corrections are applied, it is estimated that, of Van Valen's 82 survivorship curves for extinct taxa, only 12% are definitely linear. Evidently Van Valen cannot win. Either his results show linearity, which is held to be biologically without significance, or most do not, in which case his "law" breaks down.

Although it begins to look as though the Red Queen has been toppled from her throne, the criticism directed at Van Valen's work should not be held to detract from an original, perceptive and imaginative attempt to glean more from the fossil record than a more conventional approach would allow. It has been stimulating in the best sense and may yet lead to important new advances in our understanding of evolution. That it appeared in the first issue of an obscure journal with limited circulation lends support to the view that if a paper is sufficiently interesting it will be widely read, regardless of where it was published. □

Strong absorption in ^{40}Ca–^{40}Ca elastic scattering

from P. E. Hodgson

MANY studies of the elastic scattering of heavy ions have now been made, and it is usually found that the differential cross section has a diffraction structure that varies smoothly with the incident energy and is well described by the optical model.

A notable exception to this behaviour was found some years ago by Bromley *et al.* (*Phys. Rev. Lett.*, **19**, 369; 1967; *Phys. Rev. Lett.*, **20**, 175; 1968): the cross section for ^{16}O–^{16}O elastic scattering shows a very irregular behaviour as a function of incident energy. This is in marked contrast to the corresponding data for ^{18}O–^{18}O, which varies smoothly with energy as expected.

This early work, together with subsequent studies, showed that this notable difference in behaviour is determined by a balance between the strong absorption of the lower partial waves and the weaker absorption of the higher partial waves. For heavy ion collisions many features of classical behaviour remain, so that partial waves correspond to the interactions at different radial distances: the lower to interactions inside the nucleus and the outer to interactions in the nuclear surface and beyond. The scattering is thus determined by the absorbing part of the optical potential, and it was found that the observed behaviour could well be reproduced by allowing the strength of the absorption to depend on the orbital angular momentum quantum number L, being strong for small L and weak for large L.

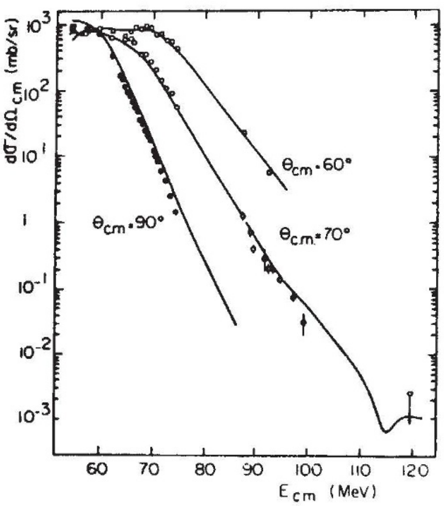
More physically, it was shown that the absorption is mainly due to the direct reactions strongly coupled to the entrance channel. When there are many of these, the nuclear surface is nearly opaque and one observes the small structureless cross section strongly decreasing with energy—behaviour typical of strong absorption. This is the case for ^{18}O–^{18}O, which has two neutrons outside the stable ^{16}O core that can be excited and transferred in many ways, leading to many possible reaction channels.

The situation is quite different for ^{16}O–^{16}O which is stable and difficult to excite and so absorbs weakly. Each partial wave makes its own particular contribution, giving the strongly-marked fluctuations in the cross section as a function of energy.

This explanation accounts for all the data in the oxygen region, but it is clearly desirable to confirm it by measurements on other nuclei. It is increasingly difficult to make measurements on heavier nuclei because the strong coulomb repulsion must be overcome before the nuclear interactions can take place, and this requires high incident energies.

The next lightest nucleus after ^{16}O that has a very stable doubly-closed shell structure is ^{40}Ca, and so it is desirable to make measurements of ^{40}Ca–^{40}Ca scattering. This has recently been done by Doubre *et al.* (*Phys. Rev. Lett.*, **35**, 508; 1975) at Orsay in France, and some of their results are shown in the figure.

It is notable that, contrary to expectation, the cross sections fall smoothly with increasing energy, so characteristic of strong absorption. An optical model calculation with an absorption increasing with energy agrees well with the experimental data. The physical explanation of this result is not clear. The explanation used in the oxygen region fails for calcium, and it may be that the density of states in the appropriate region of excitation is sufficiently high in the calcium case for the required absorption to occur. More measurements are in progress to provide data for a more comprehensive study of these effects. □



Differential cross section for ^{40}Ca–^{40}Ca elastic scattering at three angles as a function of energy and compared with optical model calculations.

Dominance and diversity

from Peter D. Moore

BY far the most frequently used index of diversity in studies of plant communities is that derived from Shannon and Weaver's information theory, in which,

$$H' = \Sigma p_i \ln p_i,$$

where p_i is the proportion of the total number of individuals (or biomass) belonging to the ith species. This index is a function of both species richness and evenness (the apportionment of individuals or biomass amongst species). The feature of plant communities to which the index responds most effectively is the presence of one or more dominant species. This results both from the consequential inequitable arrangement of biomass or numbers in the community and from the reduction in species number which often accompanies the assertion of dominance by certain members of the community. When one speaks, therefore, of high diversity in plant communities, one is often in fact referring to a lack of dominance.

Because of this it is unwise to assume that diversity changes as a consequence of a particular management practice, such as the abandonment of arable land, or the disturbance of equilibrium communities, can be easily predicted. Such unpredictability is a feature which has been demonstrated in two recent pieces of work in the United States concerned with precisely these situations. Tramer (*Ecology*, **56**, 905; 1975) has studied selected plots on abandoned agricultural land in Ohio over a period of four years and has attempted to document changes in plant species diversity. Numerically based diversity was highest in the second year after abandonment and subsequently fell to a lower level, while biomass-based diversity declined steadily over the four year period. This