and 6 kb appeared to be uniformly deformed.

At all pressures, straining led first to a compaction of the specimen and subsequently to a dilation, although the initial compaction at 1 kb is probably mainly an elastic effect. A notable feature of the measurements was a large scatter between specimens (especially at 2 kb), as a result of which it is doubtful whether the differences shown between the mean curves for the three higher pressures [Fig. 5(c)] are significant. However, the change from compactional to dilational behaviour during straining was consistently present. The observation differs from observations on unbonded sand at moderate pressures (up to the order of 1 kb) in which only compaction during straining is observed [12, 13] although there is a suggestion of the effect at $1 \cdot 5$ kb effective pressure [5]. As for the calcite rocks, substantial non-elastic volume increases occurred during pressure release, larger at higher pressures, and leading in all cases to a final porosity greater than the initial [Fig.5(d)].

Three Springs talc

The measurements are given in Figs 6(a), (c) and (d). Specimen appearance suggested a brittle–ductile transition at about 4 kb, corresponding to the change to continually rising stress–strain curves. As for the previous materials, all specimens decreased in volume at first during straining, probably mainly elastically, followed by considerable dilation at 2 and 4 kb, approximately constant-volume deformation at 6 kb and slight further compaction at 8 kb [Fig. 6(c)]. Barrelling was minimal at 6 and 8 kb. Considerable non-elastic volume increases, larger at higher pressures, occurred in all cases during pressure release, giving a final porosity greater than the initial [Fig. 6(d)]. Further stress–strain studies, at high temperatures and on other talcs, are reported elsewhere [14].

Graphite

The behaviour of graphite is discussed in detail elsewhere [15] but the results are given in Figs 7(a), (c) and (d) for comparison with the other materials. The brittle–ductile transition

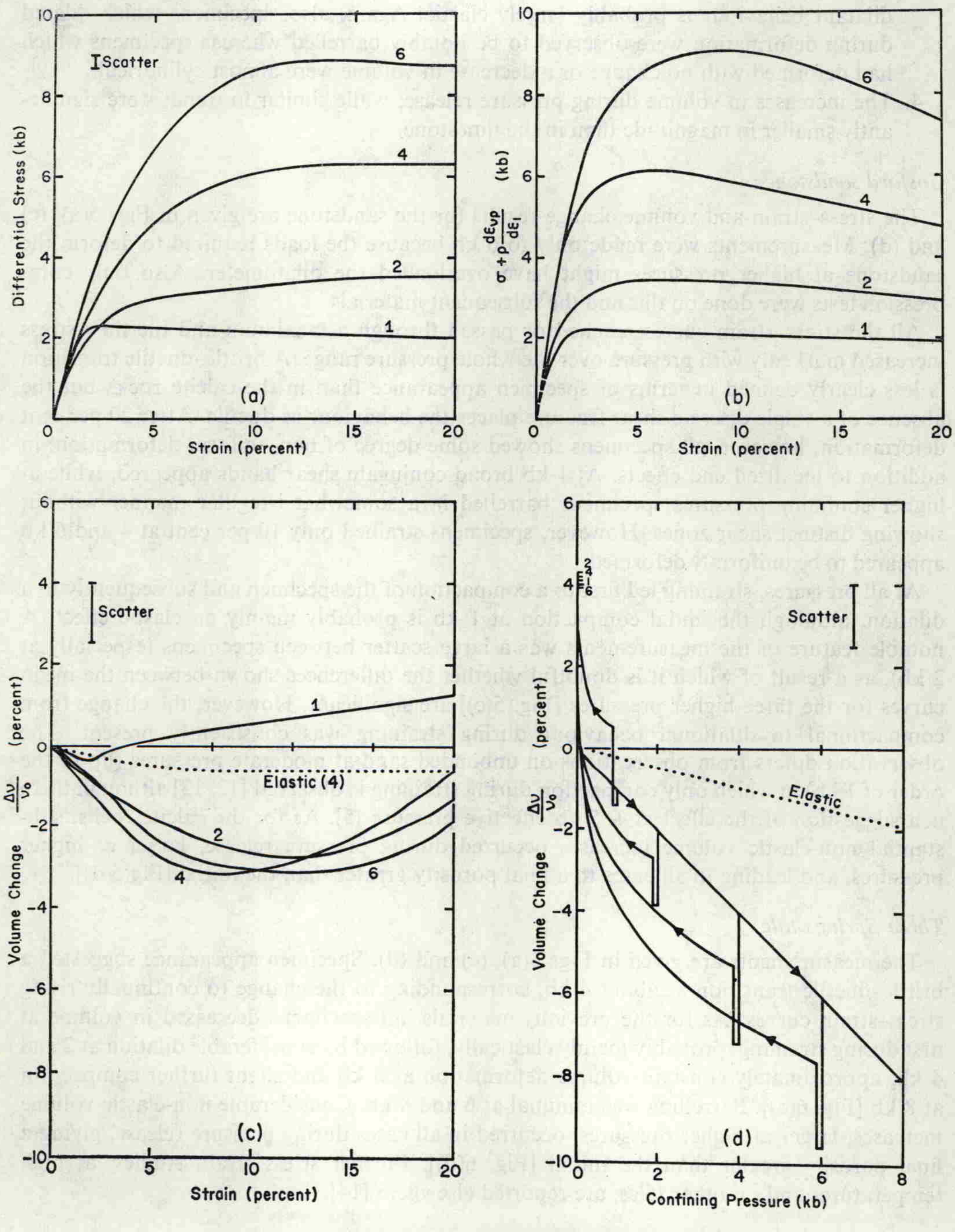

FIG. 5. Results for Gosford sandstone (cf. caption to Fig. 3).