matters arising

Nonradioactive silver

SIR,—Lindner *et al.*[1] described the detection of small amounts of radioactive silver isotopes (^{108m}Ag and ^{110m}Ag) in silver bars from an eastern European source. They suggested that the activity may have originated from any one of several causes: nuclear mining, that is, the breaking up of rock before the removal of the ore, using nuclear explosions; neutron irradiation of the ore after it was mined; the introduction of silver isotopes into the melted silver during processing; or irradiation of the silver bars.

Another possibility has been suggested by Boyle[2]. An intimate contact of silver, uranium and light elements such as boron, might produce, through (α, n) reactions, enough neutrons to give measurable events of ^{108m}Ag ^{110m}Ag. This phenomenon could occur in uranium deposits of the vein type, which are found in eastern Europe.

We have checked this speculation by counting specimens of silver ore collected from the Echo Bay Mine (near Port Radium), Great Bear Lake, Canada[3]. Ore samples from this vein-type uranium deposit included two pieces of massive native silver mined from uraninite-rich areas of the 302 Stope, and a third sample from an occurrence of pitchblende, 206A W Drift in the mine, containing veinlets of native silver. The first two samples were counted directly but in the latter case the silver was separated from the ore by dissolution in nitric acid. The silver was therefore in intimate contact with the pitchblende until a few hours before it was counted.

For counting, a 70 cm^3 Ge(Li) γ-ray detector and multichannel analyser were used. The sensitivity was 10 nCi, the same as that of the NaI(T1) detector used by the Dutch workers. Since we did not possess an anticoincidence array, we were compelled to count for several days in order to achieve this. In all three cases there was no measurable ^{108m}Ag or ^{110m}Ag in the samples. On the basis of the Dutch work, we would have expected to have detected as much as 3 μCi.

We conclude that, at least for our samples, uranium does not produce significant activity in the silver associated with it. In view of the calculated low neutron flux[2], this is not surprising. Our conclusion can probably be applied to similar ore bodies.

R. W. Boyle (personal communication) cannot find any reported nuclear detonations which correlate with the time of origin of the activity as calculated by the Dutch workers. We agree with their current view (personal communication) that the most likely source of the reported activity is the addition of silver tracer to the silver during some stage of the refining process.

Yours faithfully,

N. E. WHITEHEAD
B. W. ROBINSON

Institute of Nuclear Sciences,
Department of Scientific and Industrial Research,
Lower Hutt, New Zealand

1 Lindner, L., Brinkman, G. A., and Schimmel, A., *Nature*, **240**, 463 (1972).
2 Boyle, R. W., *Nature*, **243**, 460 (1973).
3 Robinson, B. W., thesis, Univ. Alberta (1971).

Great Glen Fault

SIR,—Detailed mapping of the regional metamorphic pattern of the central and northern Highlands has led to the conclusion that a post-metamorphic sinistral shift of 160 km must have occurred along the Great Glen Fault[1]. A reappraisal of the considered data suggests, however, that the proposed shift probably represents a minimum estimate; a displacement of 200 km would, for example, fit the data equally well but even this figure cannot be taken as a reasonable upper limit of possible strike-slip movement.

The most likely northward continuation of the Great Glen Fault is through the Walls Boundary Fault in Shetland[2]. This provides a slight curvature in the fault line which seems to have an important geophysical bearing on the displacement problem. Thus, it can be shown[3,4] that a certain discordance in Devonian palaeomagnetism across the Great Glen Fault can be fully explained by incorporating a late or post-Devonian sinistral shift of at least about 200 km. At present, palaeomagnetic results cannot be used to set an upper limit of the actual movement but a displacement of at least 250 km is possible. What is really important at this stage, however, is to stress that a geophysical and a geological method have both led to practically identical palaeogeographic reconstruction of Scotland, which involve a transcurrent movement, at least twice as large as previously suspected along the Great Glen Fault. Consideration of the lower age limit of this movement (provided by palaeomagnetic results) seems to indicate that the Strontian and Foyers granites (K/Ar ages of around 400 Myr, ref. 5) never formed part of the same intrusive complex.

Yours faithfully,

K. M. STORETVEDT

Department of Geophysics,
University of Bergen, Norway

1 Winchester, J. A., *Nature phys. Sci.*, **246**, 81 (1973).
2 Flinn, D., *Geol. J.*, **6**, 279 (1969).
3 Storetvedt, K. M., *Geol. Mag.*, **111**, 23 (1974).
4 Waage, H. L., and Storetvedt, K. M., *Z. Geophys.*, **39**, 937 (1973).
5 Miller, J. A., and Brown, P. E., *Geol. Mag.*, **102**, 106 (1965).

DR WINCHESTER replies: Storetvedt's comments are very welcome. The suggested displacement of 160 km was chosen as the optimum fit of the metamorphic patterns in the opposing blocks. A precise metamorphic zonal correlation across the fault is not possible because on opposite sides of the fault, Moinian rocks are concealed beneath Devonian sediments east of Inverness, and beneath Tertiary volcanics in Mull. The zonal pattern may therefore be extrapolated across these areas to fit a post-metamorphic displacement of between 140 and 200 km along the Great Glen Fault, before it becomes impossible to match without requiring an unjustified warping of the metamorphic pattern adjacent to the fault. A displacement of 250 km is therefore not supported by the metamorphic evidence. It is significant, however, that the maximum displacement allowed by the metamorphic pattern, and the minimum shift indicated by Storetvedt's palaeomagnetic work should agree so well.

University of Durham

McCollough colour after effect

SIR,—McCollough[1] demonstrated a striking, long lasting colour after effect. Observers adapted (2–4 min) to a vertical grating of black and orange stripes alternating with a horizontal grating of black and blue stripes. Thereafter a pattern made up of a black and white vertical grating and an adjacent horizontal grating appeared tinted with colours complementary to the adapting colours. The