100 YEARS AGO

Another of those disastrous hurricanes which occasionally visit the West Indies and United States at this season of the year has to be recorded. On the 8th Inst. a storm of great violence struck the coasts of Louisiana and Texas, and, owing to the thickly populated districts over which it swept and to the high water wave which accompanied it, immense destruction to property and lamentable loss of life ensued. The fury of the storm is said to have been felt for at least a hundred miles inland, but up to the present time scarcely any details have arrived as to its character and the exact path that it followed. This part of America is one of the three regions referred to in the works of Prof. W. M. Davis from which tropical storms move into temperate latitudes in the northern hemisphere; but we must wait for further details before it can be stated whether the one in question was of the nature of a tornado, which differs from an ordinary hurricane chiefly in its excessive violence over a small, instead of a large, area. From the description so far given, and from its duration, the storm would appear to have been of the nature of the worst West India hurricanes.

From *Nature* 13 September 1900.

50 YEARS AGO

Publication of the Report of the Royal Commission on Population has been followed by a series of papers, and the fifth volume… contains an important contribution on "The Economic Position of the Family"… The authors of this paper, after discussing the various ways in which parents meet the extra cost of bringing up children, by comparing their expenditure with that of childless couples having the same income, conclude, first, that at all income-levels parents have to make considerable economic sacrifices to maintain their children, and, secondly, that children in large families have a lower standard of living than children in smaller families… It would seem that, despite the large increase of prices and incomes, the actual money cost of a child to its parents, at a low working-class level of income, is substantially unchanged as compared with the pre-war figure. The burden of two children, which at this income-level was about a third of a childless couple's income, has now fallen to one-sixth. The raising of the school-leaving age, however, has meant that the burden lasts a year longer.

From *Nature* 16 September 1950.

(annealing), does not seem to work well, even under high pressure. But replacing oxygen ions is not the only way to introduce holes into high-T_c compounds. For example, because yttrium ions (Y^{3+}) and calcium ions (Ca^{2+}) are almost identical in size, it is possible to introduce holes into YBCO by replacing some of the Y^{3+} by Ca^{2+}.

Now imagine that you could balance the number of holes lost at the grain boundary through oxygen depletion with holes from an appropriate number of Ca^{2+} ions substituted for Y^{3+} in the same region. You might be able to 'repair' the weak link with a low-resistance — and hopefully superconducting — bridge. This is what Hammerl *et al.* have done. Their first attempt[8] at this approach led to the grains themselves, as well as the boundaries, receiving the same amount of Ca^{2+}, so the former became 'overdoped' (too many holes) and T_c dropped from 91 K to 77 K. Not so impressive if you want to use liquid nitrogen for a coolant, because a superconductor needs to be well below its transition temperature to carry a useful amount of current. In their latest work, Hammerl *et al.*[1] have grown a calcium-doped YBCO film over an undoped one, and found that some of the Ca^{2+} appears to migrate into the grain boundaries, partially 'healing' them. This improves superconducting current flow between grains three- to sixfold, without degrading current flow within grains or adversely reducing T_c. The authors suggest that their result could have profound consequences for future developments of high-T_c technology. I agree.

Present high-T_c wires — or more precisely, tapes — are based on lead-stabilized $Bi_2Sr_2Ca_2Cu_3O_x$ (BSCCO) drawn into a series of long, fine filaments enclosed in silver[9]. It is now possible to produce kilometre lengths of such tape that carry supercurrents in excess of 100 amperes (A) at 77 K. The main barrier to wider use of this 'first generation' technology is cost (principally of the silver). The price-to-performance ratio of superconducting wire is measured in US dollars per unit of supercurrent per unit of length. For example, the performance of Nb_3Sn, used in many high-field laboratory research magnets, is about \$5–6 $kA^{-1}\,m^{-1}$, and NbTi, the mainstay of MRI and particle-collider magnets, is roughly \$0.90 $kA^{-1}\,m^{-1}$. For comparison, several companies offer BSCCO tape at \$300 $kA^{-1}\,m^{-1}$, with estimates that this figure may drop to \$50 $kA^{-1}\,m^{-1}$ with mass production. But this is still too high. Fortunately, a second-generation technology is being developed, and the findings of Hammerl *et al.* may mean that much cheaper alternatives are not far off.

This second-generation technology is based on 'coated conductors' — films of

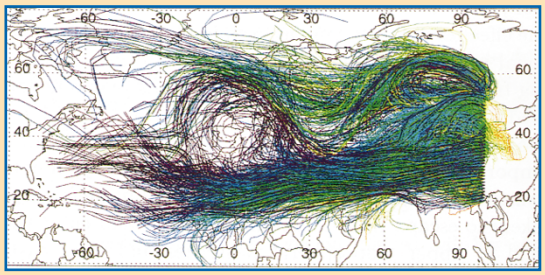
Atmospheric physics

Sky-high Asian imports

The Tragedy of the Commons has long been seen to apply to air pollution. Many nations freely dispose of their emissions, but others — downwind, and maybe far away — will be most affected by the consequences.

In this context, the paths of emissions from Asia across the Pacific Ocean, and their potential effects on air quality in the United States, have been well investigated. Reginald Newell and Mathew Evans of the Massachusetts Institute of Technology have taken a different perspective, as they report in *Geophysical Research Letters* (**16,** 2509–2512; 2000). They have investigated the question of how much pollution reaches Asia from sources elsewhere.

Newell and Evans set up particles along an imaginary wall, extending meridionally from north of Bangkok to Siberia. Data on wind strengths and directions allowed them to reconstruct the particles' possible routes through the atmosphere. The picture here shows the resulting 'spaghetti plot', with each line representing a path that would have taken an air parcel, starting at an altitude of 2.5 km or more, to the imaginary wall within five days.



A detailed analysis of the complete data set reveals that in January and February, 30–40% of the air that arrives at longitude 100° E has passed over Europe. Considering European emission levels, and the tendency of winter storms to swirl pollution up through the atmosphere, European air up to a height of about 10 km is likely to be far from pristine. So, in winter, Europe may contribute significantly to Asian pollution.

So much for the dynamics. At this point, the researchers hand over to the atmospheric chemists, who will have to measure the composition of the atmosphere above Asia to confirm or disprove the point. **Heike Langenberg**