a support unit. It is particularly noticeable in timber that the force increases 7 per cent for every tenfold increase in the deformation rate. To illustrate this point, the force–deformation curves for two different loading rates are shown in Fig. 2 of the paper. For steel or hydraulic props, this effect is insignificant.

(2) If the analysis outlined in the paper had been undertaken with the full stroke reduced by 20 per cent, the amount of energy that the props could absorb would have been reduced by 20 per cent, but the calculations would still have illustrated the main point of the analysis, namely that *the props have a decreasing ability to absorb energy as stope closure acts on them*. It would also have shown that the support system will fail closer to the stope face.

(3), (4)
It is acknowledged that the specific geometry of the blocks that were assumed to make up the hanging-wall does not accurately simulate the well-known underground fracture patterns. However, the object of the analysis was to illustrate the trend that, with higher stope-closure rates, these stope-support systems become increasingly vulnerable to lower ground velocities. A different geometry could have been chosen, and it would have shown the same result. What Hodgson *et al.*[1] observed was just such an example, where the props were damaged because they were not able to absorb the energy associated with the ground velocity or rate of stope closure. In this regard, it is very unlikely that any support system, except perhaps backfill, would be able to control stope closure during ground velocities of 6 m/s, the velocity estimated by Hodgson to have acted on the hydraulic props installed in the stope that he was monitoring. Moreover, it should be pointed out that work sponsored by the mining industry and done by the Rock Engineering Division[2] has shown that 80 per cent of rockbursts are accompanied by closure rates of less than 3 m/s. The rapid-yield props currently in use in mines are normally able to respond to ground movements of only up to 2 m/s. Thus, the rock-engineering staff are at present working with manufacturers and the industry on the development of an improved rapid-yield hydraulic prop with the capability of closing at 3 m/s.

Conclusions of the paper

I believe that the conclusions of the paper are significant: the fact that normal stope closure is constantly decreasing the ability of the support system to do work if a rockburst occurs is surely of significance. This must lead to a careful consideration of the choice of support system in rockburst-prone stopes, and to the redesign of support units such as yielding timber props so that they have a larger yield range and, consequently, an increased ability to absorb energy. I would also encourage rock-engineering personnel to seek direct evidence of the failure of these support systems in the way described in the paper on their particular mines.

This paper was originally conceived as the result of underground observations over a considerable number of years in stopes supported by yielding timber props. It became obvious that, at high rates of stope closure, yielding-timber-prop support systems, such as profile props, would have a reduced ability to absorb rockburst energy compared with a similar situation in which the stope closure rates were lower. These ideas were certainly not formulated in the laboratory.

The paper used data obtained from underground measurements at various sites throughout the industry. The closure rates quoted, for example, were given a realistic upper limit. Similarly, the force–deformation behaviour of yielding timber props was determined underground for typical stope-closure rates.

The only laboratory-determined force–deformation curve was that determined for the force–deformation behaviour of profile props at a deformation rate of 1 m/s, and this was essentially a check on the force–deformation curves obtained underground and adjusted for the higher deformation rate of 1 m/s.

References
1. HODGSON, K., *et al.* Rapid-yielding hydraulic props as stope supports in deep gold mines. *Pap. Discuss. Assoc. Mine Mgrs S. Afr.*, 1972–1973. pp. 279–334.
2. JAGER, A.J. Chamber of Mines Research Organization, personal communication.

Book news

The following are available from Metal Bulletin Books Ltd, Park House, Park Terrace, Worcester Park, Surrey KT4 7HY, England.

● *World aluminium—a Metal Bulletin databook.* 2nd ed. 1990. £71.50 surface, £76.50 airmail.

This is a compendium of information listing salient details of companies mining bauxite and producing alumina, primary aluminium, secondary ingot, master alloys, and semi-fabricated products; aluminium trading companies; and a memoranda section listing associations, brand names, and other useful information. It is a user-friendly international reference book for aluminium buyers, traders, and producers.

● *Iron and steel works of the world.* 10th ed. 1991. £134.00 surface, £146.00 airmail.

For almost fifty years, thousands of companies have relied upon this directory as a databank on the world's iron and steel producers, re-rollers, tube makers, iron-powder producers, strip coaters, and makers of cold-rolled sections.

Corrigendum

The following error in the *Journal* has been notified: in the issue of May 1991 (p. 158), Mr Paul McKelvey received a Cullinan Design Award on behalf of New Concept Mining, and not New Consort Mining as printed.