difficult to obtain a good direction from very old sediments because of their age, it can be equally difficult to obtain a good direction from very young sediments because of their extreme youth. The problem is that the most recent sediments are still unconsolidated and thus subject to erosion, slumping and many other processes likely to distort whatever magnetisation they may already have acquired. Moreover, the 175 1-m cores taken from the top of the sediment in Lake Geneva by Creer *et al.* (*Earth planet, Sci. Lett.*, **28**, 127; 1975) were also disturbed during handling and kept in storage for more than a year before any palaeomagnetic measurements were made on them. It is thus all the more surprising that no less than 39 of these cores gave "satisfactory and interpretable" declination-depth curves. Comparison of these results with the historic–archaeomagnetic declination curve has enabled Creer and his colleagues to estimate the sedimentation rate and its variation in Lake Geneva over the past 400 yr.

By contrast, Thompson's (*Geophys. J.*, **43**, 847; 1975) measurements of magnetic declination in lake sediments have been concerned with a much longer time scale. Cores from Lake Windermere, Blelham Tarn and Ennerdale Lake in NW England and from Lough Neagh in Northern Ireland show that an oscillation in declination (about true north) with a period of about 2,700 yr has been occurring for at least the past 10,000 yr. Such oscillations are probably due to a combination of dipole wobble, drifting non-dipole sources and stationary intensity-varying non-dipole centres—which presumably explains why declination-time curves from Britain, Switzerland, the Aegean Sea and the Black Sea are difficult to correlate. However, as long as the core magnetisation is stable and at least one horizon is dated absolutely or cross-correlated, recent NW European sediments may be dated against the British declination mastercurve.

Thompson's sediments were all normally magnetised, of course; it is necessary to go back a few more thousand years to the most recent (short) reversal. Not that the reversal pattern is yet perfectly clear, even for the past few million years. For example, the Olduvai normal event within the Matuyama reversed epoch was originally dated at ~ 1.9 Myr and the subsequently discoverd Gilsa event in the same epoch was dated at about 1.6 Myr. In short, there appeared to be two separate events—a view supported by an early report suggesting that the Gilsa type section in Iceland included two normal flows possibly separated by a reversed one.

Unfortunately, it has since become clear that the original Olduvai date may not be accurate; indeed, the wide limits now placed on it are such as to throw doubt on the whole existence of two separate events. This doubt has now been reinforced by Watkins *et al.* (*Earth planet. Sci. Lett.*, **27**, 436; 1975) who have re-examined the Gilsa section and find that although there are two normal flows there is no reversed flow between them. Thus only one normal event is definitely represented (at 1.58 ± 0.08 Myr); and the question of whether the Gilsa and Olduvai events are identical or distinct remains open.

Returning now to the almost single (normal) polarity of the Brunhes epoch, Watkins and Richardson (*Geophys. J.*, **43**, 501; 1975) have been looking again at the contrast in palaeomagnetic data between the northern and southern hemispheres. Second-order differences between hemispheres were first discovered by Wilson (*Geophys. J.*, **19**, 417; 1970 and **22**, 491; 1971) who concluded that during the Upper Cainozoic the axial dipole was displaced along the rotational axis

Orchids adapting

from Peter D. Moore

One cannot help admiring the way certain species of plant and animal have exploited to their own advantage situations created by man. Even the most ugly and destructive activities have provided opportunities for those species with a sufficiently wide range of tolerance or the capacity to evolve such a tolerance. As a result urban environments have become populated by species such as the starling whose cliff and tree nesting and roosting habits, coupled with the capacity to feed in short turf, have provided it with a competitive opportunity. Among plants, the rose bay willow herb (*Chamaenerion angustifolium*) is a particularly successful invader of demolition sites, arriving as wind borne seeds and propagating vegetatively once established by means of stolons which give rise to erect stems. It is intolerant of shade and its natural habitat is open scree slopes. This is one of the many weed species which has survived in open localities since the close of the last glaciation and has spread extensively as man has provided it with new opportunities.

The mining of heavy metals and the tipping of spoil has created habitats which are toxic and inhospitable to most plant species, but some appear capable of evolving tolerance to such conditions and expand their populations as a result. For example, the bladder campion (*Silene vulgaris*), another periglacial species turned weed, has developed races tolerant of high zinc concentrations and able to invade mine spoil (Gries, *Flora, Jena*, **156**, 271; 1966). A similar process has been observed operating in a number of species, particularly grasses, in the British Isles (Bradshaw *et al.* in *Ecology and the Industrial Society*, edit. by Goodman, G. T., Edwards, R. W., and Lambert, J. M., 327, Blackwell, Oxford; 1965).

Orchids are not normally regarded as a group of plants exhibiting heavy metal tolerance, but some recent observations by Richards and Swan (*Watsonia*, **11**, 1; 1976) in Northumberland in the north of England have altered this. They have found the narrow-lipped helleborine (*Epipactis leptochila*) growing on eleven sites, 180 miles north of the nearest previously recorded station. All the sites consisted of bare, open river gravels and most of them contained very high levels of zinc (up to 2,300 p.p.m. air-dry soil), and had a neutral *p*H.

The characteristic habitat of *Epipactis leptochila* is beneath beech canopies on chalk and limestone in southern Britain. The plants in Northumberland could be derived from some previously undiscovered, relict population, or they could have invaded directly from the south of England. Richards and Swan consider it possible that the species has been in the area for 80 yr or more, having re-examined older, less critical identifications, but the origin of the species in the area remains uncertain. What is of greater importance and interest is the development of tolerance to zinc and its resultant success in polluted gravels where mining activities have occurred. At such sites the general vegetation is sparse due to toxicity, hence there is little competition from other herbaceous species, which is one character these northern sites have in common with the southern habitat of *Epipactis leptochila*.

As Bradshaw *et al.* have shown, not all plant species possess the ability to adapt to soils polluted with toxic metals, but evidently *Epipactis leptochila* does, and the Northumberland populations must have been subjected to considerable selective pressure for zinc tolerance. Like the starling and the rose bay willow herb, this is a species with latent talents that is now proving its worth by exploiting habitats made derelict and inhospitable by man. □