

Letter from . . . Chicago

Unification by catastrophe

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A dramatic painting of Naples during the plague, shown at last year's exhibition of mediaeval masters in London, depicts the heaps of corpses piled up in the city square, while the frightened people scurry to and fro and the Turkish slaves, wearing masks to avoid the contagion, are busily carrying away the dead. We learn that Naples, then the second largest city in Europe, lost more than half of its population—as indeed did most of the rest of Europe. All of this is relevant as our civilisation stands threatened by nuclear or chemical annihilation—and adds interest to LeRoy Ladurie's account of how in the middle ages the plague of the Black Death "achieved the unification of the globe by disease" by wiping out millions of people through a massive Hiroshima like operation.¹

In his book Professor Ladurie, an eminent modern French historian, describes how before the Black Death the stable conditions prevailing in Europe since the eleventh century had allowed an unprecedented growth of the population. By 1348, the first year of the Black Death, France had 17 to 20 million and England about four. Up to that time wars had been local affairs of relatively little importance, but with the establishment of larger kingdoms they changed their character, becoming prolonged, international, and pathogenic. Even small armies could cause much damage, and we read how 8000 troops in Richelieu's time were responsible for the death from plague of over one million people. In the Hundred Years' War the Black Death reduced the population of France to under ten million within a century. The rest of Europe was likewise depopulated, and for the next three centuries, till 1720, continuing epidemics, with their attending famine and economic devastation, helped to maintain the population at its 1348 level.

For bringing the plague into Europe Ladurie blames the Mongol hordes who, in the thirteenth century, established a "Eurasian short circuit" as, in the words of Gibbon, they "spread their cruel devastations and transient empire from the sea of China to the confines of Egypt and Germany." The Genoese completed the job, firstly, by bringing the plague from Asia along with their silken wares in their galleys, and later by sending Columbus to further the "unification" of the New World through wiping out whole populations by plague, smallpox, dysentery, and measles. In Europe, however, the population was endowed with much greater natural resistance. Already once before, during the seventh century, the plague bacillus had reached Europe via the Mediterranean but had been unable to set up what Ladurie calls a successful ménage à trois, or a quâtre, as the case may be, with flea, rat, and man.

Two main theories are invoked to account for the explosive march of the Black Death across the continent of Europe: the British "rat school" and the French "flea school." The former emphasises the role of the black rat, *Rattus Rattus*, a timid

fighter and a bad swimmer who was able, though, to spread the disease once most towns reached a minimum required population of some 5000 people. The flea school, by contrast, emphasises the role of the flea in an overcrowded and impoverished population at a time when bad hygiene was the rule and nit-picking a common and potentially fatal practice. The flea, incidentally, was repelled by olive oil and by the smell of horses and male goats, hence the prophylactic value of keeping such animals in the house. But whether one follows the rat or the flea school, conditions at the beginning of the fourteenth century were clearly favourable to the creation of a "common market of disease," giving rise to the "particularly intense, rapid, dramatic, or even apocalyptic phase of 1300-1600." Even the climate was propitious, allowing the bubonic plague to rage during the summer and the pneumonic form in the winter. And it was in Provence, in the winter of 1348, that the pneumonic plague sprang fully armed from the Genoan vessels, writes LeRoy Ladurie. In our time, he points out, despite the occasional cholera or influenza epidemic, the concerns have shifted from microbes to chemicals, pesticides, and pollutants. And lately we note how clouds of gases have also been effecting a "unification" of some sorts by travelling thousands of miles from their origin before descending on their victims in the form of acid rain.

Acid rain

First described in the 1960s, acid rain has a pH of 4 to 5 and arises when the sulphur and nitrogen oxides released from the ground are converted into sulphuric and nitric acids. Though often associated with industrialisation, it has also been described in Colorado at 2900 m, in Hawaii, in the remote islands of the Pacific and Indian Oceans, and over the North Pole. Its origin is often difficult to trace because the gases travel through the atmosphere at an altitude of several kilometres. Some acid precipitation seems to have taken place since time immemorial, originating from forest fires, volcanoes, or decaying organic matter, and being largely neutralised by the alkaline oceans (pH 7.5-8, and by many of the large rivers. Yet much acid rain seems to be related to the migration of industrial products, and as each year billions of tons of pollutants go up into the atmosphere they must eventually come down. Thus acid rain at the North Pole seems to come from North America, Europe, and Siberia as the air moves northwards during the winter. Likewise the acid derived from burning coal in the Ohio River Valley is blamed for sterilising the lakes in New York and Canada; emissions coming from Britain seem to be killing the salmon in Norway; and "alarming" acid levels in Sweden, Japan, and the northern and western United States are killing the algae, the fish, and the frogs. In Canada the government has estimated that within 20 years the fish in 48 000 lakes will be exterminated unless something is done. Already thousands of lakes in eastern Canada, the United States, and southern Norway have been sterilised, as have 18 000 of Sweden's 90 000 lakes. Acid rain

has eliminated the salmon from the rivers of Nova Scotia. It destroys crops, corrodes metals, dissolves building materials, damages forests, and may cause lung disease. One of its variants, acid fog, formed when pollutants fail to rise high up into the air but instead mix with the water vapour, has a pH of 3 and could be as devastating as the famous London fogs of former years. According to a Canadian parliamentary study, acid precipitation constitutes the greatest environmental threat to Canada in its 114 years as a nation. It has certainly clouded the relations between Canada and its southern neighbour.

One problem seems to be that the phenomenon is not fully understood. As with the rat and flea schools, there are two main points of view, one emphasising natural causes, the other emissions from burning coal. Environmentalists have focused on industrial pollutants, but because the gases may travel thousands of miles it is not always clear who is causing the pollution and who should be paying for cleaning the air. The Canadians, heavily dependent on fish and forests and tourism, want immediate controls on emissions of sulphur and nitrogen. The United States, less dependent on fishing and tourism, but responsible for seven times as much pollutants, would find more controls quite expensive in these difficult economic times, given that it has already spent billions of dollars, much more so than Canada, to control sulphur dioxide and other emissions. We find then the Canadians possessed by a feeling of urgency, wanting immediate action, and getting upset about the recent environmental budget cuts in the United States, while the Reagan administration wants to study the problem some more and is delaying action, despite a congressional study suggesting that as many as 51 000 people may have died in 1980 from illnesses caused by sulphur pollution. Late in 1982 a coalition of 10 environmentalist organisations protested at the "gutting of conservation enforcement and slashing of funds for environmental research" by "an administration committed to a systematic weakening of pollution controls to suit the polluters, and to handing over publicly owned resources to private interests." But the government dismissed the report as election year politics, and its environmental chief indicated that more research was required and that recent studies have cast doubt on the notion that the burning of coal in the mid-west is the chief source of the acid rain that pollutes the waters of the north east and Canada. In a like vein an editorial in the *Wall Street Journal* (7 September 1982) pointed out that dead lakes are not new, having been described as long ago as 1930, that anyway the acidity in New York State has not increased since 1965, and that some Swedish scientists now think that the acid could just as well originate from lightning, thunderstorms, and cold fronts as from English power plants. Some of the acidity responsible for the death of Canadian and north eastern lakes could come from the soil rather than the air through a process of soil formation that has been going on since the last ice age. "Acid rain, in a sense, has existed for thousands of years" concluded the editorial, warning that the ways of nature are complex and "should give pause to anyone who wants to commit \$300 billion in hard earned economic resources to try to alter these processes."

More decisive was the administration's stand on another form of rain, the yellow variety. This is also achieving some degree of "unification" by being used indiscriminately in Afghanistan, Laos, and Cambodia. After Mr Haig's initial complaint in 1981, the State Department followed through with another report indicating that toxic concentrations of the tricothene toxin T₂ had been found in supposed victims in south east Asia. Further investigations proceeded slowly because of the enormous difficulties in gathering conclusive evidence. But the press later announced that in addition to the mycotoxin, which causes haematemesis, melaena, skin and nervous system manifestations, investigators have also found polyethylene glycol, a substance that does not occur free in nature. Further reports also indicate the use of a knockout agent and of possibly other substances, including one that causes the skin to turn blue black after death and the body to decompose very quickly. In November the State Department produced a further report, claiming that nearly

10 000 people have died from chemical sprays and presenting as evidence a gas mask with its headpiece still contaminated with the fungal toxin believed to be the active ingredient of yellow rain.

Elsewhere the American evidence has generally been dismissed as propaganda. This attitude has been likened by some to the initial reaction to the news about the Nazi gas chambers. It's like "Laughing at Guernica," commented the *Wall Street Journal*, pointing out that the Red Cross was unwilling to get involved, the French and German governments eschewed the issue for political reasons, and the United Nations was too timid or ineffective to find the answer. But a Canadian investigation has also concluded that chemical or biological agents are being used in south east Asia; and in December even the United Nations voted to establish a "flexible, objective, and non-discriminating procedure" to ensure compliance with international treaties and verify complaints of violations.

But while the issue of yellow rain remains unresolved, some 95 000 veterans are complaining about damage from Agent Orange, which contains small quantities of dioxin and was used in the Vietnam war as a defoliant. Side effects claimed by the veterans include not only the more common acneiform rash but also cancer, liver and kidney involvement, impaired hearing and vision, fatigue, numbness, reduced sexual drive and impotence, miscarriages in their wives, and birth defects in their children. Yet none of these claims are proved and, as the long term effects of the compound remain unknown, congress in 1979 ordered the Veterans Administration to look into this problem. Little progress was made, however, and recently, in response to complaints, the study was turned over to the Center for Disease Control in Atlanta. In November a group of angry veterans came to Washington complaining that the answers have been too slow in coming, especially since the government has refused to pay benefits unless a direct link between exposure to the agent and symptoms was found. Nor is much known about another defoliant, Agent White or piclorane, used not only in Vietnam but also in the United States on farms, power plants, railroads, highways, and forests. Complaints originating mainly from the south blame this agent for a rising incidence of cancer, to some 60% above the national average. But as this issue also requires further study, one is left with the uncomfortable feeling that in the long run the white, yellow, orange, and acid rains will truly unify the universe by wiping out not only man and his cat, but also the rat, the flea, and all the interesting germs.

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¹ Ladurie E LeR. *The mind and method of the historian*. Chicago: University of Chicago Press, 1981.

When was chlorination of drinking water introduced in the United Kingdom?

The traditional measures for purifying a water supply are storage and filtration. Modern requirements for a bacterially pure water supply have resulted in the use of chlorine as a disinfectant. Bleaching powder was first used in 1897 to disinfect the Maidstone supply because a typhoid fever outbreak had occurred, and this method was repeated in Lincoln in 1905.¹ Bleaching powder was widely used to sterilise water supplies for the army in the field during several campaigns. After the first world war several water undertakings introduced sterilisation, using chlorine gas on a voluntary basis when a sufficient level of bacterial purity was not obtainable with storage and filtration. It was not until the outbreak of the second world war, however, that chlorination of water supplies was generally adopted. The government was concerned about the risk of water borne epidemics resulting from damage to the distribution systems from aerial bombardment or the contamination of reservoirs by the addition of pathogenic bacteria by the enemy. Since 1939 chlorination of all public water supplies has been obligatory.—ANDREW B SEMPLE, emeritus professor of community and environmental health, Liverpool.

¹ Roberts L, Shaw CH. *A synopsis of hygiene*. Edinburgh: Churchill Ltd, 1966:445.