

magnetic disturbance, and winds up to 500 m/s were measured at a latitude where the Earth's rotational speed is only 170 m/s. Such winds are presumably caused by acceleration of the neutral air by the auroral electrojet, a mechanism which could contribute to the super-rotation, as suggested by Cole (*Planet. Space. Sci.*, **19**, 59; 1971).

If progress is proportional to the number of theoretical

studies, the revolutionary behaviour of the upper atmosphere should soon be understood. Detailed observational results from vapour trails may continue to be rather sparse, not only because of the expense, but also possibly because people may begin to wonder whether the pollution of the upper atmosphere by metal atoms is as harmless as the experts say.

Reverse Transcriptase in Human Milk Virus

At the end of February, Moore and his collaborators in Camden, New Jersey, Detroit and Bombay electrified the worlds of tumour virology and cancer research with their report of the detection in human milks of virus particles virtually identical in structure to mouse mammary tumour viruses (see *Nature*, **229**, 593; 1971). The occurrence of these particles in the milks of a small sample of American women was found to be highly correlated with familial histories of breast cancer. And so it now seems highly likely—although it will be very difficult to prove rigorously—that human breast cancer is at bottom a virus disease, the course of which in any particular woman is strongly influenced by her sex hormone status. This belief receives support from the experiments of Schlom, Spiegelman and Moore reported on page 97 of this issue of *Nature*.

Collaborating with the Camden, Detroit and Bombay teams, Schlom and colleagues have quickly done what was perhaps the most obvious next step towards characterizing the putative human mammary tumour virus; they have assayed milks for RNA dependent DNA polymerase activity, reverse transcriptase, and correlated the presence or absence of this enzyme with the presence or absence of the virus particles. They have come up with the predictable result; of the thirteen milks they tested, only four were found to have this activity and only these four milks, as the Camden group found, contain detectable amounts of human mammary tumour virus. Furthermore, the reverse transcriptase activity is uniquely associated with particles which sediment on centrifugation in density gradients at a density of 1.17 to 1.19 g per ml., the density of the virus particles. In other words, the correlation between the presence of the virus and the presence of this enzymatic activity, which has now been found in every sort of tumour

virus which has been assayed, twenty-seven types in all, is perfect in this small sample.

No doubt because this is precisely the result anticipated by everybody, Schlom *et al.* took great pains to obtain unambiguous data. They have, for example, used the original assay system for reverse transcriptase devised by Temin and Mizutani, which involves treating the samples with a non-ionic detergent to disrupt intact virus and then allowing the reverse transcriptase to use the endogenous RNA as template. In these conditions DNA synthesis depends on a supply of the four deoxyribonucleotide triphosphates and it is inhibited by ribonuclease. As Schlom and colleagues point out, they refrained from using synthetic double-stranded RNAs or synthetic RNA/DNA hybrids as template, for, even though these molecules are more efficient templates than viral RNA, they are less specific. Enzymes other than reverse transcriptase can use them to make DNA. The possibility that the activity detected in the four milks arises from contaminating mycoplasma has also been carefully ruled out. Samples of pure human and animal mycoplasmas do not contain reverse transcriptase detectable in the assay used.

Clearly the presence of reverse transcriptase in these human milk virus particles does not prove that they are oncogenic; that will depend on collecting a variety of circumstantial evidence. But the fact remains that these particles are under the gravest suspicion and it is up to the tumour virologists to assemble a totally incriminating case. If they can prove that the human milk viruses are serologically related to murine mammary tumour viruses, that they induce mammary tumours in animals and transform at least some cells *in vitro*, and that the correlation between the presence of the virus in milk and the

risk to breast cancer holds true of large samples of women, few will be left doubting the assertion that breast cancer is a virus disease.

GEOMAGNETIC REVERSALS

Matuyam Reassessed

from our Geomagnetism Correspondent

It has been evident for some time that although the principal features of the geomagnetic polarity-time scale are well established the finer details are likely to prove troublesome. Part of the reason for this is, of course, that potassium-argon dating—like any other experimental technique—has a limited resolution, which means that the shorter magnetic "events" within the longer and well defined "epochs" are difficult to define precisely. This point is particularly relevant in the light of Cox's theoretical prediction (*J. Geophys. Res.*, **73**, 3247; 1968) that during the past 10 million years, at least, there have been numerous short events with durations less than 0.05 million years. But even longer events are not easy to tie down.

One particular part of the polarity-time scale covering the past four million years or so which has recently proved to be a source of controversy is that in the vicinity of the Olduvai and Gilså polarity events within the Matuyama reversed epoch—that is, the period between approximately 1.6 and 2.1 million years ago. The confusion inherent in this part of the scale is well illustrated by reference to a single author. Three years ago, in a version of the reversal-time scale derived only from dated continental rocks, Cox *et al.* showed (*Quart. J. Geol. Soc. Lond.*, **124**, 53; 1968) the Gilså event lasting from 1.6 to 1.65 million years and the Olduvai event from 1.88 to 2.0 million years. In a more recent version, however, modified in the light of data from deep sea sediment cores and ocean magnetic profiles Cox showed (*Science*, **163**, 237; 1969) each event to be split—1.61 to 1.63 and 1.64 to 1.79 million years for the Gilså and 1.95 to 1.98 and 2.11 to 2.13 for the Olduvai. Moreover, in the second article Cox identified the large event in this region, the only event