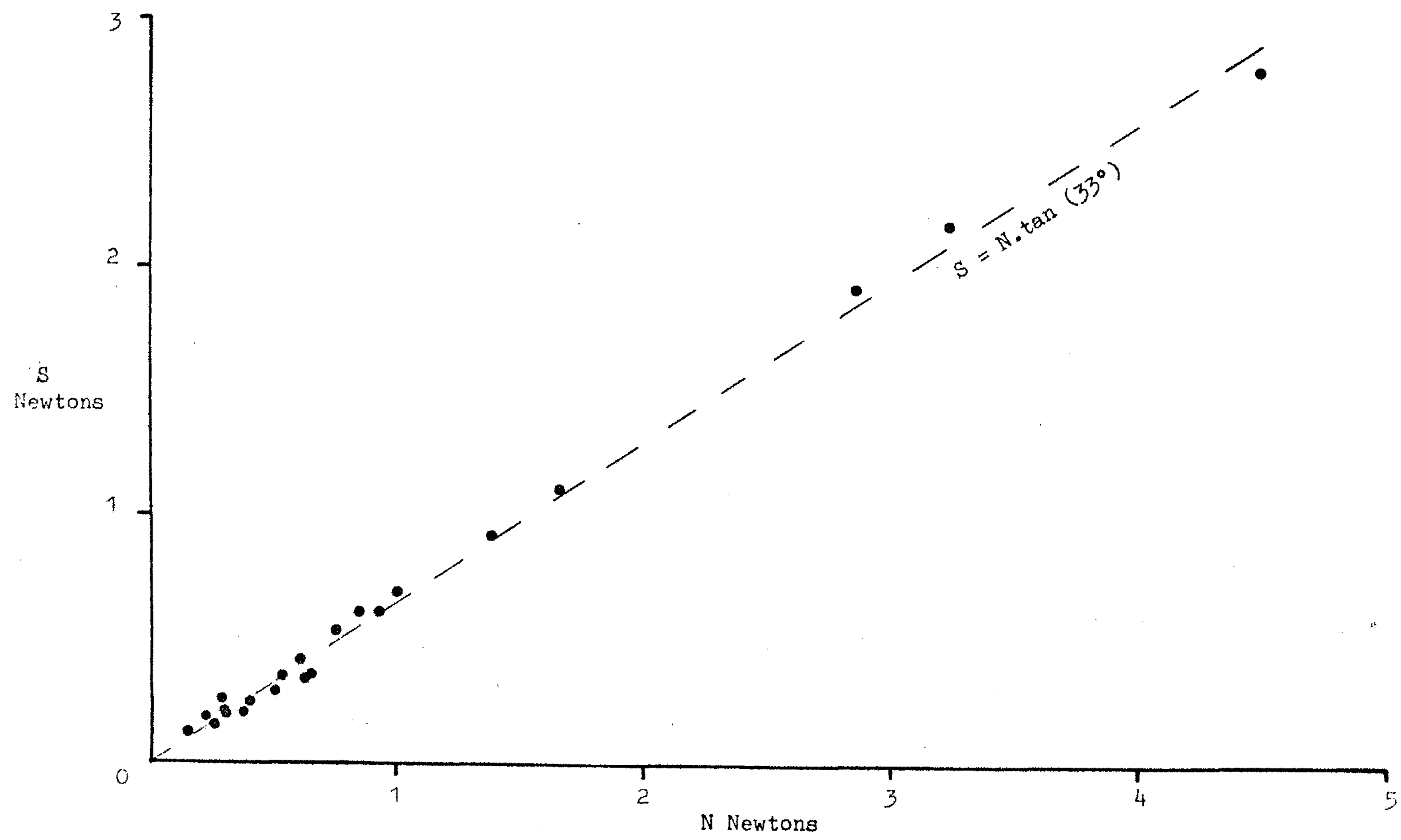


Figure 5.30 Shear load versus normal load at 0 cm displacement

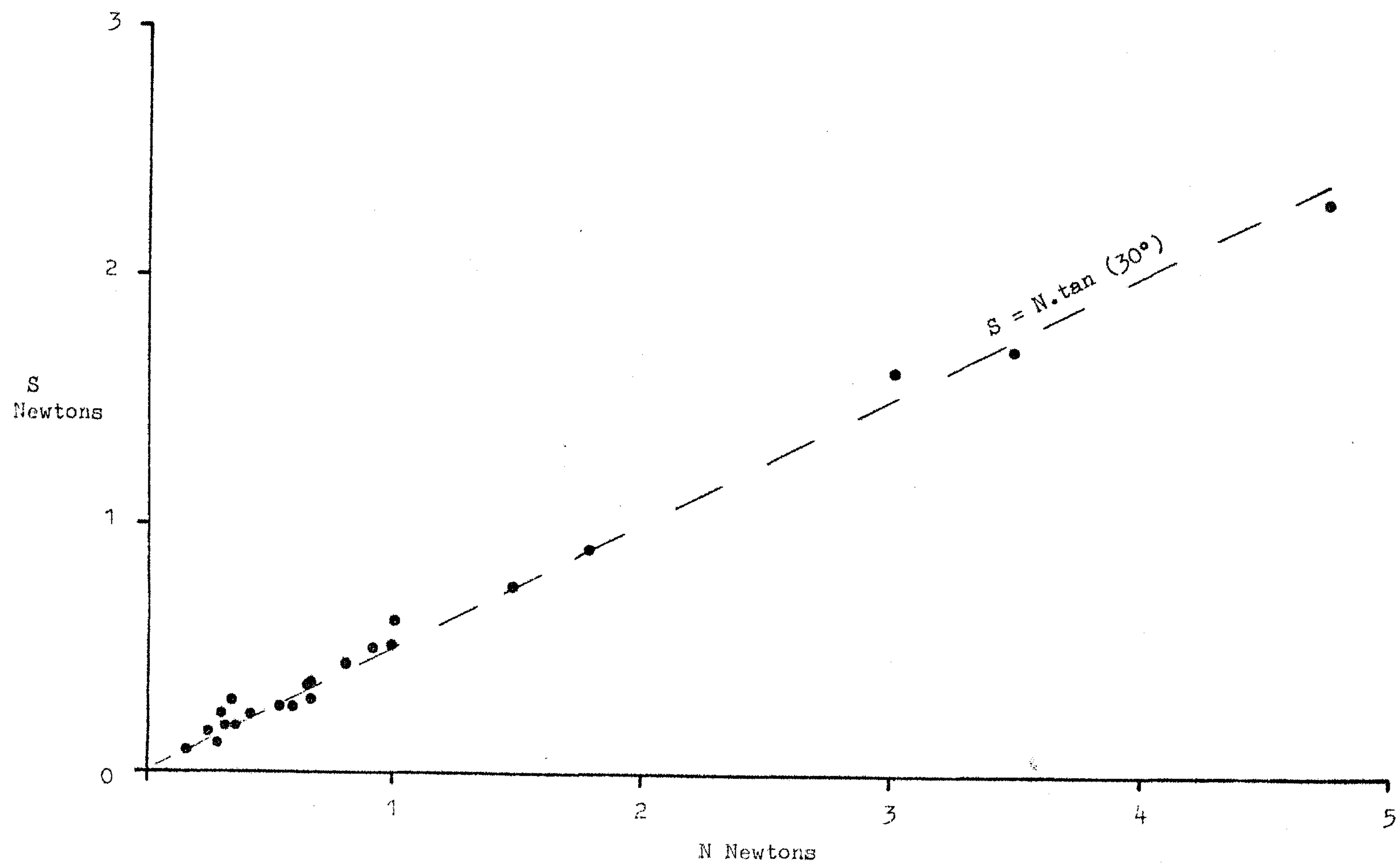


Figure 5.31 Shear load versus Normal load after 32 cm displacement.

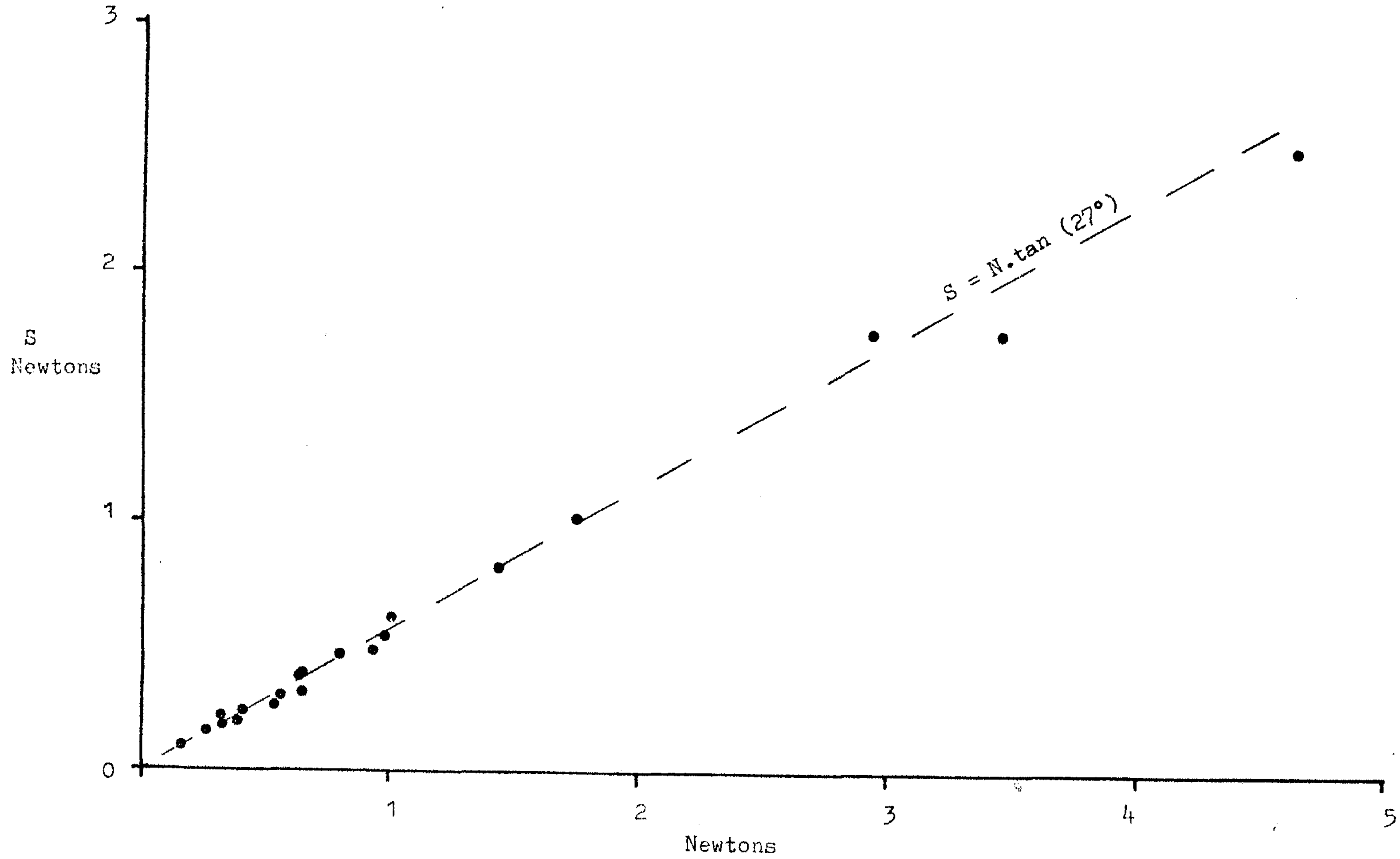


Figure 5.32 Shear load versus Normal load after 160 cm displacement.

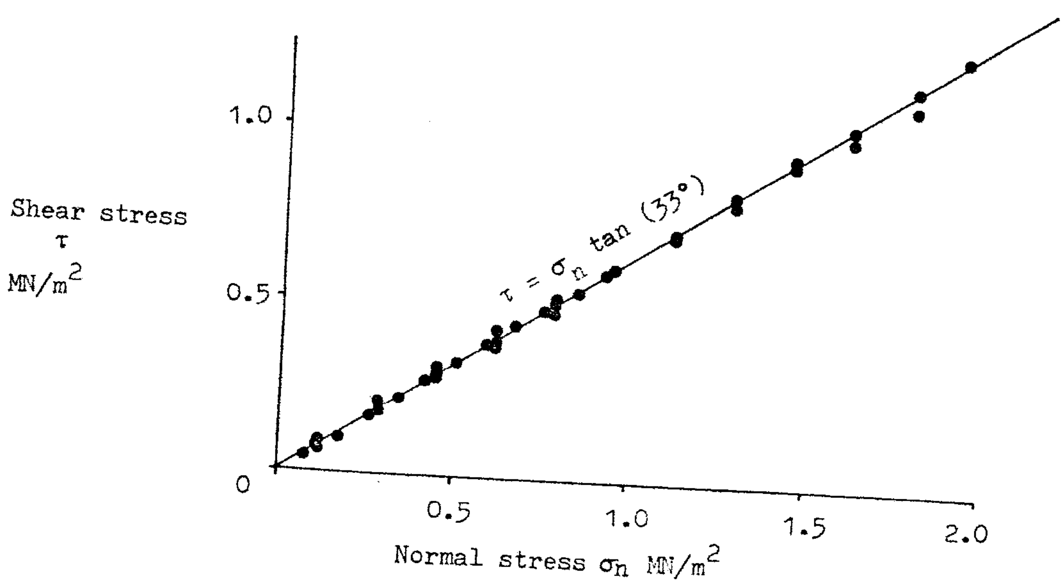


Figure 5.33 Shear stress versus Normal stress. Darleydale Sandstone sawcut and sandblasted samples.

(redrawn from Ross-Brown and Walton, (1975).

at 32 cm $\frac{S}{N}$ = tan β = tan 30°

and at 160 cm $\frac{S}{N}$ = tan β = tan 27°

i.e. at each stage in the wear process the shear strength is a linear function of normal load. Evidently the results cannot be explained by an equation of the type S = N tan ø + c where c is a constant at each stage of wear and ø a 'basic' angle of friction for Darleydale Standstone.

The factor resulting in the lowering of β with displacement must be a function of normal load at each stage of wear.

In chapter 2 it was shown that according to the adhesion theory of friction, the linear relationship between S and N is due to the true area of contact, Ac, being linearly dependant upon normal load so that frictional resistance may be represented by an equation of the form :

$$S = Ac.sc$$

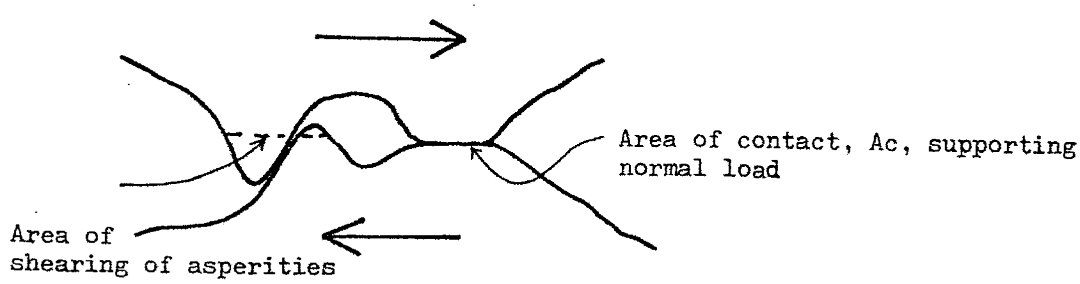
where Ac is a linear function of normal load

and sc is unit strength of bonding at contact points

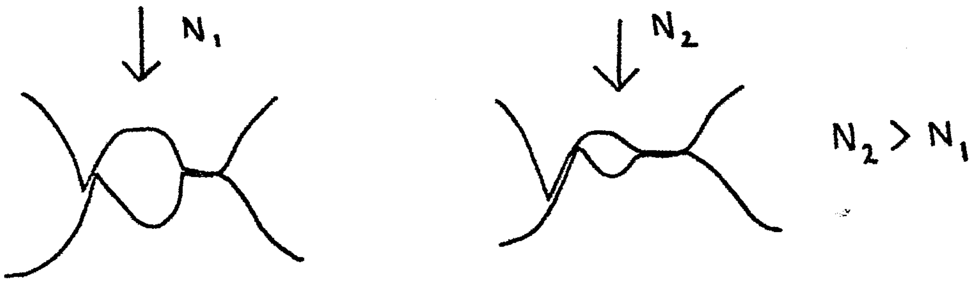
In the tests described above a great deal of wear was caused by shearing of interlocking asperities, and plucking of grains from the rock surfaces.

Therefore, the shear strength of these surfaces may be considered as a sum of two factors

1) adhesional strength at contact points
2) strength due to interlocking



It is the second factor that will decrease with displacement and cause the drop in angle of sliding. It is difficult to qualify this factor as the surface conditions are changing constantly during sliding. However, it is clear from the results given that interlocking increases with applied normal load as would be expected as surfaces deform.



Clearly if the factor due to adhesion does remain constant for a given normal load acting on surfaces at different stages of wear then the component of β representing this must be less than 12.5°, the lowest angle of sliding recorded for Darleydale Sandstone (section 5.6, figure 5.17).

Data obtained for blocks sliding in position 2 are plotted in figure 5.34 with peak values for position 1 sliding. The data indicates slightly lower angles of sliding for blocks in position 2, but there is insufficient data to allow any firm conclusion to be drawn.

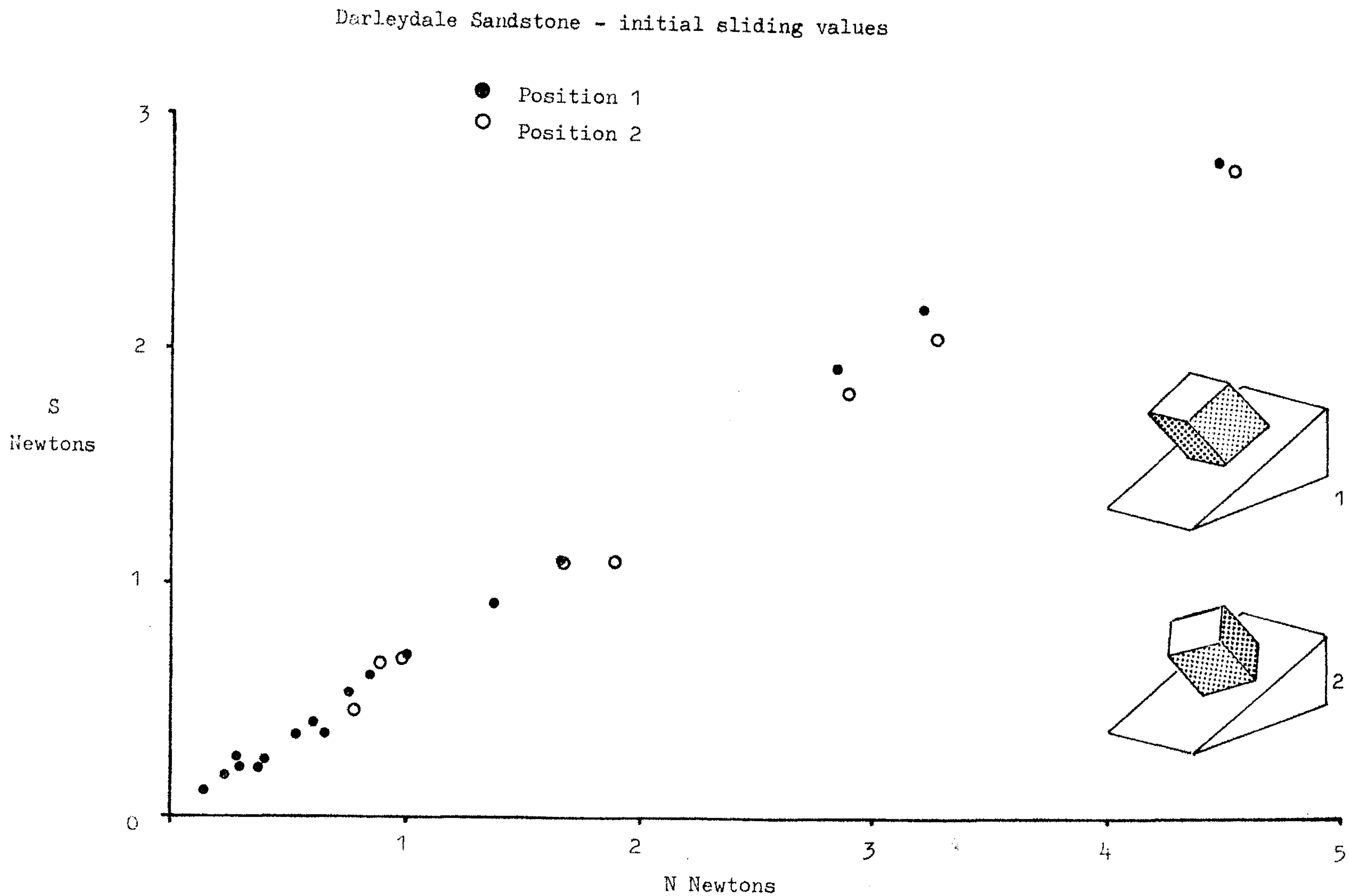


Figure 5.34 Shear load versus normal load components for blocks sliding in positions 1 and 2

Conclusions to Section 5.7

1) Using blocks of different sizes and weights as surcharges to ground sliders of Darleydale Sandstone, no relationship was found between geometry or weight of the top block and angle of sliding.

2) Data from all position 1 tests give a peak angle of sliding for ground Darleydale Sandstone of 33°. This angle agrees with that obtained from data of other workers. A residual angle of 27° is obtained for surfaces after 160 cm displacement.

3) The scatter in data is highest for lighter blocks, cohesive factors due to minor variations in surface finish being greater for these blocks. It is therefore, concluded that a steel block should be used in experiments on the effect of vibration on angles of sliding for rocks.

5.8 Conclusions to Chapter 5

1) Inclined plane sliding technique has been shown to be a very useful tool in the study of friction of both wood and rock.

2) The very large displacements possible using this technique have shown that rocks may show decreases in their angles of sliding of almost 200% with displacement.

3) Much lower residual angles of sliding are reached for surfaces with rock flour removed than for surfaces covered with rock flour for most rock types tested.

4) Geometry and mass of the upper block has been shown to effect the angle of sliding for wooden surfaces, i.e. for materials with a low Youngs modulus.

5) The area of wear of rock sliders on an inclined plane is dependant upon the distribution of contact stress as determined in Appendix 1.

6) Results for peak angles of sliding for ground surfaces of Darleydale Sandstone agree with values obtained by other workers using direct shear apparatus.