

Geological Survey

SIR — With regard to your succinct appraisal of the Natural Environmental Research Council (NERC) and, more particularly, of the British Geological Survey (BGS) and the problems of its basic mapping programme (11 October, p.499), it is important to realize two things. First, the geological survey of the country is a fundamental need. It forms the starting point both of countless "academic" researches and of even more investigations with a practical purpose — geotechnical, resource-seeking, planning or whatever. It should be supported on a stable basis, irrespective of short-term advantages or requirements, and should certainly not be at the mercy of a change of government, as it was when the "Rothschild principle" was brought in in 1973.

Second, it needs long-term support because it is never finished. Ideas and needs are both constantly changing. An area that was mapped, even to the highest standards, 40 or 50 years ago may need doing again, because progress in geology will result in things being found which were previously unremarked, and because new kinds of information must be gathered to meet new demands. Hence there must be regular revision and long-term planning.

You quote a BGS figure of "at least 25 per cent" of the maps as obsolete. This appears to represent maps not available at all plus those listed as provisional editions, that is, based on very old mapping. It is a gross underestimate. Many sheets, not classed as provisional, are based on mapping in the early years of this century, at the latest. To take an example at random, Sheet 266, listed in 1983 as published 1974 (in fact the date when it was transferred from the old one-inch to the 1:50,000 scale), was surveyed 1888–95, partially revised 1923–24. The oldest work on it is now 96 years old. Many other sheets have a similar history.

When we consider the accompanying sheet memoirs the situation is scandalous. They are essential because, obviously, not all the information gathered by the surveyors can be shown on the map. Yet the list of June 1983 shows only 60 memoirs as available, that is for about 22 per cent of the available maps. Even adding the 50 memoirs said in your article to be in preparation only raises this figure to about 40 per cent. The survey's inability to get its memoirs written and published is legendary. Some of those that can be bought were published only several decades after field work was completed.

There should be, urgently, public discussion of the survey's long-term plans, and a programme drawn up which will allow real progress, that is, maps and memoirs being produced faster than they are becoming obsolete. Funds for this must be earmarked and must not be at risk from the numerous other activities of the survey. Then, an organization needs to be devised

which will get work completed and published in reasonable time. Many of the missing memoirs were in people's heads. They just never got written.

The Geological Survey's 150th anniversary will occur in 1985. It could receive no better birthday present than an assured and planned future.

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Unfair to SERC

SIR — *Nature* has a reputation for sharp but informed criticism of the activities of the UK research councils. However, your leading article of 4 October (p.397) was doubly unfair. After discussing the "inflexibility" of the research councils you criticize the Science and Engineering Research Council for taking on burdens of "strategic" research and then refer disparagingly to funds earmarked for "trendy" subjects: you cannot have it both ways. In my experience, it is the refusal of the research councils to follow every "fashionable" topic that leads to accusations of "inflexibility". These accusations often come from people who think their own line of research is being starved — anything else, particularly long-term studies that need continuity, is to them "inflexibility".

Scientists who have the fortune to work in certain organizations will know that it is perfectly possible to combine "strategic" research and flexibility. A long-term series can be continued, but at the same time the scientists involved can alter the course of part of their studies in response to results of their own and their colleagues' researches. It can be bad for a scientist to pursue the same narrow line all the time, but equally bad to take up "trendy" subjects for the sake of newness.

The situation we face now is not unique. Arguments about the relative values of short-term contracts, once called "industrial" research, compared with open-ended "spontaneous" research have raged for at least a hundred years. In my own discipline, as long ago as 1920, in an unpublished but influential report, Sir Ray Lankester pointed out the incalculable advantages of "spontaneous" research in which the solution of one problem leads to the formulation of more problems to investigate, problems that were not apparent at the start of the programme. Everyone will have examples from his or her own discipline. This sort of research is now condemned by critics who favour short-term contracts. Many of these short-term contracts fall into the "trendy" category, others are "safe" topics thought up by committees: what major scientific advances have accrued since the inception of the short-term "customer-contractor" principle for government-financed research?

Nature should avoid this sort of general attack on British research and come out more in favour of "spontaneous" research as the *fons et origo* of scientific advance.

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Carbon dioxide

SIR — In her article in *Nature* (4 October, p.401), Anna Lubinska erroneously assumes that carbon dioxide is a harmless gas, whereas it is in fact corrosive. Millions of tons of the gas enter the atmosphere every day in the products of combustion from fossil fuels such as coal, oil products, natural gas and other sources.

The carbon dioxide dissolves in rain water to form corrosive carbonic acid that falls on soil, streams and lakes, but also on calcareous materials such as limestone rocks, concrete products and marble. The acid dissolves these materials to form soluble calcium bicarbonate. Copper and bronze are attacked to form cupric carbonate — commonly called verdigris.

The other chemicals listed occur at levels which are infinitesimal compared with the quantity of carbon dioxide in the products of combustion of petrol. The modified list reads:

	grams per mile
Hydrocarbons	0.41
Carbon monoxide	3.4
Nitrogen oxides	1.0
Carbon dioxide	320.0

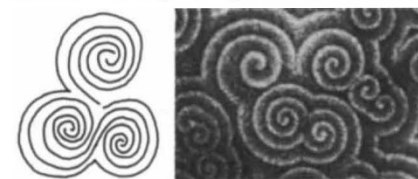
The quantity of carbon dioxide is increased by 5.3 grams when the carbon monoxide is rapidly oxidized in the atmosphere.

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Chemical waves

SIR — It cannot have escaped the attention of some of your readers that the photographic representations of spiral chemical waves (*Nature* 18 October, pp.611–615) bear an uncanny resemblance to the prehistoric carvings of spirals on stones. In



Spiral carving, Newgrange passage grave, Co. Meath, Ireland (right) and a monolayer of slime mould cells (left)?

spite of numerous studies, these ancient carvings have so far defied interpretation. Is it conceivable that our ancestors understood chemical waves?

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