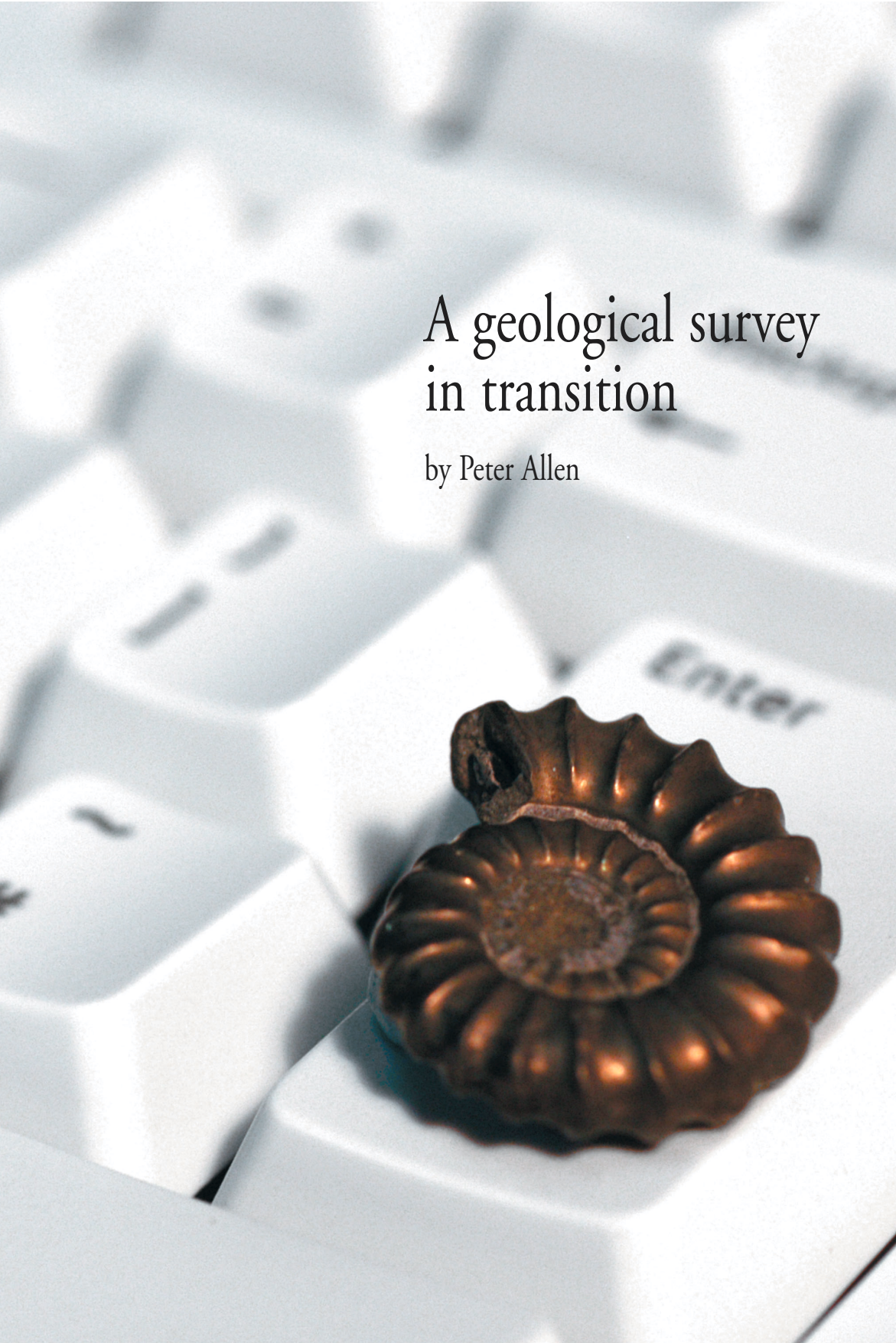
A geological survey in transition

by Peter Allen



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British Geological Survey 2003

BRITISH GEOLOGICAL SURVEY

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The British Geological Survey carries out the geological survey of Great Britain and Northern Ireland (the latter is an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as its basic research projects. It also undertakes programmes of British technical aid in geology in developing countries as arranged by the Department for International Development and other agencies.

The British Geological Survey is a component body of the Natural Environment Research Council.

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Preface

This book is Peter Allen's account of the events that affected the role, status, organisation and management of the British Geological Survey during the latter part of the twentieth century. The author is particularly well qualified to write this account. He joined the Survey (then the Institute of Geological Sciences) in 1967. After a period working overseas he transferred to the Land Survey in 1970 and was based in the Leeds Office. His interest in the way the Survey was run soon found expression in trades-union activity. He was active within the Leeds Subsection of the Institution of Professional Civil Servants during the 1970s and was chairman of the IGS Section of IPCS between 1978 and 1981. In 1978, when the transfer of staff to the new headquarters at Keyworth was already under way, he took part in a Staff Side initiative that led to the establishment of a working party to identify and assess the scientific and organisational considerations for and against the centralisation of IGS staff in England and Wales. As a result of this, district offices were opened in Aberystwyth and Newcastle and the Joint Official/Staff Side Committee on Keyworth (JOSCK), which oversaw the move, was established. In 1985 he was secretary to the Survey's first Strategic Plan Working Party. His first management position was Programme Manager for the Lower Palaeozoic, Southern Uplands and Lake District, which he took up in 1984 when he was based in Newcastle. Following this, after a short period in charge of the South-western England Programme, based in Exeter, he became an Assistant Director in 1987 and served on the Directorate until he retired at the end of June 2000.

Peter started this book during his last weeks of service and completed it during his retirement. To a certain extent it is a personal story, reflecting his own experiences and viewpoint, but it is well researched and provides an authoritative account of the period. Nearly all of the events described have been in the public record for some time, but much of the background information and analysis is published here for the first time. In gathering this information the author has been allowed access to confidential BGS papers as well as documents that are in the public domain. Throughout, he sought documentary evidence to support his analysis rather than rely on his memory.

The book covers a time of transition for all public services in the UK; a time of change in the perception of how a public-service organisation should be run; a time when the public services were forced to become increasingly commercial in their outlook, with a concomitant change in the nature of their customer base; a

time of stringency in public-sector budgets; and, not least, a time of revolution in information technology.

The British Geological Survey shares some experiences in common with other parts of the public sector during this time, but in other respects it is unique. This book, therefore, is a case history of a public body undergoing change. It will be read by those interested in the recent history of the BGS, but it should also attract a wider readership among students of the history of geological surveys, public administration and the management of science in government. The book provides insights into how one public body has responded to changes in the political, social and technological environment within which it exists. Many of the ideas for change came from outside the BGS; others were internally stimulated. Not all were well conceived and the book covers in detail the way in which the Survey resisted and, ultimately, defeated some of the worst of them. The reader may find it heartening to learn that so many of the least appropriate proposals were eventually defeated, but may also be more than a little dismayed at the enormous expenditure of time, effort and money required to achieve this end, all of which could have been better spent carrying out the geoscientific research for which the BGS exists.

I am indebted to Peter for providing this invaluable record for us.

David A Falvey, PhD
Executive Director

Foreword

There are five histories of the British Geological Survey (BGS) currently available. The first was written by Sir John Smith Flett, *The first hundred years of the Geological Survey of Great Britain*. It was a memorial volume to celebrate the centenary of the Survey and contained a full and systematic account of its growth and development. In 1952, Sir Edward Battersby Bailey published the *Geological Survey of Great Britain*. In the preface he says that he wrote it originally for the British Council, to appear in their series *Science in Britain*, but the series was discontinued so he published it as a book rather than waste the effort he had put into it. He also covers the period since the Survey was founded in 1835, but he put more emphasis on scientific progress than did Flett. Harry Wilson wrote another full account, *Down to Earth*, bringing the history up to the sesquicentennial year, 1985. Two other accounts have been published as BGS technical reports covering only recent history. Peter Cook, on his retirement at the end of 1997, published his review of the period he was Director, *A history of the British Geological Survey 1990–1997*. Finally, in 1999, Dennis Hackett, who had been the BGS Secretary since the mid-1980s, compiled *Our corporate history*. *Key events affecting the British Geological Survey, 1967–1998*, which contained brief summaries of major events since the formation of the research councils in 1965, including a detailed commentary on the development of the Survey at its site at Keyworth.

I planned this book to carry on from where Harry Wilson finished. My original aim was to concentrate on the period from 1985, which is where he ended, to 2000, which was when I retired. Much of what happened in that time, however, was influenced by earlier events. Reference to them, often in some detail, is unavoidable. Thus, though the end date is fixed at the year 2000, the start date for this history is variable.

It must always be a temptation to regard one's own time in an organisation as being the most exciting in its history and I admit sometimes to succumbing to that thought. In fact, it was this that stimulated me to write the account in the first place. The British Geological Survey is an instrument of Government, though a very small part of it, and its fortunes wax and wane according to policies of Government as interpreted by the Natural Environment Research Council (NERC), which has been the Survey's parent body since 1965. When Peter Cook came to the end of his directorship at the end of 1997, he calculated that the BGS had been subjected to a major review at the rate of one every two years since 1985 and pleaded with the

NERC Science and Management Audit team in 1997 to recommend a period of calm. I strongly sympathised with his plea. Because of my involvement in the development of the 1985 Strategic Plan I was in a central position among BGS senior management even before I became an Assistant Director in 1987, and looking back on the fifteen-year period now, it seems that the whole of it was in turmoil. It was full of reviews, management reorganisations, funding crises, periods of bullishness in NERC HQ, demands to adapt and adjust to something new from Government and, hanging like a black cloud over all of this from 1988 to 1997, was the threat of privatisation. Throughout, the BGS seemed to be set in a responsive mode. Much of the energy expended by BGS management during this period was used up fighting external threats and reacting to external demands; too little to the job of managing the organisation. But there is no doubt that, despite the odds, this was a very vigorous and creative period, which has left the Survey now a totally different organisation from the one that celebrated its sesquicentenary in 1985.

This book is laid out thematically, with a chronological overprint. I have concentrated on the major events, usually those surrounding the reviews to which Peter Cook referred. My purpose has been to look at these outside influences to see how they affected the BGS and how the Survey reacted to them. In this respect, this book is quite different from the other histories of the BGS. I have paid little attention to the science or the structure of the work programme or the Survey's achievements during this period. These could lead to a major study in its own right. My justification for missing these out is that they were not the central theme of the book I wanted to write. Besides, there are good summaries of all the Survey's scientific achievements in its annual reports.

Throughout the book, I have tried to remain true to the factual evidence at my disposal, but it is unavoidable that in places I have offered interpretations or made judgmental comments. Where this has happened, the responsibility for them is mine alone. This is particularly true of the analysis I have presented in the final chapter. My source material has primarily been from the official files for the period, but I have been able to use the personal files I kept through the turbulent period 1985 to 1988. I have also referred to various published sources, such as the BGS and NERC annual reports, the NERC corporate plans, the BGS business plans (which were internal documents, not available outside BGS) and a number of brochures, pamphlets, the BGS office notices and NERC notices. A list of sources is presented in Appendix 3.

The British Geological Survey came into existence under that name in January 1984. From 1965 until then it had been called the Institute of Geological Sciences. In order to avoid confusion, I have, as far as possible, tried to avoid using the name Institute of Geological Sciences, preferring to use British Geological Survey or the BGS or simply the Survey, even when referring to the organisation prior to 1984.

I have written this book in the third person, but in places, where I have recounted events in which I was intimately involved, I found it difficult to sustain without making the text clumsy and I have slipped into the first person.

Many people have helped me. I have had lengthy conversations with Innes Lumsden and Geoff Larminie, both past Directors. Dennis Hackett and Tony Reedman have read and commented on the whole book. Doug Fettes and Ian Jackson have read and commented on parts of it. It was edited by Henry Haslam, who also made useful comments about the content. David Gray, an Assistant Director in the early period, also provided information. In addition many current members of staff sought out information for me. Among these, Graham McKenna, the chief librarian, has been very helpful, often finding things that other mortals have forgotten about. To everyone, I am extremely grateful. I am most grateful to the current Executive Director, David Falvey, for allowing me unconstrained access to all relevant official files and for giving permission to publish this book.

Peter Allen
August 2001

Notes on the British Geological Survey

The British Geological Survey is the sole national body responsible for the acquisition, interpretation, management and dissemination of geoscientific data relating to Great Britain and the surrounding continental shelf. This is done primarily through nationwide geological, geochemical, hydrogeological and geophysical surveys and monitoring, a programme of underpinning research and development and the publication of maps and descriptive accounts. In addition, the BGS carries out commissioned geoscientific research in the UK and overseas on behalf of Government, other public bodies and the private sector. The BGS manages and maintains the national geoscientific archive of maps, documents, rocks, fossils and borehole core and samples. Much data are in digital form.

The British Geological Survey has been a component body of the Natural Environment Research Council (NERC) since 1965.

Between 1965 and 1983, the Survey was known as the Institute of Geological Sciences. In 1984 the name was changed to the British Geological Survey.

The headquarters of the Survey formally moved from London to Keyworth, near Nottingham, in 1985. Staff from several London offices and Leeds were transferred there during the period 1976 to 1989. In 1990 the Keyworth site was named the Kingsley Dunham Centre, in honour of the first Director of the Institute of Geological Sciences. Other offices are in Edinburgh (regional office) and Wallingford, where hydrogeological staff share premises with the NERC's Institute of Hydrology. There are small offices in Exeter and Belfast; one member of staff is retained in Cardiff and a London Information Office with sales outlet maintained in The Natural History Museum.

Staff grades and titles in the Survey

The organisational structure of the British Geological Survey and the responsibilities of senior staff between 1980 and 2000 are shown in Figures 2 to 10.

Until 1985, the Survey was headed by a Director at Grade 3 level. There was a Deputy Director at Grade 4 (between 1982 and 1984 there were two Deputy Directors). In 1985 the post of Deputy Director was abolished and the Director became Grade 4 (See Appendix 2).

There were between nine (1980) and five (2000) Assistant Directors (ADs), each heading a Division or Directorate. They were at Grade 5 level (later called Band 2). Together with the Director, Deputy Director(s) and BGS Secretary (head

of administration), the ADs formed the Directorate, the governing body of the Survey (See Appendix 2).

Each Division (or Directorate) was composed of a number of Units, later known as Groups or Programmes. Most were headed by Senior Principal Scientific Officers (SPSO, later termed Grade 6 and now Band 3), though some were headed by more junior grades. The SPSOs in charge of units in the Land Survey (whose main work was systematic geological mapping) were known as District Geologists (DGs).

The career grade for a scientist was Principal Scientific Officer (PSO; Grade 7; Band 4). Below this level were Senior Scientific Officers (SSO; Band 5), Higher Scientific Officers (HSO; Band 6), Scientific Officers (SO; Band 7) and Assistant Scientific Officers (ASO; Band 8). There were equivalent grades for non-scientists.

Individual Merit Promotion (IMP; formerly Special Merit Promotion) enabled particularly successful scientists to be promoted to SPSO (Grade 6; Band 3) or higher and continue with scientific work, without the managerial responsibility normally associated with their grade.

Chapter 1

The first hundred and fifty years

It is not the purpose of this book to go over the ground covered in the histories published by Flett, Bailey and Wilson, mentioned in the Foreword, but when an organisation is over a hundred and sixty five years old it is impossible to describe what happened in the last fifteen to twenty without some reference to what had gone before. The process of change that has been so vigorous in the last three decades is part of a continuum that began long ago and can only be viewed properly in the context of past events. The published histories have generally concentrated on the work of the Survey and, although there was some reference to the external pressures on its management and the political framework within which it operated, these were not central themes and little analysis was offered. It is useful, then, before embarking on the detail of the last fifteen to twenty years, to pick out some of the events and drivers that influenced the way the Survey was able to develop in the early and middle stages of its history.

There is no single, defining event that marks the origin of the British Geological Survey, though the process that ultimately led to its foundation probably began with the geological surveys, described by Harry Wilson, which had been initiated by the Board of Ordnance in Scotland and Ireland in the years that preceded the contract let to Henry De la Beche in 1832 to add geological information to the topographical map of Devonshire. De la Beche had been making a geological map of the county, funding it himself, for some years, but the failure of his income from his estate in Jamaica led him to ask the Ordnance Trigonometrical Survey of Great Britain for a sum of £300 to complete this work. Three years later, when De la Beche had completed the map of Devon, he proposed to embark on mapping Cornwall. The Board of Ordnance took him on as a salaried employee with the aim, eventually, of making a decision about carrying out a geological survey of the whole of the country. It is this year, 1835, which is usually regarded as the founding date of the Geological Survey, not 1832, or 1845 when the Geological Survey became independent of the Ordnance Survey by Act of Parliament, the Geological Survey Act of 1845.

The British Geological Survey is generally credited with being the first national geological survey in the world. There is no surprise here. The Geological Survey is a direct product of the Industrial Revolution and the extraordinary intellectual vigour that characterised Great Britain at that time. Geology itself was a newly independent science, and Charles Lyell's book, *Principles of geology*, which was the first attempt to define the basis for the science, was

published only in the period 1831 to 1833. Equally important for the Geological Survey was the publication of the geological map of England and Wales by William Smith in 1815. This most remarkable map, at the scale of five miles to the inch, took him twenty-four years to make and bears a striking resemblance to its modern equivalent.

William Smith, who is usually described as the 'father of stratigraphy', had a life-long interest in geology, which he applied to his work as a canal builder. Smith observed that different layers of sedimentary rock contained different fossils, and from this was able to determine the relative ages of the different layers. Maps showing the distribution of different types of rock had been produced since antiquity — indeed a map showing the rocks in the area around a gold mine exists from ancient Egypt — but William Smith's map was the first truly modern geological map, in which the relative ages of the strata were reliably shown, as well as differences in rock type and their structural relationships with each other. William Smith's discovery provided geology with a predictive tool that revolutionised the way in which the science was conducted. It enabled a geologist, by making observations and measurements at one field locality, to make a reasonably good attempt at predicting where else it may be possible to find that same rock. The improvement in the quality of geological maps that followed this was immeasurable and turned them into documents of real utility.

The invention of this type of geological map was timely. The Industrial Revolution was creating a demand for huge quantities of the Earth's resources. At the end of the eighteenth century Great Britain had the biggest and most diverse mining industry in the world, with a massive production of copper, lead, zinc, tin and iron, and substantial outputs of a wide variety of other metals and minerals. The demand for all manner of building materials was insatiable and there were thousands of small stone quarries providing building stone. Geological knowledge was required for building canals and roads, for locating sources of groundwater in areas where the supply of surface water was poor and for finding fertiliser and conditioners for the improvement of the soil to increase the supply of food for the growing population. William Smith himself, in *A Memoir to the Map and Delineation of the Strata of England and Wales with a part of Scotland*, which accompanied his 1815 map, had listed the diverse uses for the information provided on a geological map in a way that is recognisable and applicable today. When Henry De la Beche made his application to the Treasury for funds to make a geological map of Great Britain at the scale of one inch to one mile he met little opposition.

De la Beche was both a practical man and a visionary. As Paul J McCartney described in his book, *Henry De la Beche: observations on an observer*, he understood not only the utility of geological maps, but also that it was necessary to educate the public about them and train people in geology so that they could take their expertise to their work in mines, canal building and elsewhere, and also that it was essential for Government to keep records in relation to the largely unregulated mining industry. Thus, in addition to the Geological Survey, he

created the School of Mines, the Mining Records Office and the Museum of Practical Geology. All came under his direction, but by 1872 the links with the School of Mines (now the Royal School of Mines at Imperial College) had been severed. The Mining Records Office was transferred to the Home Office in 1883. Almost exactly a century later, in 1985, the Museum of Practical Geology was transferred from the Geological Survey to the British Museum of Natural History. The progressive narrowing of the remit of the Survey from De la Beche's ideal continued in other ways. In 1905 the Geological Survey lost its responsibility for surveying in Ireland. The impact of this was virtually to end all geological mapping in Ulster in the period 1923 to 1947. When geological surveying was resumed it was carried out by the Geological Survey under contract to the Northern Ireland Government. This position has remained unchanged. Thus, in Northern Ireland, as in the Isle of Man and the Channel Isles, the Geological Survey does not have a remit to work without making special provisions.

The first home for the Geological Survey was with the Commissioners of Woods, Forests, Land Revenues, Works and Buildings. In 1854 it was transferred to the Department of Science and Art, which was in the Board of Trade. Later in that decade it was moved to the Education Department of the Privy Council. It was at this point that the Director of the Survey ceased to have direct access to a Minister of State. This is a situation that has prevailed ever since and has been a cause for complaint by many Directors, though the lack of a direct link to a Minister and the consequent absence of ministerial protection for the Director have, at times, been beneficial. In 1900, staff discontent with their treatment by the Director, Sir Archibald Geikie, was so intense that they managed to raise the matter in Parliament. An enquiry into the whole period of Geikie's tenure followed.

This was the first external enquiry into the working of the Geological Survey, and its impact was considerable. The enquiry committee was chaired by J L Wharton, MP and consisted of W T Blanford, a former Director of the Geological Survey of India, and Charles Lapworth. Its findings led to wide-ranging reforms in the management of the Survey and probably forced the retirement of its Director the next year. One of the most significant outcomes was the establishment of a Consultative Committee on the Geological Survey to oversee the activities of the Survey. This was later called the Committee of Advice and it remained active until 1919. This insertion of a buffer between the Director and ministers, though it did offer the staff some protection from poor management, was a further distancing of the Director of the Geological Survey from the seat of power.

Quite early in his career as Director of the Geological Survey, De la Beche was pressed to make a statement about when the survey was going to be completed. In the end he answered by saying, cleverly, that it would be completed when the topographical survey finished. The question, however, was a reflection of the *laissez-faire* attitude of Governments of the period, which were reluctant sometimes to provide the funds that De la Beche and his successors needed. The speed of the survey, remarkable though it was, slowed when, in the 1860s, the

Ordnance Survey began to publish topographical maps at the scale of six inches to the mile. These immediately became the favoured maps for field recording among the geologists, a situation that remains to this day though now the scale is 1:10 000. The survey was planned to be systematic, starting in the south of England and moving north, but a new direction was provided for it in 1871. This was the year that the *Report of the Commissioners appointed to inquire into the several matters relating to Coal in the United Kingdom*, usually referred to as the Royal Coal Commission, was presented to the Houses of Parliament. The Government of the day was concerned about the possibility of exhausting the coal resources of the country. The Commission looked into several matters, but one of them was critically important to the Geological Survey. This was the investigation into the possibility of finding coal at depth beneath the Permian and Triassic rocks and in south-east England. The report concluded that there was a strong possibility of finding concealed coal in many places, but not in south-east England. This conclusion, in identifying the strategic importance of coal, forced the Geological Survey to prioritise its mapping, rather than pursue a systematic survey. Something similar happened in 1919 when the Coal Conservation Committee reported.

In 1919 the Geological Survey was moved into the Department of Scientific and Industrial Research (DISR), partly on the recommendation of the Coal Conservation Committee, which had reported that year. The Committee had been tasked to deal with concerns about the supply of coal, the most important of all strategic minerals, during the First World War. It had been severely critical of the poor quality of geological maps of the coalfields. By then, all of England and Wales had been surveyed at one inch or six inches to one mile, often using the large-scale maps for field recording but working at the small-scale resolution. A programme of resurveying areas in more detail was under way. The Survey reacted to the Coal Conservation Committee's criticism by concentrating its efforts on the coalfields in preference to other areas. This prioritisation within the mapping programme was to remain for nearly half a century. It delayed the completion of the systematic resurvey of England and Wales that had begun; it left many parts of the country, particularly the upland and fen areas, with nothing better than the one-inch geological maps produced in the middle of the nineteenth century and it delayed the completion of the primary survey in Scotland. When a major programme of resurvey began in 1990, there were some substantial areas which had not been mapped by Survey geologists for one and a half centuries and some areas that had never been mapped at all.

The Survey remained in DSIR until the latter was disbanded in 1965. Each of the component bodies of the DSIR was overseen by a Board. The Survey came under the Geological Survey Board. Made up of eminent academics and representatives from industry and Government, this was a powerful body. It had the authority to redirect the work programme, which it did on more than one occasion, but it also had influence within the DSIR, which seemed to compensate for the lack of a direct ministerial link in the previous organisational

arrangements. One example of the benefit the Geological Survey Board brought is in relation to the publication of the report of the Coal Conservation Committee in 1919, which required the Survey to intensify its mapping in the coalfields. The Survey was able to undertake this task because the Board prevailed upon the DSIR to increase its budget to enable it to recruit more staff.

The next change in the administration of the Geological Survey came as a result of the Trend Committee, set up in 1962 to look into the working of the DSIR. In the *Report of the Committee of Enquiry into the organisation of Civil Science* (Cmnd 2171, published in 1963) it was concluded that DSIR should be disbanded and its components reformed within research councils. The Science and Technology Act of 1965 led to the creation of the Natural Environment Research Council (NERC) by Royal Charter. The Geological Survey of Great Britain was transferred into it. At the same time as this was happening, a committee under Sir Frederick Brundrett (*Report of the Committee on Technical Assistance for Overseas Geology and Mining*, Cmnd 2353) was considering the future of the Directorate of Overseas Geological Surveys, then a part of the Department of Technical Co-operation. The committee's conclusion was that the Overseas Geological Surveys should be combined with the Atomic Energy Division of the Geological Survey of Great Britain and incorporated into the GSGB. The newly combined organisation was placed into the NERC and called the Institute of Geological Sciences.

There were enormous consequences of this change. Before 1965, the main purpose of the Geological Survey of Great Britain had been to make geological maps of the country and publish descriptive accounts to accompany them. To carry this out, the Survey mainly employed geologists for field mapping, together with a few palaeontologists, petrologists (specialists in the chemistry and mineral composition of rocks) and other specialists to support them. Specialists in hydrogeology had been added when the Survey took on responsibilities for groundwater.

Within the Institute of Geological Sciences, geological surveying of the UK landmass became reduced to less than half of the remit of the new body immediately it was formed. Soon after, as a wide range of new activities was taken on, it was reduced further to become, eventually, a minor activity in terms of the staff time devoted to it. The field units within the Geological Survey of Great Britain became collectively known, informally, as the Land Survey within the Institute of Geological Sciences. It continued with the work of its predecessor, somewhat isolated within the Institute. The most important impact of this change, however, was that instead of having a single, easily defined, purpose, like the Geological Survey of Great Britain, the new Institute of Geological Sciences had a multiplicity of purposes, the limits to which were never clearly defined. This left the door open for the immense amount of experimentation within the process of change that was to be undertaken in the decades that followed, giving the BGS freedoms that were not available to most other geological surveys when they had to face similar pressures to adapt to a free-market economy.

The conversion of the mapping-orientated Geological Survey to the broadly based Institute of Geological Sciences was an implicit recognition that Government and the public now required something more from the Survey than a geological map of the UK landmass. The geological survey of the continental shelf and massive programmes to assess the national asset of building materials and industrial and metalliferous minerals, which began just before the creation of the IGS and expanded afterwards, are some of the ways in which the survey remit expanded. In parallel, there were programmes of research into the chemistry and physics of rocks that led to increasing sophistication of laboratory and other facilities. Most of these new facilities were brought into the IGS from the Overseas Geological Surveys, where the approach to geological mapping was quite different to that in the Geological Survey of Great Britain. Working overseas, where large areas had to be mapped quickly, staff in the OGS had learned to use air photography, geochemistry and geophysics to help them. They were equipped to find the ages of rocks using radioactive isotopes, and their chemical analytical facilities were used to support mineral exploration. The Geological Survey of Great Britain, on the other hand, was a traditional field-based organisation, which used none of these techniques. After the merger, something was to be learned by each from the other, but the biggest impact was made by the OGS, whose broad, open and innovative approach to geological surveying was such a contrast to the conservatism of the Land Survey.

There were other consequences of the creation of the Institute of Geological Sciences. One was that by 1967 all staff in the merged organisation had ceased to be civil servants. Working for a research council, they now formed a new class of non-ministerial Government employees, though their employment conditions remained the same as those of civil servants. This is not as trivial as it may seem. The Survey was now firmly placed on the margins of the public sector, whereas once it had been within the mainstream of Government.

More serious was the loss of the Survey's legal identity. The Geological Survey Act of 1845, an enabling act that had facilitated geological surveying for one hundred and twenty years, had been amended and subsumed by the Science and Technology Act, 1965. All the provisions in the Geological Survey Act and the various other, later Acts of Parliament that related to the Geological Survey had been transferred to the Natural Environment Research Council. This meant that the Institute of Geological Sciences became an instrument of the NERC, which, in theory at least, had the potential to reorganise, disband or dispose of the Survey in any way that it saw fit. The 1965 Act itself described the function of the NERC as, among other things, to carry out research in the earth sciences, disseminate knowledge in the earth sciences and provide advice on it. The Charter of the research council was no more specific in this respect. It was left to NERC Council itself to decide whether or not the work programme being carried out in the bodies that came together to form the Institute of Geological Sciences constituted research and was of a type that it wanted to support. Council also could decide whether or not it needed component, self-managing institutes to carry out

its research. Some other research councils did not operate this way. The supplemental charter of December 1993 does not differ from the original in this respect.

The Geological Survey Board was disbanded with the DSIR, and there was no intention to replace it with something similar within the NERC. From 1965 the IGS was overseen by the Geology and Geophysics Advisory Committee of the NERC. The purpose of this and the four similar committees covering other science disciplines in the NERC was to help the new Council develop its research programme. The Geology and Geophysics Advisory Committee's remit embraced both the work programme of the IGS and the research that the NERC would fund in the universities. The committee's members were mostly external academics and representatives of industry and Government departments. They made no significant amendment to the work of the Survey. By 1970, the advisory committees' job was done and they were all disbanded. The NERC then introduced a dual committee structure of Preparatory Groups and Advisory Committees to replace it.

The Preparatory Groups (or Prep Groups), of which there were five, were committees of Council and consisted of Council members and officials. Their purpose was to act as intermediaries between Council and both the universities and institutes on matters relating to policy. They were also to investigate policy issues before they went to full Council. Prep Groups were the parents to the Visiting Groups, which were set up to audit the workings of the institutes. In establishing the Prep Groups in this manner, the NERC internalised the process by which it defined and implemented policy in a way that had never before been practised, in either the DSIR or its predecessors.

The second element in this dual arrangement was the Advisory Committee. The one formed for the Institute of Geological Sciences was modelled on the Geological Survey Board, in terms of composition, consisting of members from industry, Government and academia. This committee advised on the work programme and provided links with the external community, but there was no link between the Advisory Committee and Council either through the Prep Group or in any other way. This effectively isolated and emasculated the Advisory Committee, which gradually withered away. Most BGS staff were not even aware that it existed.

Even though the Geological Survey had been a semi-independent body for one hundred and twenty years, overseen by a non-executive board for over sixty of them, the sudden and decisive loss of its identity in 1965 was not immediately felt. At first, the new research council had to work hard to justify its existence. The Institute of Geological Sciences, being the largest component of the NERC by a long way, was important to the NERC. The Director, Kingsley Dunham, worked together with the Secretary to NERC Council, Mr Ray Beverton, to enlarge and diversify the work programme. Staff numbers steadily grew, and more than doubled in the first ten years. By 1979, however, these good times were over.

Indications of the direction that change was likely to take after 1979 had already come with the publication, in 1971, of Lord Rothschild's report, *The Organisation and Management of Government Research and Development* (Cmnd 4814). This report made radical proposals for the funding of civil science, requiring the transfer of significant sums of Science Budget from research institutes to customer departments (see Chapter 4).

The Science Budget, sometimes called the Science Vote, is the allocation of funds made by Government directly to its research organisations. After 1965, the Institute of Geological Sciences received its share of the Science Budget through the NERC. The funds came as a general grant with no instructions from Central Government on the detail of how it was to be spent. Overall direction on spending was provided by the research councils' Royal Charter. Lord Rothschild believed that there should be more accountability in the way the Science Budget was spent. Thus, he proposed transferring some of it from the research councils to Government departments for them to spend, initially, with the research councils on research that met their specific needs. As a direct consequence of this, the research councils would receive less Science Budget than they needed to pay for all their staff, laboratory facilities and the research that they sponsored. The gap would have to be filled by the research councils winning commissions for research from Government departments and elsewhere.

By 1976, when the transfer of funding that was recommended by Lord Rothschild had taken place, the proportion of the Survey's income that came from the Science Budget had fallen from nearly 100% to 25%. Nearly all the rest came from a small number of very large commissions from Government departments, which now dominated the work of the Survey. The full impact of this new arrangement, however, did not begin to be felt until the policies introduced by the Conservative Government elected in 1979 began to bite. With new ideas for managing the economy and new attitudes to public spending and state ownership, the policies of this Government were to make life uncomfortable for the British Geological Survey for the next eighteen years.

In 1980 the senior management structure of the NERC was changed. The power and authority of the post of Chairman of NERC Council was increased by changing it from part time to full time. In addition, Dr John Bowman replaced Mr Beverton, who had been Secretary to Council since it was founded. The new NERC Chairman and Secretary, reacting positively to the new direction provided by Government, began to question some of the old certainties. The first challenge to the hegemony of the IGS had come a little earlier, in the form of the Lucas Report of 1976 (see Chapter 4), in which institute directors were criticised for showing more loyalty to their institutes than to the NERC as a whole. The next came with the report of the NERC Visiting Group which carried out its investigation of the Institute of Geological Sciences between 1982 and 1984. A far more serious challenge was presented by the first NERC Corporate Plan in 1985 (see Chapter 3). The mutual lack of trust between NERC HQ and the Survey, which had first surfaced after the Lucas Report, came to a climax in 1985, when

Plate 1 Aerial view of the Keyworth site taken when all scheduled building work and moves from London and Leeds were completed. Site changes made since then include the conversion of one of the tennis courts at the eastern end of the site into additional car parks and the extension of the National Geoscience Data Centre.

relations between the Survey and its parent body were worse than at any time in the previous twenty years.

There is one last event of significance: the move of the Survey headquarters from London to Keyworth, a village a few miles south of Nottingham. Full details of this remarkable exercise are contained in Dennis Hackett's account, *Our corporate history. Key events affecting the British Geological Survey, 1967–1998*. He records the discovery of the site in 1975, a teacher-training college that was about to be made redundant, its purchase the next year and the subsequent transfer to Keyworth of hundreds of staff from several offices in London and Leeds. The first staff to occupy the site came in October 1976 and the last transfer was in December 1989. In all, the cost of the exercise, including the purchase price, the construction of new buildings and the transfer of staff and goods to Keyworth was in excess of £24 million.

When Keyworth became the official HQ of the BGS in 1985, this was the culmination of twenty-two years of effort. The original idea came from the Cabinet Committee on Population and Employment, which, in 1962, endorsed a

new drive to disperse Government staff from London. A survey was set up under Sir Gilbert Fleming, who recommended in 1963 that 70 staff of the Geological Survey of Great Britain (excluding the Museum) should move from London to a new locality in the south-east of England. The story of how it came that the Survey moved to Nottinghamshire is well told by Dennis Hackett. The period of the move was turbulent, to say the least, and much pain and anguish were suffered by staff who were forced to move there. The outcome, however, was an HQ complex that is as well equipped as any Geological Survey in the world and contains adequate room for expansion, should that become necessary (Plate 1).

By 1985, the year of the Survey's one hundred and fiftieth anniversary, the headquarters had officially been transferred to Keyworth from the Geological Museum in Exhibition Road, South Kensington, London. There were, at that time, two offices in Edinburgh and one in Wallingford, and two London offices had yet to close. There were small district offices in Newcastle, Exeter and Aberystwyth and an office in Belfast for the staff working on the contract to the Northern Ireland Government. In addition, there were geomagnetic monitoring stations at Hartland in Devon, Eskdalemuir in southern Scotland and Lerwick in Shetland.

Chapter 2

Visiting Groups

The year 1985 should have been one of joyful celebration for the British Geological Survey. The acquisition of its new name in January 1984, to replace the Institute of Geological Sciences, with which few staff had readily identified, had provided a welcome boost to morale in a generally very unsettled period. There was a feeling around that the new name now described what the institution was and, for the first time in the career of many of the staff, it allowed them professionally to be what they wanted to be. Staff were looking forward with enthusiasm to celebrating the Survey's sesquicentennial anniversary and the opening of the Keyworth office as the headquarters of the British Geological Survey by the Hon. Peter Brooke, MP, Parliamentary Under Secretary of State for Education and Science, in October 1985. Sadly, two events were to overshadow the new sense of purpose. These were the publication of the report of the 1982–84 Visiting Group, in November 1984, and the issue of the first NERC Corporate Plan, on 14 February 1985.

The launch of the Corporate Plan, dealt with later (Chapter 3), set off a chain of events that lasted to November 1989 and which gave shape to the modern British Geological Survey, but the modernisation process itself began earlier and was much influenced by the 1982–84 Visiting Group.

Visiting Groups were an instrument of the NERC Council, used to assess the scientific, operational and managerial performance of the NERC's component institutes. They were ad hoc groups, accountable in the first instance to Preparatory Groups, which were subcommittees of Council. Since 1970 these had been responsible for the quality of research in each of the major scientific disciplines covered by the research council. Preparatory (or just Prep) Group A covered the earth sciences. The 1982–84 Visiting Group was the last of its kind to review the BGS. The next internal NERC review of the whole of the BGS was the Science and Management Audit (SMA) of 1991, which operated in a somewhat different style; the most recent, the 1997 SMA. While both of the SMAs found room for improvement in the way the BGS performed, neither of them had the impact of the last Visiting Group.

While it was still called the Institute of Geological Sciences, nearly the whole of the BGS had been scrutinised by a series of Visiting Groups between 1974 and 1978. This had been done in five phases, and was brought together in a final report to Council in 1978. The 1982–84 Visiting Group was different in that it was to look at the whole of the BGS, except for the Hydrogeology Unit and the

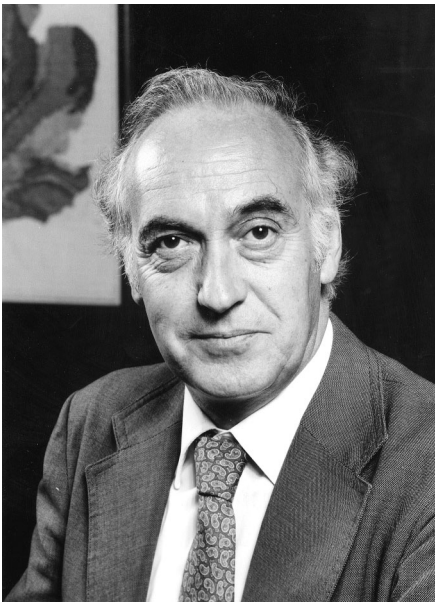

Plate 2 G M Brown, Director from 1979 to 1985.

Malcolm Brown was born in Redcar, North Yorkshire on 5 October 1925. After war service as a navigator in the Royal Air Force he went to Durham University to read Geology, then Oxford for his DPhil on the layered and ultrabasic rocks of Rum. After a short spell in Princeton University and the Carnegie Institute in Washington, he returned to lecture in Oxford in 1955. In 1967 he became Professor of Geology at Durham, where he remained until he became Director of the Institute of Geological Sciences. Because of his expertise as a petrologist he was appointed a NASA Principal Investigator of the Apollo Moon Programme and brought a sample of moon rock to the UK for research. He served on NERC Council. He was elected a Fellow of the Royal Society in 1975 and was knighted in 1985. He died on 27 March 1997.

Museum, in a single exercise, taking less than half the time of previous Visiting Groups. It was to be conducted by a core group of Professor Bernard Leake of Glasgow University (chairman), Mr H R Tainsh, a consultant in the petroleum industry, and either the Chairman or Secretary of the NERC. They were aided by a secretary from the NERC HQ staff and up to six other scientists from outside the NERC, chosen for their expertise in the fields being scrutinised.

The Visiting Group began its work in April 1982 and completed its report in April 1984. This period coincided with the implementation of a new management structure (pages 83–87 and Figure 3), which was done by the BGS Director, Malcolm Brown (Plate 2), partly in consultation with the Visiting Group. It meant, however, that the management and research programme structure that was being investigated by the Visiting Group were ones that were being replaced, not the new ones. During the time of the investigation the Visiting Group gathered evidence by personal interview, presentations and written submissions from staff. A characteristic of the Visiting Group, not evident nowadays in the SMA, was for the team to visit every individual member of the science staff in their offices to discuss their work. These were private interviews, the records of which were held in confidence and, supposedly, not shown to senior managers. This arrangement gave staff an opportunity to talk freely and frankly about any aspect of their work and management. Members of the Visiting Group also visited the Bureau de

Recherches Géologiques et Minières (BRGM) in France, which the chairman believed had carried out a successful mapping programme in collaboration with universities.

They also brought in an external consultant, Dr Digby McLaren, previously the Director-General of the Geological Survey of Canada. Dr McLaren visited the BGS for a week early in April in 1984, right at the end of the Visiting Group's study, and submitted his report in a letter to Professor Leake almost immediately. The Geological Survey of Canada was (and is) a ministerial organisation fully funded directly by government. In contrast, the BGS is a non-departmental government body only partly funded by direct grant. Many of Dr McLaren's comments reflected his preference for the Canadian way of doing things, but also were more relevant to a country still economically highly dependent on resource exploitation, which the UK, by then, was not. In addition, he did not fully take into account the Government's drive towards the market economy and the impact that this was having on government bodies in the UK.

On completion, the report was passed through Prep Group A to NERC Council, where it was approved at its July 1984 meeting. A mechanism for implementation was agreed by Council in September, after which an implementation plan was requested from the Director. A series of meetings was organised in the BGS, starting on 20 November and ending on 12 February 1985, at which Dr John Bowman, Secretary to Council, addressed staff on the report.

In a summary of the report issued to staff in an Office Notice (number12/84) in November 1984 it was said:

> The VG concluded that, although the Survey was sustaining scientific vigour and innovation in some areas, there were major problems which needed to be tackled, particularly in work funded through the Science Budget. They were extremely concerned that many of these problems had been identified by the previous VG (1978) but that little progress had been made in tackling them. They concluded that Council must take a much more positive role in ensuring that changes recommended by the current VG are carried through.

It was also stated that the Council wished to exercise more control over the work carried out with funding from the Science Budget. They proposed that a system of guidance and monitoring be set up that was similar to that exercised by customer departments in the commissioned research programme. This was, in effect, a statement of no confidence in the BGS senior management's ability to manage its own science programme without supervision and, more than anything else associated with this Visiting Group, set the management against it.

The report itself was damning. While the Visiting Group acknowledged the impact of the Rothschild transfer (see Chapter 4) and recognised the funding difficulties that had followed the completion of the funding transfer in 1976, they seemed especially irked by the apparent lack of response by BGS to the recommendations of the 1978 Visiting Group. No part of the BGS escaped criticism and it was decided by Council that the core group of the Visiting Group

should not be disbanded, but should be retained to monitor the implementation of the report's recommendations — another slight on the competence of the BGS senior management. The chairman of Prep Group A, who at that time was Professor J C Briden, was added to the core group. It was to meet every six months, starting in December 1984, to receive a progress paper from the BGS Director.

An important general criticism in the report was that the BGS work programme was too big, covering too wide a field, and work in it was not prioritised. They noted that there were too few support staff and that capital funding was inadequate. It was their view that a rationalisation of the whole BGS programme would liberate funding for both of these areas. The report was critical of the way that managers were burdened with administrative duties and not able to devote time and effort to research and scientific leadership. They recommended a review of career-development procedures and suggested that there was a need for a more formalised programme of training for all staff, as well as an improvement in management training. In their comments about the organisational structure they referred to the need for steps to be taken to improve the mobility of staff between different work areas within the Survey to give them the opportunity to acquire experience in a wider range of research, including overseas. They thought that linkages between different parts the Survey's research programme where similar research was being carried out, though variable, were generally poor enough to justify taking management action to strengthen them, including running seminars to improve the flow of information among staff. They also believed that links with universities could be strengthened and that staff were not publishing enough in the peer-reviewed journals.

The Visiting Group broke down the current BGS programme into thirteen areas, which in priority order were given as:

- backlog of land survey maps and publications
- geological and geophysical syntheses of the continental-shelf data
- deep geology studies of the UK crust
- data management
- regional multidisciplinary geological surveys of the UK landmass
- regional geochemistry and metallogenesis
- isotopic and stratigraphical palaeontological studies
- seismology, geomagnetism and other geophysical methods applied to deep Earth structures and processes
- fluid processes in crustal environments; fluid-inclusion studies
- environmental hazards and environmental maps
- geochemical and geophysical methods and techniques
- rock physical properties and engineering applications
- organic geochemistry related to energy resources.

Their view was that the primary objective of the BGS was to prepare and keep under revision the geological synthesis of the UK and the surrounding

continental shelf by the collection, interpretation and correlation of available data relating to the three-dimensional geology, and expeditiously to publish the results by means of maps and reports. Thus, priority in the programme should be given to those elements that supported this. Effectively, these were the first eight in the list above. They commented that the last five should be supported primarily by commissioned research. If commissioned research income fell below 75% of the total for any one of them, consideration should be given to curtailing or discontinuing it.

The criticisms relating to the conduct of the mapping programme were, perhaps, the harshest. The report claimed that there was a lack of concentrated drive, poor management and too much perfectionism in it. These, they considered, could not be dealt with by a simple injection of funds to clear the backlog of maps and publications that they had identified and to speed up the rate of mapping. They could only be addressed by fundamental changes in work practices and an appreciation by staff of the needs of the modern industrial and scientific communities. It is significant that the Visiting Group praised the way that the BGS handled its commissioned research programme, commenting that in it there was evidence that staff could deliver high-quality maps and reports to time, which they contrasted markedly with the conduct of the Science-Budget-funded geological mapping programme.

Their detailed comments covered all aspects of the mapping programme. They were tacitly critical of the way that mapping projects were carried out, usually with only two or three field staff in the project team, compared with the recently created Regional Geological Surveys (RGSs) (see Chapter 9), which consisted of up to ten multidisciplinary staff. These had been set up by the Director as a model for the future mode of operation of the Land Survey, the part of the Survey that carried out the geological mapping programme. The Visiting Group enthusiastically endorsed this approach.

Their criticism went right to the heart of the Land Survey and caused considerable resentment. Traditionally, the geological mapping staff had regarded palaeontologists, mineralogists, geochemists and geophysicists as service providers to be called upon only when needed. By contrast, in the RGSs all staff were equal members of the project team, taking part together in project planning, interpretation of the results and end-of-year reviews. In some of the RGSs there was also a significant involvement of academics, who were similarly regarded as members of the project team. The service relationship, which the Visiting Group clearly did not like, did not exist within the RGSs, which even included analytical chemists within the teams. Indeed, one of the Visiting Group's specific recommendations was that such staff should become more involved in interpretation within the team context throughout the BGS work programme. There is no doubt that this was a more expensive way to carry out the mapping programme, but the Visiting Group was convinced that there were clear scientific and operational advantages of this approach. They also believed that it should become part of the project specification to write up the research findings and prepare

maps for publication. Surprisingly, even in the early 1980s it was not mandatory for field staff to ensure that all the maps and the memoir were produced for each sheet that was mapped before moving on to new work.

Since the last quarter of the nineteenth century there had been three standard outputs from the mapping programme. The mapping scale at which the field geologists worked was six inches to the mile (later 1:10 000) and maps at this scale were compiled from field data and made available to the public. These same maps were used as a source in the process of compiling maps at the scale of one inch to the mile (later 1:50 000), which were colour printed and sold to the public. Thirdly, each one-inch map was accompanied by a memoir describing the detail on it.

The emphasis within the Land Survey was pre-eminently on mapping. Field staff were expected to do 20 weeks or more mapping a year. In some of the field units if they were not in the field immediately after Easter or if they were back in their offices before the clocks went back in October, individuals had to explain why to their District Geologists. The field staff would invariably compile their 1:10 000 maps during the winter, but there was often too little time for them to begin to work on the memoir and the 1:50 000 map. Added to this, after 1976 the demands of commissioned research took priority over Science Budget work and it is not surprising that a backlog of publications and maps had built up.

The backlog of maps and publications had been identified and criticised by the 1978 Visiting Group. By 1984 the position had not improved. The Visiting Group reported this to Council in July 1983, half-way through the review, and was asked to propose practical measures to deal with the backlog. They identified two classes of backlog material. In one, all the work had been completed, but there were insufficient funds to pay for printing. In the other, for various reasons, staff had been diverted from the tasks of writing and map compilation, leaving the work incomplete. In some cases, the unfinished work had languished for many years and the Visiting Group recognised one group of backlog items that would have to be abandoned because there was no one left in the Survey who could carry them through. In their interim report they identified a recoverable backlog of 37 memoirs, 13 sheet explanations (it was not clear at this stage what they meant by a sheet explanation, because none had been written in the Survey) and 20 1:50 000 maps. A little later, these figures were revised upwards to 52 memoirs and sheet explanations and 21 maps. There was an additional problem. It was expected that each year nine new maps and explanatory texts would be added to the production schedule. If these were not to be added to the backlog, a plan for the current programme was required that was separate from that to clear the backlog.

A separate task, which they thought needed tackling even though they did not give it high priority, was the completion of the conversion to the 1:50 000 scale of all maps that had been published at one inch to one mile. This task was well under way, but they had identified 228 sheets in the UK that still had to be converted.

Though the reasons for the backlog were many and varied, they generally reflected inefficiencies right through the system, from the way the mapping programme was planned and carried out to the production process and protocols for proof checking. Clearing the backlog was never going to be easy, a point the Visiting Group recognised when it said that fundamental changes in work practices were required in the Land Survey. They also recognised that there was a cost to clearing it, putting it at £1.21 million over the three years 1984–87, and they asked Council for special earmarked funds for this purpose. Of all their recommendations, the Visiting Group stressed that this was the most important.

The group's next major criticism related to the way that the Land Survey should operate in the future so as not to build up another backlog. They were concerned about the impact of commissioned research on the Science Budget Programme, seeing this as one significant reason why projects were not completed. They looked forward to the development of a five-year plan for the Science Budget Programme to run alongside one for the Commissioned Research Programme, which, they noted, was being discussed with customer departments. In fact, neither happened. Discussions with Government departments failed because this was a way of working that was no longer in fashion. The trend among all Government departments was away from special or single-tender relationships towards competitive tendering for all its research, and no exceptions were to be made for the BGS. Instead of a five-year plan for commissioned research, the opposite happened. The Commissioned Research Programme became an agglomeration of small contracts each one won as a result, often, of cut-throat competition.

The Visiting Group also noted, using information from 1980, that for about 60% of the land area of Great Britain the 1:10 000 mapping was either seriously deficient or had failed to keep pace with advances in geological thinking. A plan to deal with this was needed, and, during 1984, Plan 2000 was developed by the BGS senior management (see Chapter 11). This was a critically important document. It was based on an evaluation of the quality of mapping on each one of the 1:50 000 sheets that covered Great Britain. It proposed a resurvey programme to replace the deficient maps with ones that would meet modern needs. The programme was to last fifteen years and it was proposed to start it in 1985. Though Plan 2000 was not funded and did not take place, the document was used for planning the major resurvey programme that started in 1990.

Important though it was for the Survey to develop Plan 2000, the Visiting Group seemed to be more concerned that a way should be found to bring in the universities to help with the mapping than for the BGS to improve its own medium and long-term planning. Out of this concern came their recommendation to establish the Joint BGS/Academic UK Geological Mapping Committee (see Chapter 7).

There were several other key recommendations, some having a bearing on the operational procedures within the BGS, others being somewhat academic.

Among the most significant were:

- Following completion of those currently in preparation, memoirs should be abolished and replaced by short explanatory booklets to accompany each map sheet. This was a decisive act, which the Visiting Group felt was necessary in view of what they claimed was a difficulty in writing memoirs that had been evident throughout the whole of the twentieth century.
- A standardised, Survey-wide database management system should be developed.
- The NERC Deep Geology Committee should review the work of the Deep Geology Research Group.
- Liaison between offshore and onshore mapping programmes should be improved.
- More scientific research arising out of the Offshore Commissioned Research Programme should be funded out of the Science Budget. This drew attention to the failure of Government departments to make any contribution to BGS research other than that which they paid for directly in contracts.
- The aims and objectives of all the research groups in the Geochemistry Directorate needed urgent review, partly in consultation with industry and relevant Government departments, and the number of projects in the Geochemistry Programme reduced considerably.
- Similarly, the Geophysics Programme needed to be reviewed and focused on fewer projects, becoming more integrated within the overall BGS Science Programme. Greater emphasis should be put on interpretation of data, and less on data acquisition.
- An investigation of the funding arrangements for handling enquiries should be carried out, to ascertain whether charges could be levied for them.

The echoes of these and additional minor recommendations were to reverberate around the BGS for years to come.

The full report was not released to BGS senior management until October 1984, when the Council had decided on their implementation strategy. When it came, the Director was given until early December to write a detailed implementation plan, but on 5 November he had to face Prep Group A to defend his current Science Budget Programme, in particular the retention in it of the five programme areas that the Visiting Group declared should be funded by commissioned research only. A special meeting of the BGS Directorate was called for 25 October to plan the approach to be taken in dealing with the implementation.

Malcolm Brown's paper to the core group was presented at a meeting on 12 December, which, coincidentally, was the day that the NERC Corporate Plan for 1985 was received by senior management under conditions of great secrecy. It was a fighting document running to seventeen pages. Malcolm Brown had good cause to be annoyed. As early as June 1981 he had presented a paper to Prep Group A identifying a series of problems that had been precipitated by chronic underfunding of the Land Survey. The balance between strategic and applied

research was wrong, too many staff were taken away from strategic programmes for commissioned research, leading to loss in continuity in the programme, and there was inadequate funding to sustain even a basic mapping programme in such a way that meaningful targets could be set and deliverables delivered. Although he had been given £800 000 in 1982/83 by the NERC specifically to start the Regional Geological Surveys (see Chapter 9), the underlying problems could not be addressed and had remained there. He, therefore, did not deny the validity of some of the criticisms, but they were not new to him and they remained as problems, in his view, because of inactivity at NERC HQ when faced with his requests for help. He clearly pointed out where the Visiting Group had misinterpreted evidence and gave a number of cases where actions were already in hand to deal with points raised in recommendations. In a report that was put together over a period of two years it is inevitable that some issues raised early on would be overtaken by events. The introduction of a new matrix management structure was a case in point. It was still only partially implemented and many of the benefits from it, which the Director expected would deal with points of criticism made by the Visiting Group, were not yet in evidence. But Malcolm Brown was insistent that without a higher level of Science Budget no matter what he did he could not guarantee success in addressing any of the Visiting Group's criticisms.

Five actions emerged from the December 1984 meeting of the core group. The first was to revise the draft of the terms of reference for the BGS, which Malcolm Brown had presented to it in his paper. These were the first terms of reference that the BGS had ever had and were an attempt to clarify the function of a national geological survey; it was clear from much of what had been written in the report that this was necessary. These terms of reference were eventually established by NERC Council in July 1985 and released to staff in an office notice (16/85) in October that year. They were based in part on the terms of reference prepared by the 1985 Strategic Plan Working Party which had been submitted to the Director in March that year. His derivative consisted of a concise general statement followed by a supporting functional description. The concise statement read:

> The primary objective of the British Geological Survey is to prepare and keep under revision the geological synthesis of the UK and the surrounding continental shelf by the collection, interpretation and correlation of available data related to the three-dimensional geology, and to publish expeditiously the results by means of maps and reports.

The next action required of the Director was to define the high-priority science research projects and identify the individuals to work on them, so that moves could be made towards reducing the staff complement to a level that was more manageable within the available Science Budget. This had nothing at all to do with the Visiting Group report, but everything to do with the first NERC Corporate Plan, released that day. The other three actions were about support-staff recruitment and ways of dealing with the backlog.

By the May 1985 meeting of the Core Group the Director had initiated a plan to clear the backlog of publications and maps within three years, as required by the Visiting Group. Guidelines for the new sheet explanations that were to replace memoirs had been drawn up, and actions relating to all the other recommendations were in hand. Malcolm Brown also presented his version of the breakdown of the work programme. He had quite clearly been upset by the way both the Visiting Group and Prep Group A had dealt with it. He did not agree with the thirteen-fold division of the work programme presented in the Visiting Group report, nor with the principle of prioritising it, nor with relegating parts of it to the Commissioned Research Programme. His modification was:

- UK land-survey mapping, and elimination of in-house backlogs in maps and publications
- geological and geophysical syntheses of UK continental-shelf data
- deep geology studies of the UK crust (geological, geochemical, geophysical and geotechnical)
- a national geoscience database development and application to the maintenance of an ongoing UK inventory with acquisition, handling, interpretation and dissemination of data
- regional multidisciplinary surveys of selected, problematical areas within the UK landmass (in other words the Regional Geological Surveys)
- regional geochemistry, metallogenesis, and mineral resource studies
- geological, geochemical and geophysical studies required to improve the national geological database, advance the basic science programme, and introduce more modern methods in order to become more effective.

In arguing for this breakdown, Malcolm Brown managed to persuade the Core Group that, except for the backlog of maps and publications, which was highest priority, no priority order was to be inferred from this list.

There are some interesting differences between his list and the one the Visiting Group produced. Whereas the Visiting Group inferred that the whole of the geological mapping programme would be conducted through the regional multidisciplinary surveys, Malcolm Brown restricted this approach to problematical areas. It is difficult to understand why he did this. He had created the Regional Geological Surveys alongside the systematic mapping programme with the aim of influencing the way the Land Survey operated. At first, he had not included the routine production of maps in the remit for the RGSs, but by 1984 he had begun to change his mind about this. Now, when given the green light by the Visiting Group, he chose to keep the RGSs separate from the routine geological mapping programme. Perhaps he was facing reality, knowing that some of the Assistant Directors managing the mapping programme were implacably opposed to the idea.

Among the other changes, he added important detail to the line on database management and brought in a mention of mineral resources, missing from the Visiting Group list. Most significantly, he obtained freedom to reshape the

programme in future years by rolling the last seven of the Visiting Group's list, which included five items that they thought should be funded by commissioned research only, into one, catch-all category.

The Core Group accepted Malcolm Brown's revised listing, though by then, within the BGS, it had effectively been made redundant by the 1985 Strategic Plan. They were satisfied, overall, with the actions that had been set in train to deal with all the other recommendations of the Visiting Group, agreeing at the May meeting that the only significant outstanding action was the one related to the map and memoir backlog.

The Visiting Group had been critical of the BGS for not implementing the recommendations in the 1978 Visiting Group report. In Malcolm Brown's vigorous defence of this charge he had specifically identified funding shortages as the root cause of the failure. Equally, there were resource implications to full implementation of the 1982–84 recommendations. The Visiting Group recognised this. In addition to the request for £1.21 million to clear the backlog, they made a special plea to Council to restore the BGS baseline funding to enable the Geological Mapping Programme to be continued at a level that was more appropriate for the enormous task the Visiting Group itself had identified. This was less than what was required for Plan 2000, which had been drawn up to deal with this task. It was Plan 2000, however, that was presented to Council. They approved it, but made no funding allocation to it. Nor did they enhance the baseline. The plan to clear the backlog of maps and publications in three years, as required by the Visiting Group, was given high priority within the BGS, but this also was not fully resourced. The debate between the Director and NERC HQ was about whether the money for this task could be taken out of the Science Budget allocation each year without wrecking the remaining programme or whether a special additional allocation should be made by NERC HQ. This argument rumbled on and was never resolved. The backlog was not finally cleared until 1997.

Council's wish to exercise more control over the conduct of the BGS Science Budget Programme because of its dissatisfaction with the lack of response to the 1978 Visiting Group's recommendations was not acted upon in the context of the Visiting Group. It was meant to be taken up during the reorganisation of the NERC that followed the 1985 Corporate Plan, but it was not until the creation of the Programme Board in 1989 (Chapters 5 and 6) that this issue was resolved.

The 1982–84 Visiting Group report was such a severe shock to the BGS and Council that it became a serious stimulus for change. Although it was overshadowed by the events surrounding the 1985 Corporate Plan, the impact that the Visiting Group report had on operational procedures in the BGS was not in any way diminished. Most of the recommendations were acted upon, though it took many years for some of them to become fully implemented. More importantly, the need for radical change was pushed into the forefront of the minds of the BGS senior staff; thus enabling the modernisation process to gather momentum and proceed at a pace that was commensurate with what was happening in the outside world.

CHAPTER 3

Strategic planning and the NERC Corporate Plan, 1985

Strategic planning was as new to the BGS in 1985 as corporate planning was to the NERC. For both it was a first-time experience. That year, the Advisory Board for the Research Councils, the management umbrella for all the research councils, required the NERC to begin the process of making annual corporate plans. The BGS developed its own first Strategic Plan as an act of rebellion against the NERC Corporate Plan.

Sir Hermann Bondi put the first draft of the NERC Corporate Plan together with the help of his personal aide in the last few months of his tenure as the Chairman of the NERC. It was then submitted in secrecy to a brainstorming by a small group of officials and NERC Council members, including Geoff Larminie who was later to become Director of the BGS. During 1984 it went through a number of drafts, the seventh of which was issued from the Chairman's private office for distribution amongst senior managers in the component institutes of the NERC on 10 December. Council had agreed the broad structure of the plan and the principles outlined in the document on 29 November.

The two main themes in the Corporate Plan that provoked antagonism amongst NERC staff were the ones to reduce the staffing in the component institutes by about 30% over five years and to move spending away from the component institutes towards universities. The third theme, which created a more adverse reaction in the BGS than in any of the other institutes, was to centralise the management of the institutes by the creation of a new tier of senior management to be based at NERC HQ in Swindon.

The plan envisaged the creation of three science directorates, headed by directors of science based in Swindon. They were to be Grade 3 in rank, which was the rank of the BGS Director. The creation of Directors of Marine Sciences and Terrestrial and Freshwater Sciences was not seriously opposed by the other NERC institutes, largely because this would bring together under common management a disparate group of small institutes that seriously lacked a common sense of purpose. In contrast to this, the creation of a Director of Earth Sciences was to accompany the fragmentation of the BGS and the transfer of the Grade 3 post from the Director of the BGS to the Director of Earth Sciences. In the proposed structure for the Earth Sciences Directorate there were to be five BGS senior managers answering directly to the Director of Earth Sciences. These were the Director of the BGS, the Chief Geochemist, the Director of Information and Central Services, the Director of Energy and Offshore Programmes and the Chief Geophysicist. The entity called the

British Geological Survey was to contain three divisions. These were the Overseas, the UK North Land Survey and the UK South Land Survey divisions. The title of Director of the BGS was to be used for the Grade 4 post with management responsibility for all three of them. He was to manage the UK South Land Survey Division; the other two divisions were to be headed by deputy directors.

In every respect this was an ill-conceived plan. Downgrading the rank of the Director and transferring the top layer of management to Swindon were mere insults; breaking up the Survey into five parts and running four of them independently of what was to be called the British Geological Survey struck right at the heart. It had been Sir Kingsley Dunham's aim that the Institute of Geological Sciences should become the 'premier research institute of its kind in Europe'. Between 1967 and 1975 he doubled the staff to over 1000 and in doing so recruited scientists capable of carrying out research in almost all branches of the earth sciences. Although the divisional management structure lead to rivalry and conflict there were several big, multidisciplinary programmes, like the Mineral Reconnaissance, Mineral Assessment, Geothermal and Radioactive-waste-disposal programmes, which provided the cement needed to maintain the integrity of the organisation. Malcolm Brown's introduction of matrix management and the establishment of the multidisciplinary Regional Geological Survey projects added to this. The view then, as now, was that the BGS's strength lay in it being a big, multidisciplinary research institute with a great breadth of research capability. The segregation of the geological mapping operations into a separate body, as envisaged in the Corporate Plan, was contrary to all the trends of the time. As so often has happened, it illustrated the lack of understanding of earth science among the largely biological membership of Council and the NERC senior management in Swindon. The proposals in the Corporate Plan also appeared to take little cognisance of some of the important recommendations of the 1982–84 Visiting Group.

Careful reading of the Corporate Plan revealed a number of other issues to concern BGS staff. For example, there was full recognition that it was an objective of the NERC to undertake strategic and applied research of practical relevance to public and commercial policies in the UK and overseas (paragraph 3.6), but this was followed (7.3) by a statement that the NERC's financial objectives in commissioned research were, among other things, to sustain strategic and applied research without undue strain upon the Science Budget. The implication of this statement is that strategic research, which was fundamental to the existence of the BGS, should be funded primarily by commissions. Furthermore, paragraph 4.6 contained more than a veiled threat:

> The problem of the systematic regional geological survey of the UK landmass [presumably a reference to the large backlog of maps and memoirs mentioned in the draft 1982–4 Visiting Group report] must be resolved in the interests of Government and industry. Alternative approaches, with concomitant loss of precision, will be applied if additional resources cannot be found.

It was fairly easy for geologists to come to the conclusion that Council did not regard the surveying function of a Geological Survey as one that they should

fund and, by implication, that they were looking for a way of reducing the Science Budget spend on earth science. The last sentence in the paragraph, in particular, with the words 'concomitant loss of precision' provoked fury within the Land Survey of the BGS. It was a repeat of the attack the Visiting Group had made on what it called 'perfectionism' in the mapping programme, but it also carried with it the message that geological maps were easy to make and were not something that NERC research staff should be involved with.

The draft Corporate Plan reached BGS managers on a 'for your eyes only' basis on 12 December. The NERC Secretary, Dr John Bowman, revealed the contents of it to the General Purposes Committee of the NERC Whitley Council (the Whitley Council is the machinery by which management ('Official Side') negotiates with trades unions ('Union Side' or 'Staff Side') in the Civil Service and related bodies) on Monday 17 December. Union representatives at the meeting were sworn to secrecy, which meant that officers of the union at lower levels were not allowed to see the plan or know what was in it. Significant parts of the content had, however, been leaked by Christmas and the BGS Section Committee of the Institution of Professional Civil Servants (IPCS, later to become the IPMS) was becoming highly agitated, not least because BGS management appeared to be doing little more than murmuring darkly about it. The minutes of the Directorate meeting of 11 December 1984 record that the Corporate Plan was shortly to be released in confidence to senior managers. The next meeting was scheduled for 21 February and there is no evidence from the files that any emergency Directorate meetings were called in the intervening period to discuss action over the Corporate Plan.

Frustrated by the inactivity, Neil Aitkenhead, who was Chairman of the BGS Section of the IPCS, phoned me during the Christmas break and asked me, as a past chairman of the section, if I would act on behalf of the union and try to organise the management into effective opposition to the plan. (As a PSO Programme Manager I had received a copy of the plan — against instructions from the NERC that it was to be issued only to managers of Grade 6, which was what most Research Programme Managers were, and higher rank.) I agreed, and a letter was put out to all IPCS members in BGS management on 4 January 1985 calling them to meetings in Keyworth on 11 January and in Edinburgh on 14 January, which I would chair. Practically all senior managers attended whether they were union members or not. There was unanimous opposition to the NERC Corporate Plan and the idea emerged at the meeting in Edinburgh that the BGS should develop its own corporate plan.

I reported these meetings to the Director, Malcolm Brown, and he agreed that I should convene an Extraordinary Senior Officers' meeting to discuss appropriate action for the BGS to take; this would take place on Friday 18 January, and he would be in the chair. Despite foul weather, almost all staff at Programme Manager level and above attended this meeting.

Although BGS senior staff had complied with the injunction from the NERC to treat the Corporate Plan as a confidential document, the whole of it had been leaked, allegedly from one of the NERC's small grant-aided research bodies

attached to a university. The institute directors, themselves, wrote a letter of protest to Council, which they copied to the Times Higher Education Supplement (THES). An article and an editorial based on it appeared in the THES on 25 January. Both of these actions were described as an act of betrayal of trust by the new NERC Chairman, Mr Hugh Fish, in his letter to staff about the Corporate Plan early in February. However, because of them, enough was known about the plan's contents during January for staff to have formed a view on it before the meeting held on 18 January. The common perception in the BGS was that the Assistant Directors and Director either did not have the will to fight it or did not know how to do it. There is some substance given to this in the wording used by the Director in his introduction to the meeting on 18 January. Ramues Gallois (Programme Manager, Armorica; see Figure 3) took notes throughout the meeting and prepared a report on it afterwards. The following is a direct quote from that report:

> Director introduced the discussion of the NERC Corporate Plan by stating that it had not been discussed with any institute director, but had been revealed to them at a meeting just before Christmas. They were told that it had been approved by Council. He therefore took no responsibility for the plan and wished to offer every assistance to those members of staff who wanted to make comment on or oppose the plan. Because of his complete lack of involvement in the formulation of the plan, he had not called the present meeting, but welcomed the grass roots interest it has aroused and the enthusiasm with which the staff had sought to bring discussion of the plan into the open …

The Director then went on to give details of the letter sent to NERC Council and copied to the THES. There were, in fact, two separate letters: one signed by the eleven institute directors and another from the directors of the three grant-aided bodies in the NERC. Points made by the directors included:

- the apparent defeatism of the NERC in accepting a progressive decline in funding from Government without making any effort to seek additional funds
- the introduction of an additional tier of management at NERC HQ in Swindon
- their total opposition to the proposal that programmes would be managed from Swindon
- the cessation of direct access by directors to the Chairman of the NERC by the intervention of a new committee and the new post of Director of Science
- the absence of any statement about how the staff cuts were to be realised; in particular the absence of any mention of compulsory redundancy, which the directors thought would be required
- the iniquity of transferring funds from the institutes to universities
- the lack of a definition of the role of institute directors in the new structure.

The THES article was highly critical of the NERC and referred back to a speech made by Professor John Sutton of Imperial College at the opening of an exhibition in the Royal Scottish Museum in Edinburgh to mark the 150th anniversary of the founding of the British Geological Survey, in which he had expressed the opinion that the thrust of the Corporate Plan was wrong and that it should be

frozen until an enquiry had taken place on how the NERC did its job. He, like many others at that time, thought that the BGS should be funded from outside the research-council system. The leading article was no less critical. It pointed out two main pressures that were being brought to bear on the NERC. One was from Government departments who, in managing post-Rothschild arrangements for commissioning applied research, had shown no regard for the NERC's need to maintain a portfolio of strategic research to underpin the short-term commissioned research. The second pressure was from the Advisory Board for the Research Councils, which wanted to see a larger proportion of the Science Budget spent in universities and less in the institutes. The ABRC was accused of being prepared to permit the dissolution of the Government's important scientific assets for a highly uncertain return and of displaying a bias towards the physical sciences and the physico-chemical end of biology. The NERC's response to both pressures was described as doing it little credit.

The full senior officers' meeting at Keyworth lasted for over two hours and finished with unanimous agreement to take action on four fronts:

- A letter, already drafted, should be sent to all Council members and the assessors from Government departments who attended Council meetings, urging a major revision of the plan. It was to be signed by all members present. The letter was to reach the Council members before the next Council meeting on 24 January and remain confidential until then.
- The letter was to be released to all staff on 25 January and from that time would form the basis for BGS opposition to the plan.
- The Director and all senior officers should actively encourage all staff to campaign against the plan and for the retention of the BGS as a single management entity, as autonomous as possible and not in the NERC.
- The BGS should draw up its own Strategic Plan (not a corporate plan, as originally intended, in order to distinguish the BGS activity from that of the NERC) as a matter of urgency; this should include realistic cost estimates for running the Survey's Science Programme.

The proposal to prepare a BGS Strategic Plan was made from the floor by Tony Wadge, and he was nominated by the Director to be the chairman of a working party of six who would have access to all BGS staff for the purpose of taking evidence. On the following Wednesday, the Chief Geologist, Gordon Smith, the two Land Survey Programmes Directors, John Hull and Wyndham Evans, the Deputy Director, Innes Lumsden, and I met in Edinburgh and agreed that either the Director or the Deputy Director should chair the Working Party. Tony Wadge agreed to stand down. The Director, however, would not agree to this proposal, and the next day he suggested, instead, that Brian Kelk, who was the Programmes Director in charge of the Information and Central Services Directorate, should take the chair. I was nominated to be the Working Party secretary.

The nomination of Brian Kelk, was not widely welcomed. He had only recently transferred to the BGS from the NERC Science Division in Swindon,

where he had been secretary to Prep Group A, the committee which oversaw earth sciences and which had instigated the damning 1982–84 Visiting Group report on the BGS. It did not help that, by Friday 25 January, rumours were circulating that his name had appeared on a list of possible candidates for the Swindon-based post of Director of Earth Science, which was, in the new structure, to be superior to the Director of BGS. As it turned out, he was an excellent choice as chairman of the Working Party, being able to take advantage of his position to coordinate the campaign against the NERC, in which he astutely used the skills and contacts he had made while at NERC HQ.

The campaign, which, in simple terms, was to keep the BGS together and outside the NERC, officially began on 25 January. NERC HQ was sufficiently disturbed by it to call a special meeting of Council specifically to discuss it on 30 January, less than a week after their normal, scheduled meeting.

Effective use was made, in the campaign, of those Members of Parliament in whose constituencies staff lived, and of the scientific press. Representatives of industry, whether large companies or small consultancies, were also drafted in to help. In all of this, the BGS Strategic Plan was of central importance, both as a description of the sort of organisation that the BGS staff wanted it to be and as a campaigning document. It was meant to demonstrate the centrality of a geological survey in providing basic geoscientific information of all kinds for the user community as a whole and to make the case for a minimum level of public funding to support it.

Though not the first occasion in the recent history of the BGS when a hard look at its function and long-term future was needed, it was the only one with sufficient urgency attached to it to overcome the complacency that is inherent in any organisation that has survived 150 years and still thought that it was untouchable. In 1966, after the amalgamation of the Geological Survey of Great Britain and Museum with the Overseas Geological Surveys to form the Institute of Geological Sciences, there were 501 staff. These grew to just short of 1200 by the end of the 1970s. During this period of expansion, the Survey had been sufficiently preoccupied with a highly demanding and newly diversified work programme to pay little attention to such philosophical issues as the function of a geological survey in society. Even in 1973, when the Rothschild proposals first took effect, and funding for the work programme came to be predominantly from commissioned-research income, the full implication of the Rothschild transfer was not debated much outside the coffee clubs or in 'state-of-the-nation' letters by retiring Directors. There were, however, several important issues that were in need of attention. Most important of them, the balance between the Science Budget Programme and commissioned research had skewed dangerously towards the commissioned and in real terms the value of the Science Budget allocation to the BGS had fallen considerably. Malcolm Brown and the two directors before him had complained about the impact of high levels of commissioned research on the geological survey function, but in the absence of any indication on the horizon that they were likely to come down, senior managers in the BGS had had little

confidence in taking a long-term view of the work programme. In fact, the only long-term view of any significance that had been taken was in relation to the recommendations of the 1982–84 Visiting Group report, when Plan 2000 was drafted. These matters strongly coloured the thinking of the members of the Strategic Plan Working Party, when they began their deliberations.

The Working Party consisted of Brian Kelk in the chair; myself, Programme Manager for Lower Palaeozoic, Southern Uplands & Lake District, secretary; Chris Browitt, Group Manager for Global Seismology; John Day, Group Manager for Hydrogeology; Don Mallick, Group Manager for Remote Sensing & Airborne Geophysics; Bob McQuillin, Programme Manager for Marine Geophysics; John Moore, Chief Geochemist; and Tony Wadge, Programme Manager for Upper Palaeozoic, Midlands and South Wales. Invitations went out to all prospective members on 29 January and draft terms of reference followed. The first meeting was held on 5 February at which, inevitably, the terms of reference were modified. The finally agreed terms of reference were:

1. After studying the demands upon the BGS, the foreseeable use of geological data within the UK, and the structure and development of comparable geological surveys, to make recommendations on the objectives appropriate for a British Geological Survey.
2. To make recommendations on the nature and size of a programme to meet those objectives, including a 'core' programme of activities without which the national geological database would be severely jeopardised.
3. To consider all elements of the current and longer-term programme and identify those more appropriate for the university and private sector than for in-house provision.
4. To consider how these objectives, in particular the Core Programme, can best be met, having due regard to present and probable future constraints.
5. To report to Director by 4 March 1985.

The schedule set was punishing and it was evident early on that it could not be met. A new date of end of March was set. The Working Party met seven times, on two occasions for two days. There were over sixty hours of meetings, held in Edinburgh, Keyworth and London. To facilitate communication between the members, who were based at all the BGS offices, arrangements were made to transfer documents by the computer network. This is probably the first time that networked communication like this was done in the BGS.

An Office Notice, announcing the Working Party and its terms of reference and asking for written contributions from staff, was issued on 8 February. Verbal evidence was taken from the Director, the Deputy Director, the Chief Geologist and officers of the BGS Section of IPCS. In the period up to 18 February, 35 written submissions were received, representing the views of over 60 staff.

Discussions at the first meeting were very much influenced by a fear that the NERC wished to reduce the Survey in size or even close it down, and the first aim

of the Working Party was to define the minimum viable level of activity in a geological survey, i.e. the size below which it would not be possible for the BGS to carry out what the Working Party regarded as the core functions of a geological survey. This attitude changed somewhat, after more discussion, and the more positive aim became to define the optimum level of scientific effort for a geological survey in the UK. Early on, it was decided to adopt the concept of a Core Programme, which had been introduced in the Serpel report on the Ordnance Survey, and the term 'Responsive Programme' was coined to include the work BGS carried out that was outside the core.

The Working Party adopted the definitions of basic, strategic and applied research provided by Dainton in *A Framework for Government Research and Development*, Cmnd 4814, 1071–2. According to Dainton, basic research, also called pure or fundamental, is research where the principal objective is an increase in knowledge. By common usage within the BGS, applied research is what Dainton called tactical science; that is, 'the science and its application and development needed by Departments of State and by industry to further their immediate executive or commercial functions'. Strategic research is the broad spread of more general scientific effort, which is needed as a foundation for this tactical (i.e. applied) science. Such strategic research is necessarily long term and systematic.

Terms of reference for the BGS were proposed which recognised that the primary role of the BGS was in strategic research and associated data acquisition, handling, interpretation and dissemination. They were:

1. To undertake, and keep under review, systematic geological and related specialised surveying of the UK landmass and designated offshore areas along with adjacent areas of future potential designation, and the underlying crust. (Throughout the report the term geological was used to encompass all branches of the geological sciences in the way that geoscience is used nowadays.)
2. To interpret the geological structure, evolution and geological resources of these areas using the results of the surveys and related studies.
3. To publish expeditiously or make publicly available the results of the surveys and research.
4. To provide a national geoscience archive in readily accessible and usable form.
5. To maintain the capability to carry out applied and other geological research on commission for Government departments and other bodies, at home and overseas.
6. To provide an information and advisory service on geological and related matters.
7. To undertake such research as is necessary to maintain a broadly based level of relevant expertise in the geological sciences.

These terms of reference were to be fulfilled by a Core Programme of primarily strategic research, which must be funded on a long-term basis, irrespective of the level of commissioned research in the Responsive Programme. They did not require the Survey to carry out commissioned research, but to maintain the capability to do it, should it be needed.

The Core Programme was defined as comprising those long-term systematic activities that only an Exchequer-funded Geological Survey can carry out. It provides the framework of geological knowledge within which industry, commerce and other activities can operate efficiently. It was stated unequivocally that such a programme could not be carried out by any university-based, or private-sector organisation.

Once the concept of a Core Programme was agreed, it was largely self-evident what should be in it and the Working Party concluded that there should be five components. These were:

- geological surveys
- geochemical surveys
- geophysical surveys
- hydrogeology
- database management and information service.

Two areas, however, did provoke debate. The first was in relation to minerals. At that time all research on minerals carried out in the BGS was funded either by the Department of Trade and Industry or the Department of the Environment. It was argued, successfully, that the basic information for mineral exploration and assessment was provided through the systematic geological, geochemical and geophysical surveys in the proposed Core Programme and that no other minerals-related work could be justified in the core. Although agreed by senior management when the Strategic Plan was accepted, staff working in minerals never did accept what they regarded as their relegation to the second division.

The second area of dispute was with regard to geomagnetism. Until 1969, geomagnetic monitoring (i.e. measuring the Earth's magnetic field) had been the responsibility of the Royal Greenwich Observatory, administered by the Meteorological Office. That year the facility had been transferred into the Institute of Geological Sciences. The resulting Geomagnetism Unit had an independent existence within the Survey, carrying out work programmes that had no bearing on anything else done in it. Eventually, the argument was carried that geomagnetic monitoring was as much a part of geophysical surveying as, say, measuring the Earth's gravitational field and it was accepted into the Core Programme, but the threat to its incorporation was not removed and surfaced again, later, with the Butler Study Group after which it was threatened with the loss of its funding and told to become self-supporting or go.

Funding for the Core Programme was largely from the Science Budget, but as a result of changes brought about by Rothschild, two essential components were funded externally. These were mapping the continental shelf, funded by the Department of Energy and the Regional Geochemical Survey, which was funded

by the Department of Trade and Industry. These were regarded as being 'core commissions', an important and necessary concept at that time.

The Core Programme was said to underpin a Responsive Programme of applied research which would vary in size according to the national requirement. It was to be funded by commission and have variable staffing levels, unhindered by arbitrary limits. In 1984/85 the activities that were attributed to the Responsive Programme required around 280 staff years of effort and included:

- geological surveys overseas
- hydrocarbon assessment offshore and onshore
- mineral resources
- geothermal energy resource assessment
- environmental protection
- specialised geological maps for planners
- miscellaneous repayment projects.

The linkages that existed between the Core and Responsive programmes were stressed in order to make the point that the two were best managed within a single organisation. The example of the Swedish Geological Survey was salutary. In 1982 the exploration and engineering geology elements of the Swedish Geological Survey (SGU) were separated from the rest to form a government-owned company, SGAB, which operated wholly on commissions from government and industry at home and abroad. The remnant SGU was concerned with the strategic activities of mapping and documentation of bedrock, soils and groundwater and acted as the government authority in the mineral sector. For a while SGAB flourished, but the SGU became progressively less well funded. At the time of the BGS strategic planning exercise it was evident that what was regarded as Core Programme functions might suffer the same fate if the Responsive Programme were to be hived off. In fact, several years later SGAB collapsed and was closed down and the Swedish Government reinvested in the SGU.

Common services which supported both Core and Responsive programmes were named as the library (which it was suggested should be linked to other databases and information services) the cartographic services, publications agency, photography, computing, technical services, workshops and administration.

Collaboration with universities, other research institutes and the private sector was strongly recommended and several activities were identified that were suitable for contracting out. These included facilities that combined both research and a service role, such as organic geochemistry, aspects of palaeontology, stable-isotope geochemistry, isotope geochronology and microbiological studies, all of which were essential to the BGS work programme, but where demand was too low to justify, on cost grounds, including them in the BGS remit. Consideration was also given to seeking outside service provision for a number of services provided in house. These included routine thin sectioning of rocks, chemical analyses, where consistency within a large dataset was not essential, photography, drilling, down-hole geophysics and land seismic-reflection surveying and

processing. It was also suggested that a review of cartography, reprographics and publication services should be carried out to ascertain the most cost-effective way of doing them.

Finally, an attempt was made to put a cost to the programmes. It was estimated that a core complement of 600 scientists, laboratory, administrative and general support staff was required and a baseline budget of £16 million from the Science Budget. Staff levels in support of the Responsive Programme had varied between 380 and 277 staff years in the previous four years. These were regarded as additional to the core staffing of 600, although then, as now, most individual members of staff take part in both programmes.

The Director submitted a consultative draft of the Strategic Plan to a meeting of all but six of the 42 senior managers in the BGS on 29 March. The agenda was brief. The report was delivered to the meeting and the motion discussed: 'That the Report of the Strategic Plan Working Group be accepted in principle as the Strategic Plan for BGS'. After this, further action was to be decided.

The draft report was not unanimously accepted. There was disagreement about many fundamentals, including what to do with the plan when it was finished. One Assistant Director thought it should be suppressed, while the Director expressed the view that it should not be formally published. Several managers, who had not reacted to the first call for written submissions, asked if they could have extra time to prepare comments. At the end of the meeting, the Director agreed to augment the Working Party by the addition of six more members to produce the final plan, but it was not clear to many who left the meeting just what had been the verdict on the motion. The new members were: Neil Chapman, Group Manager, Fluid Processes; Ramues Gallois, Programme Manager, South-western England; Richard Haworth, Chief Geophysicist; Jane Plant, Special Merit SPSO; Gordon Smith, Chief Geologist; and Alf Whittaker, Group Manger, Deep Geology. A call was put out for written comments from senior staff and the Union Side and three further meetings were held, on 2, 25 and 26 April 1985, all at Keyworth, to prepare the final document.

The revised Strategic Plan was accepted by Director towards the end of May 1985 and was released to staff in June for their internal use only. The Plan was never published and exists only as a word-processor print-out, largely in personal files of BGS staff, though one copy has been lodged in the archives. Its preparation took place entirely within a four-month span. Though attempts were made to suppress it, the 1985 Strategic Plan was the most influential corporate document to emerge from the BGS in the 1980s and, by being taken up by Butler (see Chapter 5), it laid a foundation for the Survey's development for the next fifteen years. The fact that it was never published is not a reflection of its worth or relevance, but of the tension and lack of trust that existed between the BGS senior management and staff in NERC HQ at that time.

Chapter 4

Rothschild and the impact on the funding of the BGS

Although the 1985 NERC Corporate Plan was the trigger for the reaction that led to the Butler Study Group and all that followed, reaction in the BGS might not have been so strong if relations with the NERC had otherwise been benign. Indeed, if relations had been friendlier some aspects of the Corporate Plan might not have been written in quite the way they were. There were, in fact, many causes of strain between the BGS and the NERC at the time. Not least among them was the report of the 1982–84 Visiting Group. But there were two other special ones. One was the attempt by the NERC, neither the first nor the last, to impose a corporate identity across all the institutes; the other was the attitude of Council over the funding problems that the Survey faced in the period 1980/81 to 1985/86.

The origin of the idea in the NERC to impose a NERC-centred corporate identity on the whole of the organisation can be traced to the report of a working group that was chaired by Sir Cyril Lucas in 1976. It was in this that the idea of abolishing institutes and reorganising the NERC on discipline lines was first floated. A commentary on it by NERC Official Side (i.e. NERC management, as opposed to Staff, or Union Side, in the Whitley system; see page 24) contains the amazing statement that where institute directors owe a primary allegiance to their institutes this makes considerable difficulties for HQ and the committees of Council. Staff Side at Branch level (that is the NERC-wide level) supported both the proposed reorganisation of the NERC along discipline lines and the drive by Official Side to encourage 'NERC-consciousness'. Staff themselves did not and a furious dispute broke out between staff in the institutes and both their representatives in the trades union system and the NERC senior staff. It led to the mass resignation of the IPCS Branch Committee during the course of the annual delegate meeting and the suspension from the union of all except one of the committee of the Leeds Subsection Committee of the IPCS.

The NERC was not reorganised in the way Lucas proposed, but the distrust generated by this episode was not easily dispelled and it came as no surprise to anyone that in August 1985, at the height of the row over the first NERC Corporate Plan, Dr John Bowman, the NERC Secretary, wrote to Malcolm Brown with instructions to prepare the BGS Annual Report to new design standards that were to be common across the NERC.

The source of the funding difficulties during this same period was the Rothschild transfer, which began in 1973/74. It would be wrong to say that there were no benefits from Rothschild. The very fact that the BGS survived the Efficiency Scrutiny and the Prior Options Review in the mid-1990s (see Chapter 14) and has

always managed to balance its accounts is in large part due to the skills acquired in accommodating to Rothschild. It is also likely that the very vibrancy that makes the BGS one of the most respected geological surveys in the world now can also be traced to the same source. Adjusting to the impact of Rothschild, however, in order to gain these benefits, was a long and painful process.

In the period 1966 until 1979, the Institute of Geological Sciences went through unprecedented growth. All three of the Directors from this period had striven to increase the impact of geoscientific information on Government policy by broadening the strategic research base. Sir Kingsley Dunham's period as Director began in January 1967 and came to an end on 31 December 1975. Though he actually experienced the growth during his years as Director, in his retirement report on his directorship (published as an annex in Dennis Hackett's report, *Our corporate history. Key events affecting the British Geological Survey, 1967–1998*), he gave the credit for initiating it to Sir James Stubblefield, his predecessor and the last Director of the Geological Survey of Great Britain. It was Sir James who identified the geological survey of the UK continental shelf, an assessment of the sand and gravel resources of south-east England and a major revision of the displays on the ground floor of the museum, as major projects to be developed by the new Institute of Geological Sciences. The new Director, Sir Kingsley Dunham, was able to acquire the funding for all three.

In 1967 the survey of the UK continental shelf was started and the Mineral Assessment Unit was formed to begin the sand and gravel survey in south-east England. A year later the preparatory work was started on the design of 'The Story of the Earth', the striking and innovative exhibition that dominated the ground floor of the museum for many years after. Also in 1968, the Regional Geochemical Survey was started with a pilot study in the northern Highlands. This, the Offshore Survey and 'The story of the Earth' were all funded from the Science Budget. The Offshore Survey was particularly capital intensive, requiring ship hire and expensive data acquisition using the most modern geophysical and drilling techniques. The Mineral Assessment Programme was not funded from the Science Budget, but was paid for entirely by the Department of the Environment.

Prior to this, only the Overseas Programme, which had been funded by the Ministry of Overseas Development, and the work on radioactive minerals, funded by the UK Atomic Energy Authority, had existed as contracts with outside customers. The Mineral Assessment Programme came next, but in the years up to the Rothschild transfer others were to follow. By 1973, contracts had been agreed with the Department of Industry for a major programme of exploration for metalliferous mineral deposits, and for a mineral incentive scheme for industry. Another contract was negotiated with what became the Department of Energy to carry out an assessment of the geophysical and geological results of company research and prospecting in the North Sea hydrocarbon basins. There was, therefore, a very healthy mix of commissioned and Science-Budget-funded research already being carried out in 1973 and there was a clear distinction within the Survey between Science-Budget-funded strategic science and applied commissioned research.

Lord Rothschild wrote his report when he was head of the Central Policy Review Staff. Entitled, *The Organisation and Management of Government Research and Development*, and published in the Green Paper *A Framework for Government Research and Development* (Cmnd 4818), it brought to an end arrangements for funding Government science that had been in place since 1918. Those arrangements were due to the work of Viscount Haldane. In his report, written in the aftermath of the First World War *Report on the Machinery of Government Committee* (CD 9230), he recognised three categories of research legitimately carried out by Government: (1) research done within Government departments for their own purposes; (2) research supervised by departments, but which also met objectives shared by other departments; (3) research for general use, which had relevance to the workings of several departments. Haldane insisted that the last category, which came to be called strategic research, must be developed to its fullest potential, saying, 'Science ignores departmental as well as geographical boundaries', and he warned about the dangers of departmental parochialism in research. It was Haldane's view that the Geological Survey carried out research of general, that is strategic, use. His recommendation was important in influencing the decision to transfer the Geological Survey and Museum of Practical Geology from the Board of Education into the recently created Department of Scientific and Industrial Research.

The DSIR was dissolved on the recommendation of the Trend Committee, and five research councils were established. Their purpose was, 'to develop the science as such, to maintain a fundamental capacity for research, and to support higher education'. In essence they were to support basic and fundamental research. Strategic research was not specifically mentioned as part of the remit of the research councils, but the inclusion of the IGS into the NERC, by implication, did not rule it out.

Lord Rothschild was wholly committed to organising scientific research on departmental lines, funded directly by departments through the customer-contractor relationship. Inevitably, the departments would be primarily interested in applied research. His concession to the need for some underpinning basic research, that was independent of the separately funded Science-Budget-funded research was to recommend a levy of 10% on all government contracts with research councils. This recommendation was never taken up, as all departments refused to pay the levy. Strategic research, which Haldane thought so important, was given no consideration by Rothschild.

A BGS Office Notice, number 9/74, was issued on 10 May 1974 to explain to staff the effects of the Rothschild proposals. In it are some interesting quotes from the Green Paper. Amongst them are:

> (para 2) '… ensure that the organization and management of R and D is logical, flexible, humane and decentralized, the prerequisites of an efficient system.'
>
> (para 6) 'This report is based on the principle that applied R and D, that is R and D with a practical application as its objective, must be done on

> a customer-contractor basis. The customer says what he wants; the contractor does it (if he can); and the customer pays.'
>
> (para 8) '… a major part of the work of … NERC is "applied". But this work had and has no customer to commission and approve it. This is wrong … scientists cannot be so well qualified to decide what the needs of the nation are, and their priorities, as those responsible for ensuring that those needs are met.'

This last quote seems to show that Rothschild did not recognise that there was a strategic element in the NERC portfolio. As a result, difficulties were encountered with departments as soon as consultations on the transfer of funds began between them and the NERC.

During this consultation phase, departments were expected to define the objectives of the research they would commission, while the BGS was left to decide on the way it was to be managed. Rothschild placed no conditions on the use of the money transferred to the customer departments, though it was expected that it would be spent to commission research from the research councils. Significantly, it was money that was transferred, not programmes of work.

When negotiations began, the departments made it clear that, while they recognised that they could not do other than accept existing programmes to begin with, they did not think some of them relevant to their requirements. They proposed to change the programmes in question in directions to be chosen by them in the future. There were no problems with the transfers to the Department of the Environment. Neither was there any difficulty with the Department of Industry accepting the minerals programmes. However, so much money was transferred to the Department of Industry that they had to consider taking on the Continental Shelf Mapping Programme. The Research Requirements Board of the Department of Industry, which had been set up to oversee their R&D Programme, could not see the relevance of the continental shelf mapping to their departmental needs. Eventually, they agreed to accept the responsibility for 85% of the costs, but there was a real fear at the time for the long-term stability of this programme. There was a similar problem in finding a department to fund the Onshore Geological Mapping Programme. This was solved by the formation of a consortium, initially of the NERC contributing 50% of the funds, Department of the Environment 40% and the renamed Department of Trade and Industry 10%. Both of these examples brought into sharp focus a fundamental weakness of Rothschild: to find ways of funding multipurpose and multi-user programmes that all agreed were in the national interest but are not wholly in the interests of any one department.

It is interesting to read what Sir Kingsley Dunham wrote about the Rothschild transfer in 1975:

> The Rothschild tragedy followed the negotiation of these contracts (the Mineral Reconnaissance Programme with DOI, later to become the DTI, and the Hydrocarbons Programme, with what became the Department of Energy). I say tragedy deliberately because in spite of their offensive tone, Victor Rothschild's proposals seemed to me to offer just what we had been seeking — a way to

> establish earth science in its rightful place in government; but much of the good that could have been done has been vitiated by the fatally-wrong un-negotiated figures for the transfers imposed upon NERC. The DOI (and its fission product the DOEn) have been given far more transferred money than NERC can or ought to meet, while the DOE (after all, NERC's main concern is the Environment of Man) far too little. The dire effects of this gross error have largely descended upon IGS, which carries at least 40 per cent more than its equitable share of the total NERC transfers.

The transfer of funds took place over a three-year period, 1973/74 to 1975/76 when the IGS lost £4.049 million transferred to departments. This was 54.1% of the NERC total. In addition to this, the IGS commissioned income for 1975/76 was forecast as £2.65 million. Taken together, Sir Kingsley calculated that this meant that 95% of the forecast cash expenditure for that year was from outside sources. Sir Kingsley added, 'The institute attracts therefore a negligible amount of the Science Vote money available to NERC. It could easily be argued however, that our success in attracting customers is laying the seeds of major difficulties, in which, if Council is to continue to govern and "manage" IGS, my successor will feel entitled to more consideration by ABRC [the Advisory Board for the Research Councils, which governed the research councils]'. He then wrote, 'No-one (from NERC or the Royal Society) was able to moderate this unhappy affair. The figures in the White Paper, though more reasonable than the Green in total, were quite wrong in balance. I still hope that a way can be found to approach Ministers to correct the imbalance; it is a small thing for them, but a potential disaster for us.' He must have had some success because he reported in the Annual Report for 1975, which was the first full year of impact of the Rothschild transfer, that 25% of the IGS budget was from the Science Vote.

As part of the transfer, three major strategic surveys lost most of their Science Budget funding. The Regional Geochemical Survey went to the Department of Industry. The Offshore Mapping Programme went to the Department of Energy, but with the NERC co-funding it with a 15% contribution. The Geological Mapping Programme came under the oversight of a consortium, the composition of which changed from the original proposal to NERC (60%), Department of the Environment (30%), Department of Trade and Industry (5%) and Department of Energy (5%). All three were regarded as core commissions and, later, were categorised as part of the Core Programme in the 1985 Strategic Plan and accepted as such by Butler.

When it came to an end in 1993, the Offshore Mapping Programme lost its funding almost completely. Available Science Budget allowed it to be carried on at little better than care and maintenance thereafter. In 1979 the Geological Mapping Programme, which only fifteen years before had been the raison d'être of the Geological Survey, constituted only 12% of the scientific staff effort. The decline continued when the collapse of the consortium in 1981 led to the loss of 40% of the funding, although the Department of Trade and Industry continued to fund some targeted geological mapping for two or three years afterwards. The

Regional Geochemical Survey, however, was the subject of a transfer of funds from the Department of Trade and Industry to the BGS in 1991/92 and is the only example of a reverse Rothschild transfer within the BGS.

In 1976, Sir Kingsley expressed another fear; that is that the domination of the work programme by ad hoc, short-term investigations would damage the scientific health of the Survey. Twice, pleas were made to Council to recognise that good, short-term applied research cannot be maintained without a living body of basic (or strategic) research behind it and that to sustain it more Science Budget should be made available to the Survey. Council did not appear to hear him. In 1976/77, 87% of the budget was under external control and it was to remain near this level into 1979/80. One of the many effects of this high proportion of commissioned research funding was that it was nearly impossible to maintain a Science-Budget-funded strategic programme. The Science Budget that was available became increasingly used as bridging funds to cover staff time between contracts, and in 1982 the BGS Secretary calculated that not more than two thirds of the Science Budget could be ring fenced for a planned programme of meaningful, long-term strategic project work.

The majority of staff did not notice the budgetary problems facing the Survey. Throughout the 1970s staff numbers continued to climb as the level of commissioned work increased. In 1979 there was a complement of 1200 staff, including 66 staff attached to the Museum, though not all complemented posts were filled. About 700 were geoscientists. The total budget that year was close to £22 million, which is worth £63.4 million at 2000 prices. In terms of staffing and budget, 1979 was the zenith for the Institute of Geological Sciences despite the NERC Council's stance on Science Budget allocations to it. It was only when the impact of the policies of the new Government began to be felt after 1979, and Council refused to compensate the Survey for lost funding as commissions fell away, that difficulties began to be experienced right through the organisation.

In 1983, the Advisory Board for the Research Councils (ABRC) published a report, *A study of commissioned research*, expressing misgivings about the impact of Rothschild on the funding for strategic research. Already, in 1981, there had been a back transfer of the former commissioning funds from the Health Department to the Medical Research Council, and a number of Government reviews had expressed concern about the arrangements for long-term, but directed research. The ABRC report quantified the problem and even identified the geological survey, chemistry of pollutant reactions and land use as three major programmes of national interest that were under threat. Their recommendations, to strengthen R&D policy and programme formulation within departments and to strengthen the ABRC by giving it enhanced authority and responsibilities, were sufficiently weak to be ignored and had no impact.

The BGS Forward Look for 1985 (a statement that used to be prepared annually by the Director on the work programme for the year ahead), written by the Director, Malcolm Brown, starts with the words, 'The continuous and traumatic decline in BGS funding since 1980/81 has no parallel in other

Geological Surveys of the Developed Nations of the world, and few obvious parallels in the less-Developed Nations.' He goes on to say that this cannot be a conventional Forward Look. It must include a request for Council to reappraise the customer-contractor principle, introduced by Rothschild, and its effects on forward planning and the execution of strategic research, scientific initiative within research institutes and career development of staff. He asked that Council should assess the effects on the BGS, over the past four to five years, of a continuous series of large staff reductions, staff relocations, cuts in commissioned research funding, cuts in Science Budget funding and shifts of new expenditure categories to the latter. He went on to say that the Visiting Group (1982–84) had seen much of the effects, but often in relation to what they were expecting from the Visiting Group recommendations of 1978 and what ought to be expected from a rational operative framework, which he claimed the BGS did not have. There can be few other Forward Looks written with such passion.

Calculated at 1984/85 prices, the BGS received £23.9 million from customer departments in 1980/81, which was 80% of the total budget. This reduced to £15.2 million in 1984/85, which was 70% of the total budget. Over the same period, staff levels reduced from 1093 to a target of 919. This was not a managed reduction, but was random and bore no relation to the structure of the expertise base required to staff the programme. There was no managed recruitment plan and it had been necessary to carry out compulsory redeployments of staff from Keyworth to Edinburgh to make up the short-fall in staff there with specialist knowledge in petroleum exploration. The Science Budget over this period had risen to a peak in 1981/82 and had remained stable for three years, but in 1984/85 it was reduced to £6.5 million from £7.8 million in 1983/84. Giving a breakdown of the £6.5 million Science Budget, the Director showed that only £1.53 million had been available for 'other recurrent' expenditure (i.e. indirect, non-staff costs). Out of this had to come all the costs associated with the relocation of staff to Keyworth and for maintaining the Geological Museum, which was about to be transferred to the British Museum of Natural History. The net effect was a reduction of 70% in the other-recurrent funds available for scientific research from the level of the previous year. The programme to eliminate the backlog of maps and memoirs, identified by the 1982–84 Visiting Group as its highest priority recommendation, could not be fully funded even in its first year. The other recurrent cost, as opposed to salary costs, given to the newly formed flagship Information and Central Service Directorate was a mere £40 000. Because of the protection given to the five Regional Geological Survey projects for a three-year period 1982/83 to 1984/85 the other recurrent for the remainder of the Geological Mapping Programme was barely enough to enable them to proceed. The Director's conclusion was that the Science Budget allocation from the NERC for the year 1985/86 had to be restored to what he called the 'low level' of £7.8 million in 1983/84 if there were to be any chance of conducting a sensible programme. Accordingly, he presented a work programme for that level of funding. He wrote this in September 1984. In December he was shown the draft copy of the 1985 NERC Corporate Plan.

The Science Budget was not, by then, a differential between desirable funding levels for BGS and receipts from commissioned research. It had become a fixed sum, which provided no element for overcoming sudden cuts in commissioned research funding, which may occur at or after the beginning of the financial year. Only in 1982/83, in the face of a suddenly announced reduction of £1.6 million commissioned research income, had the NERC compensated the BGS: a sum of £800 000 additional Science Budget had been returned to the Survey, but they laid conditions on its use. In the years to follow, the NERC had higher priority research to fund than the earth sciences, and the BGS was forced to compensate for its loss in commissioned research earnings essentially by cutting costs.

An analysis of the BGS funding for the period 1980/81 to 1985/86 prepared during the strategic planning exercise of 1985 showed that the provisional Science Budget allocation for 1985/86 was in fact £4.5 million, excluding the Keyworth building costs, not the £7.8 million that the Director had requested. Though part of the difference was accounted for by the transfer of the museum, with its 66 staff, out of the BGS that year, there was a real reduction, not an increase. A breakdown of the budget prepared for the Butler Study Group showed that there was only £647 000 available as other recurrent expenditure for 1985/86 to support 268 staff years of effort on the Science Budget programme. This allowed an average allocation of £2000 for each member of staff, which contrasted with the sum of £6 000 per staff member that was said to be required to run an effective programme.

There is no doubt that the first five years of the 1980s were exceedingly difficult for the BGS. Writing about the funding problems facing the BGS in the Preface for the Annual Report for 1982 and 1983 early in 1984, Malcolm Brown stated that he believed that the BGS was close then to a crossroads of crucial importance for its future. Government departments, which either had had few ideas of their own about how to spend the Rothschild transferred funds in the early years after 1973 or had delayed imposing them, had now begun to develop their own research programmes. The collapse of the consortium in 1981 was initiated by the Department of the Environment, which had moved away from single tender action with the BGS to competitive tendering at the same time as deciding that it wished to concentrate its research resources on short-term applied projects. This new assertiveness from the Department of the Environment was a shock. The attitude that 'BGS knows best' in earth science was strongly embedded in the culture and the Department of the Environment, among other departments, had benefited from this confidence in the early days after Rothschild. Suddenly, the departments had developed their own ideas and though it had taken several years to develop, Rothschild's aim, to concentrate the minds of departments on their specific research needs, was now being achieved. There had not, however, been a concomitant culture change in the BGS. In his submission to the Butler Study Group, Dr John Bowman, the NERC Secretary, commented that there were strong indications from Government departments that, though the changes in the level of funding and in contracting arrangements

were largely the result of Ministerial decisions, there was also well-founded dissatisfaction with the performance of the BGS.

The progressive decline in commissioned research income from Government departments, which started from a high point in 1979/80 and has continued to the present, was not regarded sympathetically by the NERC Council. The Director pointed out in the Annual Report for 1982 and 1983 that Council had made it clear to him, when this trend was beginning to be evident, that Council was not going to make up the lost funding with Science Budget and had urged the BGS to seek replacement funding from non-governmental sources. Indeed, in the NERC Corporate Plan for 1985 Council had agreed to set an objective for the NERC as a whole to increase its commissioned research income from 25% to 30% of its total budget. Seen from the BGS, where the proportion had never been less that 70%, this was painfully ironic.

It is clear, however, that there were major inefficiencies in the way the BGS worked at this time. Maybe it is symptomatic of the period that 'annual' reports were produced covering two years each for 1980 and 1981 and 1982 and 1983. The Visiting Group of 1982–84 had clearly identified some of the inefficiencies, and Dr Bowman pointed this out in his submission to the Butler Study Group, commenting that they were much the same as those that had been identified five years previously. The Visiting Group indicated the need for much stronger management by objective and to time, and the need to rethink the methodology and format of providing the output of a national geological survey. Dr Bowman did admit that it was not easy to make changes and to start new initiatives in a time of financial stringency, but the need to do so does become greater the more stringent the funding becomes.

The Corporate Plan, by giving planning figures, provided a degree of stability in Science Budget funding over the five-year period to 1990, though there was no planned increase to offset inflation. The BGS received around £5 million a year each year for four of them. In the fifth, 1989/90 there was a boost from the first of the awards of new money that arose out of the Butler study (see Chapter 6), adding £3 million to a reduced baseline of £3.2 million. With the start of a second award in 1990/91, £5 million was added; then £7 million in the next year and £8 million a year thereafter. The Chancellor of the Exchequer, on receipt of suitable progress reports, had agreed that the value of each award should be added to the baseline for future years. In addition to these, a transfer of £0.82 million from the Department of Trade and Industry took place in 1991/92 to cover the Geochemical Survey Programme. In the following years other adjustments to the SB allocation took place.

In a NERC Establishment Bulletin (No. 36/88) in 1988, Professor John Knill, the NERC Chairman, in his response to the success of Butler, commented that the new money would do little more than offset projected further declines in commissioned and Science Budget funding to BGS. However, it was protected funding and was not available to the NERC to redistribute to other parts of the NERC research programme.

The total annual income for the BGS for the twelve years 1987/88 to 1998/99, normalised to 1998/99 prices by taking account of inflation, shows a range of £31.9 million to £36.6 million (Figure 1). Taking out the two years, 1991/92 and 1995/96, which were unusually successful commercially, the range of income varies less than 10% throughout this period. This remarkable stability on the bottom line belies frenetic activity above it during this period.

Again at 1998/99 prices, commissioned income from Government departments plunged from just over £20 million in 1987/88 to £7.8 million in 1993/94, with a gradual decline from then to £5.85 million in 1998/99. Using the figures from Sir Kingsley Dunham's retirement report (pages 36–37), 60% of the income from Government departments in 1975/76 was transferred Science Budget, the result of Rothschild. In 1979 the value of work commissioned by Government departments was put at £15 million in the Preface to the 1979 Annual Report. At 2000/01 prices this is worth £43.2 million. Assuming that, as in 1975/76, the equivalent of 60% of this was transferred funds the present-day value of lost funding is nearly £26 million. Equally significant, the value of genuine departmental contract work in 1979, that is 40% of the commissioned earnings, was £17.3 million at 2000/01 prices. It is this that has fallen to £5.85 million in 1998/99. Whether or not a case against Rothschild is valid made this way, there is external evidence of a severe deterioration in departmental spending on science. The House of Commons Science and Technology Committee, in a report in May 2000, was severely critical of Government departmental spending on R&D, which they gave evidence to show had been steadily reducing since the mid-1980s. There appears to be abundant evidence in the BGS experience to support this.

The rate of reduction in the total commissioned research earnings since 1987/88 is much less than the rate of reduction in earnings from Government departments. Council's exhortation to find non-Governmental sources to replace lost Government earnings had been heeded. In 1987/88 approximately 18% of commissioned earnings came from non-departmental sources; in 1998/99 it was 67%. Despite this enormous effort, however, the decline in total commissioned earnings has been around 30%. This loss was not made up by Science Budget. The apparent increase in published Science Budget income figures over this period reflects a number of other factors. In 1995/96, the NERC took the decision to transfer funds to its component bodies for them to pay superannuation contributions directly. From 2000/01 the buildings maintenance budget has also been transferred from a budget managed at HQ to the component bodies. Together, these amount to nearly £2 million added to the Science Budget, but not for science. Equally significantly, the NERC began to allow its component bodies to bank excess earnings or underspend at the end of the year, instead of losing them. These are also seen in the published total Science Budget figure. The only genuine increase in the allocation of Science Budget up to and including 1998/99 was when the Treasury's decision to allow adjustments for inflation within the Science Budget was implemented. This was the first time this had been permitted in over a decade. It did little to compensate for the relentless increase in the

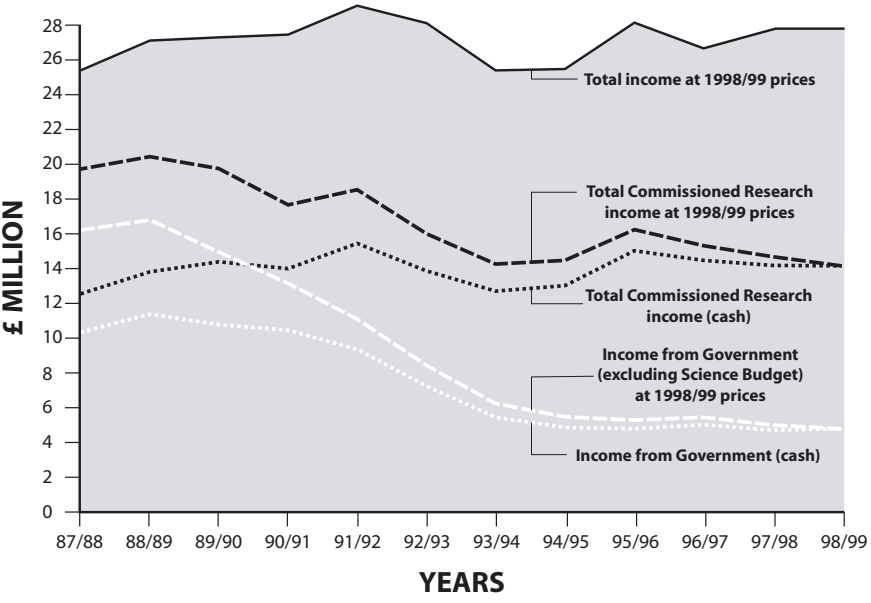

Figure 1 Income for the period 1987/88 to 1998/99. Total income, total commissioned research income and income from Government commissioned research are shown normalised to 1998/99 prices. Total commissioned research and Government commissioned research are also shown at cash value, not adjusted for inflation. Source: BGS finance files.

proportion of the total budget that was taken up with salaries. Staff levels varied quite considerably over this period. They grew from 794 in 1987/88 to an unaffordable peak of 863 in 1992/93. They then fell away to below 800 in 1994/95, and then continued downwards. Another strain on the budget was the gradual increase in the proportion of indirect expenditure in the commissioned research income. Over several years this meant that the amount of commissioned income that was available to pay staff costs declined. Thus, while the total commissioned income dropped by 30% over the period, the usable component (i.e. the proportion devoted to staff costs) fell at a greater rate.

It is difficult to calculate the drop in real value of the total BGS income over the period from 1987/88. It was sufficiently severe for the BGS to develop an action plan for the financial year 1999/00, which involved cutting staff costs by compulsory redundancy, imposing a recruitment freeze and savagely reducing spend on capital and other recurrent expenditure in all areas. At the end of it the Survey is in a healthier position financially than it has been in for many years. However, the staff level at the start of the year 2000, at 754, was the lowest since 1970 and the Survey could still not afford to do any drilling or offshore surveys or geophysical surveys, all of which were in the programme twenty years ago.

Chapter 5

Butler

The Butler Study Group came about as a direct result of the intense political lobbying that took place during the campaign that the BGS organised against the 1985 NERC Corporate Plan. Throughout the campaign, there were three issues that were given prominence: the threat of reduced funding for research in the geological sciences, the proposal in the Corporate Plan to divide the BGS up into five separate bodies under the direct management of a Director of Science based at NERC HQ in Swindon, and the matter of whether the BGS should be removed from the NERC. All three were taken up with different emphases in the weeks immediately after the publication of the Corporate Plan.

Friends of the BGS from all parts of industry and academia wrote to and lobbied Ministers, the Prime Minister and their Members of Parliament, while many BGS staff also made contact with their MPs as a result of the decision to do so taken at the senior staff meeting on 18 January, 1985. All pursued one or more of the three main themes.

The idea of instituting an enquiry to investigate them can be traced back to a speech that Professor John Sutton made in January, but it was a Member of Parliament who can take the credit for making it actually happen.

As early as January 1985, Dr John Bowman issued a warning to staff that they must not make direct representations to Ministers, but because of the wide areas around the numerous BGS offices within which staff lived, many constituencies were covered, including ones held by Ministers. Probably the most important, though, was Rutland and Melton, for which the backbencher Michael Latham was the MP. He was already known to BGS staff who had served overseas, because of the help he provided over the nationality issue. Changes in the laws on nationality from 1970 onwards, in particular, the British Nationality Act 1981, had made a large number of children who had been born overseas when their parents had been serving abroad for BGS ineligible for British citizenship, and he had campaigned on their behalf.

In March 1985 Michael Latham responded to a letter about the NERC Corporate Plan from two of his constituents, by visiting Keyworth to see the Director and other senior staff in order to gain background information. He decided that this was a matter he would take up and wrote a long letter to Peter Brooke, who, as the Parliamentary Under Secretary of State in the Department of Education and Science, was the Science Minister. In the letter, dated 18 March, Michael Latham raised several specific issues for the minister to address, but strongly expressed the view that an enquiry should be set up under an independent expert as soon as possible to study

the fundamental role and purpose of the BGS, including any question of privatisation. He also suggested that the BGS should leave the NERC and deal directly with a Government department, and urged Peter Brooke to discuss the matter very soon with Mr Hugh Fish, the NERC Chairman, and set the enquiry under way.

Mr Brooke's reply came on 30 April. It was fulsome and reassuring. He stressed that the NERC Corporate Plan did not include any plans to destroy geological sciences or the Geological Survey and that the precise reporting arrangements under the Directors of Science were still the subject of discussion and consultation. A meeting of Council members was scheduled for May, when the Director of BGS would be present, to discuss the most critical issue of the management structure for the BGS. However, though he dealt individually with the seven specific points raised in Michael Latham's letter, the one issue to which he made no reference at all was the enquiry.

Lobbying continued. Articles and leaders appeared in both *New Scientist* and *Nature* severely critical of the NERC's handling of the BGS and the geological sciences in general. The President of the Geological Society, writing in the Introduction to his 1984 Annual Report in April 1985, made what he described as a battle cry for the geosciences in which he included support for the British Geological Survey. His contention was that the bureaucratic administration of the NERC appeared to be determined to destroy the scientific autonomy of the BGS. There was a steady flow of letters from the Geological Society, the Institution of Geologists and their members and senior geologists in industry and from overseas, local geological societies and even archaeologists, to Sir Keith Joseph, the Secretary of State for Education and Science, and the Prime Minister.

One of the most damaging incidents to the NERC was the resignation of Professor John Dewey from Council. In his press release of 22 February he said: 'In my view, the fundamental strategic role can be served only by dissociating the British Geological Survey from the NERC, and its Director, traditionally and currently a distinguished earth scientist, to be given line management responsibility directly through the Department of Energy.' He went on further to suggest that a case could be made for transferring the basic earth science support role from the NERC to the Science and Engineering Research Council (SERC).

Michael Latham, in the meantime, started his campaign of Parliamentary Questions. On 29 April, one to the Prime Minister brought a sharp rebuff; but the second, on 21 May, brought a slightly better response from Peter Brooke, the Science Minister, who is reported in Hansard as saying:

> I understand my Hon. Friend's concern, although I cannot go all the way with him on the precise subject of an enquiry. I agree that there is a case for a study into the national needs of geological surveying activities, and I shall ensure that that suggestion is sympathetically considered.

Michael Latham had now a reply to all the points he raised in his letter, but sympathetic consideration of an idea was not the same as implementing it. More work still had to be done to make the enquiry happen.

The NERC Council, however, had now taken the matter up, and at its June meeting the Chairman announced to Council that he was talking to the Chairman of the Advisory Board for the Research Councils about the precise way an enquiry should be done. On 5 July Peter Brooke wrote to Sir Peter Kent, a former Chief Geologist for BP and a past Chairman of NERC, in answer to a letter he had written to the Prime Minister on 24 April. In strict confidence, he told him that there was to be a study of the way geological surveying was carried out. He said that in very broad terms the primary concern of the study would be to establish a considered and authoritative view of the need and demand. He expected that the study would examine in consultation with actual and potential customers (both inside and outside Government departments) the extent to which there is a market outside the NERC for the 'products' of geological surveying. He said it would be necessary to ascertain how much the customers would be prepared to pay for these services. Finally, a view would be formed as to how much of the surveying work would be properly funded from the Department's Science Vote.

During July, Michael Latham asked a series of Parliamentary Questions, most of which were answered by Peter Brooke. His first, however, on 19 July, was to the Prime Minister. He asked her what response she had made to the letter dated 24 April from Sir Peter Kent, and was told that a study of geological surveying was to be carried out, arranged jointly by the Advisory Board for the Research Councils and the NERC. It was now out in the open.

The issue of the enquiry, which Michael Latham pursued so relentlessly, concerned not only whether there should be one, but also the scope of its terms of reference. The BGS wanted them to be broad and address the proposed fragmentation of the BGS, its removal from the NERC and the implied reduction in funding for the geological sciences in the NERC Corporate Plan. Indeed, when Professor John Sutton first raised the matter of an enquiry in a speech back in January 1985 it was with the idea that it should be broadly based and take on such matters. Once NERC HQ had conceded that an enquiry was inevitable it was quick to state its position. Mr Fish took the opportunity to explain it in a letter to Sir Peter Kent, dated 31 July, which he wrote after being sent a copy of Sir Peter's letter to the Prime Minister. He expressed the view that he hoped the continual pressure that the geological community and others were bringing to bear would bring forth the extra resources which were required to improve the wellbeing of geological sciences in the UK. In other words, the NERC was not going to provide it. He also told Sir Peter that there was no enthusiasm in Whitehall for the option of removing the BGS from the NERC and putting it into a Government department. However, there is some evidence from the wording of the letter that the NERC was beginning to back off the idea of splitting the BGS up into five parts and making them answerable directly to the new Director of Science. Sir Peter's response to the Chairman, written early in August, as he said, more in sorrow than in anger, is interesting. He made three brief points. He pleaded that the NERC did not appoint second-rate applicants to the post of Director of Science. Secondly, he expressed fears for the continued existence of a national geological mapping programme if responsibility for it stayed with the

NERC under the present circumstances, and, lastly, he made the point that the post of Director of the BGS had always been a full-time job and could not be done by someone who also had responsibility for university research.

An announcement to the press about the study, giving the terms of reference and membership of the Study Group, was made from NERC HQ, eventually, on 17 October 1985.

The main task of the Study Group was to consider the requirements for geological surveying rather than the structure of the BGS itself, and a consideration of the relationship between the BGS and the NERC was deemed outside the group's formal terms of reference. Michael Latham, however, had not given up on this and wrote to Sir David Phillips, Chairman of the Advisory Board for the Research Councils, about it on 18 September. Sir David's reply, not sent until 21 November, a month after the press release about the Study Group, stated that it would be for the members of the Study Group to decide whether to consider evidence on this subject. The BGS now had an opportunity to raise this matter in the evidence it presented to the Study Group.

The Study Group, under the chairmanship of Sir Clifford Butler FRS, the Vice-Chancellor of Loughborough University from 1975 to December 1985, was established in the autumn of 1985 by Sir David Phillips, Chairman of the Advisory Board for the Research Councils and Mr Hugh Fish, Chairman of NERC. The Study Group's terms of reference were:

> To assess the UK needs for geological surveying over the next 5–10 years — its scale, nature and quality — having regard to the longer-term prospects for public expenditure, and in particular:
>
> 1. To determine the geological surveying activities needed to underpin basic and strategic research in the earth sciences and in other related research funded through the DES Science Vote.
> 2. To determine the scale, nature and quality of geological surveying activities for which customers, including Government departments as proxy customers, recognise a need, and for which they could reasonably be expected to pay.
> 3. To reach conclusions concerning the total resources accordingly required and to suggest the allocation of responsibility for providing them.

The men appointed to the Study Group were chosen because they were not directly or professionally involved in the NERC structure or its management. They were as independent and as impartial as you could get. Sir Clifford was a physicist, Sir Alan Muir Wood FRS an engineer, Dr Charles Suckling FRS a chemist, Sir Frederick Warner FRS a chemical engineer and only Sir Alwyn Williams FRS a geologist. Secretary to the group was Eric Brown, the former BGS Secretary.

Sir Clifford's plan was to collect written evidence up to March 1986. He began by visiting the BGS to speak to the Director at Keyworth in November 1985. In the next three months the Study Group would visit BGS offices to talk to staff and management, carry out the overseas visits and see representatives of

other relevant institutions. He expected to submit his final report in October 1986. Up to June he was on schedule.

Not surprisingly, many of the written submissions received in the early days urged the Study Group to extend their study beyond the guidelines originally set for them and to include the organisational position of the BGS. Consequently, Sir Clifford went back to Sir David Phillips and Mr Fish for advice. The letter he received from Sir David is published in the Report, and Sir Clifford chose to interpret it as giving him the green light to broaden his remit and include consideration of the future institutional arrangements for geological surveying; in other words, whether the BGS should be in or outside the NERC.

The Study Group took evidence from staff, management and the trades unions within the BGS and from a wide range of external sources. Amongst the latter, probably the most influential was the Royal Society, where six of the most eminent geoscientists in the UK met with the Study Group. The Study Group also visited national geological surveys in Australia, Canada, France, United States of America and West Germany. They interviewed the Director of the Netherlands Geological Survey and received written comments from other European surveys. They took account of the work of the Geological Survey of Northern Ireland and considered the possible role of universities and polytechnics in geological surveying.

From the beginning, the NERC strove to prevent the BGS from submitting its 1985 Strategic Plan to the Study Group as evidence. Gordon Smith and David Gray, had prepared an abridged version of it specifically for use in situations such as this. On 5 August 1985, well before the announcement was made of the establishment of the Butler Study Group, Dr Bowman wrote to the Director after having been sent a copy of the abridged version. He wondered what the BGS now intended to do with the document and said that some comments coming to him from staff in the BGS and in other institutes led him to believe that the document was causing a certain amount of disquiet. He said, ‘So far as I am aware the document has no official status and has not been approved by anybody’. He suggested that it might be helpful in the present circumstances if it was made clear to all concerned, as well as to those who prepared it, that it is a document for discussion and had not received any official blessing whatsoever.

Malcolm Brown’s reply was immediate. He explained that the abridged version that had been prepared from the full Strategic Plan would be sent to interested parties on the understanding that it did not yet reflect official policy, but was a paper of ideas. He further said that it was a substantial item of evidence that could be rapidly produced for any review body that may ultimately be set up to consider the future of the BGS. Dr Bowman’s reaction to this, when the Butler Study Group was up and running, was to inform Director that he was not allowed to use the Strategic Plan as evidence. In response, Innes Lumsden (Plate 3), who became Director on Malcolm Brown’s retirement in October 1985, rewrote the annual Forward Look for 1986. This incorporated all the main elements of the Strategic Plan and was allowed as evidence. It became Annex 10 in the Butler

Plate 3 G I Lumsden, Director from 1985 to 1987.

Innes Lumsden was born on 27 June 1926 in Banchory. After taking a degree in Geology in Aberdeen, he joined the Geological Survey of Great Britain in 1949, serving on the field staff in the Lowlands Unit based in Edinburgh. He became District Geologist of the South Lowlands Unit in 1970; Assistant Director for the Land Survey of Scotland and Northern Ireland and officer in charge of the Scottish offices in 1980; and Deputy Director 1982 to 1985.

report. To make doubly sure, however, the Union Side, which claimed some degree of ownership of it, having started the process off, based their submission to the Study Group on it. This was presented by Tony Reedman. Sir Clifford and his colleagues liked it immensely. After all, over sixty hours of meetings of the Strategic Plan Working Party, and many additional hours of staff time spent preparing and discussing contributions to it, represented a massive investment of time and thought in the very subject they were investigating.

Sir Clifford did not finish his report on schedule. By October 1986 it was announced that it would be late, but was still expected by Christmas. Final papers from the BGS were still being prepared and the Study Group, at that stage, had plans to hold further meetings with the Royal Society as well as the NERC. When there was no sign of the report early in 1987 various individuals contacted their MPs about it. Eventually, a message came out of the Department of Education and Science that the report was due to be presented to the chairmen of the Advisory Board for the Research Councils and the NERC in the spring of that year. The report itself is dated March 1987 and advance copies were distributed among NERC officials, Council members and the main customer departments during that month. No one in the BGS, even the Director, was allowed to see a copy and the trades union (IPCS) Branch Chairman protested about this to the NERC Secretary, Dr Eileen Buttle, asking to see a copy. Her reply was that only a proof copy without appendices had been distributed. The report was scheduled to go to the ABRC meeting on 1 April. After that it would go to the Secretary of

State for Education and Science accompanied by the NERC and ABRC response to it. He alone would decide on publication. The NERC/ABRC response recommended publication, but there was a general election on 11 June, causing several weeks of delay, and the report was not published until 8 July.

The summary of the recommendations runs to 55 paragraphs, starting with the words:

> After consideration of the evidence given to us, and with the benefit of our own investigations, we are satisfied that the British Geological Survey (BGS) is an important national resource but that changes are necessary if it is to make its full potential contribution.

The report recommended that the BGS work programme be divided into three parts: a 'Core Programme', a 'Responsive Programme', both more or less as described in the 1985 Strategic Plan, and a 'Scientific Programme'. This last was to be funded by grants from the NERC Science Budget and a 20% surcharge put on contract work carried out for Government departments. It was an attempt to get the departments to comply with a requirement of the Rothschild transfer to pay a 10% levy on the commissioned research contracts in order to fund underpinning research. Among the many other recommendations were:

- The BGS should give first priority within the Core Programme to the development of the National Geosciences Data Centre.
- The Core Programme should be managed as a three-year rolling programme.
- The Core Programme should be publicly funded by an annual earmarked grant of £15 million at 1985/86 prices which should be reviewed annually.
- The Core Programme should be financed in part from earnings derived from the sale of data and services.
- The BGS should be allowed to undertake contract work within the Core Programme up to £3 million p.a.
- The earmarked grant for the Core Programme should not be reduced on account of income from the Responsive Programme.
- There should be an additional grant of £0.75 million for three years to help meet the cost of voluntary early retirement.
- The BGS should have its own corporate identity.
- The BGS should be managed as a provider of an essential service needing research to maintain its quality and not as a research institution providing service as an extra.
- The Director of the BGS should be its Chief Executive and should be regarded as HM Government's principal adviser on geological matters.
- There should be a Board of the BGS, responsible for both policy and management, with an independent part-time chairman appointed by the Prime Minister.
- The membership of the Board should include the Director, three or four of the most senior members of the full-time staff plus the Director of Earth Sciences as a non-executive member. Other non-executives should stand in

their own right, rather than be representatives. Assessors should be drawn from the important Government departments.

- The Board of the BGS should be close to Government and not separated from it by intermediate layers of management. The Board should be permitted to submit proposals for the funding of major and important new projects at the time of the annual budget review.
- The BGS should be established alongside, and on a broadly similar basis to the Ordnance Survey; that is, outside NERC, thus ensuring that it would be close to Government, with direct access to a senior Minister.
- Until such time as the latter could be arranged the BGS should become an independent corporate body receiving grant-in-aid from the Department of Education and Science or possibly NERC.

Interestingly, the Study Group picked up two difficult issues that had also been troublesome to the Strategic Plan Working Party. One was the matter of funding for the mapping of the continental shelf. The Strategic Plan firmly placed this activity in the Core Programme, but, because it was funded by a commission from the Department of Energy, a category of core-commissioned projects had to be devised for it. Butler agreed that this work was appropriate for the Core Programme, but suggested that either the Department of Energy should continue to pay for it or the funding should be transferred back to the BGS. They also picked up on the geomagnetism issue, suggesting that this and, perhaps, global seismology, were not appropriate for the Core Programme. They recommended that a detailed investigation, carried out by independent earth scientists, might find that they and some other research projects might be better transferred to a separate research programme or even outside the BGS.

Most BGS staff were impressed by the report. The Study Group had taken up all the main issues that they had been fighting for and had found in their favour. No one could accuse the Study Group of not being impartial. There was, therefore, a high level of expectation that the recommendations of the report would be implemented. It was evident also why the report had taken such a long time to appear. Sir Clifford had been concerned that if they were to recommend that the BGS were to be taken out of the NERC, the Study Group had to find an acceptable home for it. They discovered early that there was no obvious home in any Government department for the BGS because of the breadth of its remit. Talks with officials in several departments revealed that most seemed to be unwilling to take on the extra burden of the BGS. This was the time of the Government's drive to reduce public spending by cutting the size of the civil service. Although there had been some privatisations at that time, policy regarding the development of Government agencies was not fully developed. The Ordnance Survey was effectively a small department with a budget directly from the Treasury, but responsible to Government through the Department of the Environment. This was the Study Group's preferred option for the BGS, though they considered variations on it. It had the advantage of

making the BGS free standing within Government, without tying it in to any one department.

The NERC had proceeded with their plans for a centralised management structure, and Professor J C Briden had been appointed to the post of Director of Earth Sciences in March 1986. By then, the argument over the proposed fragmentation of the BGS, which had been fought hard by Malcolm Brown, with the strong support of many influential people in the community, appeared to have been won. In any event, the recommendations of the Butler Study Group were strongly against both fragmentation of the BGS and the introduction of the additional tier of management implicit in the new NERC structure. Butler was also disapproving of the downgrading of the post of Director from Grade 3 to Grade 4. Professor Briden, therefore, headed a management structure that had a unified BGS under him. He wrote to all staff on publication of the Butler report pointing out the very obvious opportunities offered by Butler, but also signalling the dangers. The fairly obvious one, that the BGS might be taken out of the NERC from under him, he did not mention. However, he did say that the Department of Education and Science was now taking the lead on it and would be discussing the report in Whitehall and elsewhere. Again, this was good news for staff, who feared that the report would stick at the Advisory Board for the Research Councils, and it confirmed information published in an Office Notice in June 1987 that submission to the Minister was delayed by the general election. Independent confirmation that Whitehall was, in fact, dealing with the report came in October, when Malcolm Rifkind, the Secretary of State for Scotland, wrote to a member of staff who lived in his constituency to say that the Department of Education and Science was considering the report and was involved in wide-ranging discussions with departments which had major contracts with the BGS, including the Scottish Development Department. Then, in October 1987, Robert Jackson, who had become Science Minister after the general election, said, in answer to Parliamentary Questions from Michael Latham and Sir Trevor Skeet, that a statement would be made by the Secretary of State for Education and Science when the consultations were completed.

The BGS had to wait until November 1988 for the consultation process to be completed and the promised announcement made.

Chapter 6

Post-Butler developments

Although the Butler report was not released until July 1987, it had been seen by the NERC and the Advisory Board for the Research Councils in March and considered at a meeting of the latter on 1 April. It is from then that the decision-making process began. Gaining the Minister's approval to publish was straightforward, but the next step was much more difficult. The decisions of Government were whether or not to accept the report and what actions to take as a result of it. It was by no means evident that the Government, with its developing policies on privatisation and its determination to reduce the size of the public service, was predisposed towards accepting the report, and the fate of the BGS hung in the balance for a substantial period of time.

The key issues within the report were the source of funding for the Core Programme and whether or not the BGS should be taken out of the NERC. The Department of Education and Science could deal with neither of these on its own, because most of the options that could be considered involved other departments, including the Treasury. The decision-making process began with the preparation in April of the NERC response to the final draft of the Butler report. In general, the NERC welcomed the report, but there were significant reservations. They did not accept the recommendation to establish a Board for the British Geological Survey. Instead they favoured a Programme Board to manage the Core Programme. Neither did they believe that Butler's Science Programme should be managed within the BGS. Council had already, that year, taken the decision to remove the Isotope Geology Unit from the BGS and make it a free-standing research facility within the NERC. In the light of that sort of thinking Council would certainly regard a Science Programme to be out of place in the BGS. There were other, relatively minor matters of disagreement, but there were two major ones. The NERC did not accept that the BGS should be removed from within NERC and they did not accept that the Director of BGS should be the Government's principal advisor on geological matters; this was a duty of the newly created Director of Earth Sciences.

The NERC position, therefore, was already set when Professor Briden, the Director of Earth Sciences, announced that there would be open meetings to discuss the report in Keyworth and Edinburgh immediately after its publication in July. He invited written comments on the report from staff who were unable to attend them. Independently of these, there were divisional and unit meetings throughout the BGS to discuss it. The reaction of staff in general was to accept

the report, but there were pockets of resistance. There was no unanimity in the Overseas Directorate, and the Geochemistry Directorate was unhappy about withdrawing from the NERC. The unions were not entirely happy either, harbouring some unease about the consequences of leaving the NERC and adopting the Ordnance Survey model. A small group of members of the strategic planning team and staff side, under the chairmanship first of Brian Kelk and then Richard Howarth, when Brian Kelk was ill, was set up by Innes Lumsden, who was then the Director, to coordinate the BGS response to the report. At the first coordinating meeting, held in Keyworth on 15 July, it was agreed that a letter should go out to all MPs as a matter of urgency and that a press statement on the BGS reaction to the report should be put out. An official statement prepared by the coordinating group contained no sign of any hesitation about accepting either the criticisms levelled at the BGS in the report or its recommendations. It was not, however, put out.

After the July publication, Sir Clifford Butler wrote to the President of the Geological Society suggesting that geologists in the community at large should have an opportunity to discuss the report. An open meeting was arranged by the Geological Society at Burlington House in London on 9 November. Professor Bernard Leake was now the President of the Society. He had been a NERC Council member until 1984 and chaired the 1982–84 Visiting Group to the BGS. During the campaign against the NERC Corporate Plan he had expressed his support for the BGS position, condemning any attempt to centralise power at NERC HQ and accusing the NERC of mismanagement of the BGS. He was particularly upset that the 1985 Corporate Plan did not seem to acknowledge his Visiting Group report. He had not forgiven the NERC for not allocating the extra resources to the BGS that he had asked for to enhance the Geological Mapping Programme and to clear off the publications backlog that the Visiting Group had identified.

The meeting was attended by about 100 Fellows of the Geological Society and non-Fellows. Among them were academics, industrial geologists, members and former members of BGS and NERC staff, including three retired Directors of the BGS. There were also representatives of Government departments and the Cabinet Office. Professor Leake, Sir Clifford, Professor Briden, Geoff Larminie (Plate 4), who had taken over as BGS Director from Innes Lumsden in September, and Professor Howel Francis, an ex-member of BGS staff, gave presentations from the platform before the meeting was thrown open to discussion.

Professor Leake opened the meeting by outlining the deteriorating financial and organisational circumstances that had progressively led to a run-down of the Survey's ability to conduct systematic geological surveying and manage the National Geosciences Database, a situation with which he was familiar through his chairmanship of the 1982–84 Visiting Group. Sir Clifford then presented a summary of his report. Professor Briden spoke next. He tried to downplay what he called the constitutional issue (whether or not the BGS should remain in the NERC), but his main message was that the publication of the Butler report was

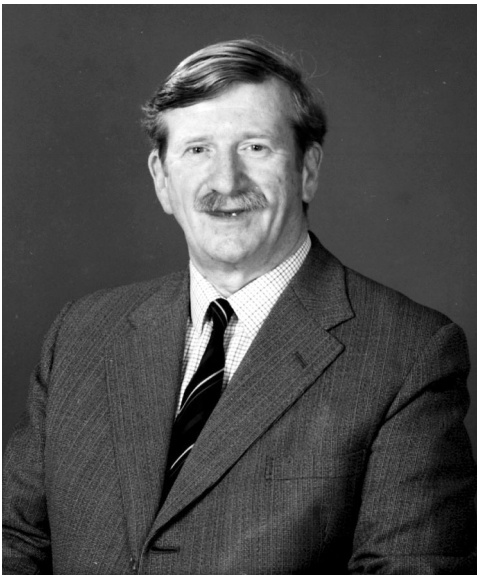

Plate 4 F G Larminie, Director from 1987 to 1990.

Geoff Larminie was born on 23 June 1929. He graduated in Geology from Trinity College Dublin in 1954 and gained his MA in 1972. He worked as an assistant lecturer in geology at Glasgow university 1954 to 1956 and as lecturer in Sydney 1956 to 1960, before joining BP in 1960. He worked in the Exploration Department all over the world, including Alaska, until 1974. Thereafter, in sequence, he was: in the Scientific Advisory and Information Department; General Manager, first of the Public Affairs and Information Department, then of the Environmental Control Centre; and External Affairs Coordinator, Health, Safety and Environmental Services. He left BP in 1987. He served on NERC Council from 1983 to 1987 and received the OBE in 1971.

only the start of a process. Government had still to be convinced that the country needed a geological survey and it was vital that those present at the meeting took every opportunity to provide evidence of support for the BGS that the government would accept. He was well placed to know what was going on in discussions in Whitehall and this was a warning that all still could be lost.

Geoff Larminie, whose first task on appointment in September had been to prepare a paper with Professor Briden on a proposed BGS Core Programme, for consideration by the Department of Education and Science, gave an outline of the proposed programme, costing it at £22.7 million a year. He said, in no uncertain terms, that these monies must be dedicated, non-transferrable, untouchable by anyone but the BGS for ten, preferably 15 years. It was ambitious, by any standards, but was clearly the start of a bargaining process.

The issues that were put to the meeting, then, were whether the country wanted and needed a geological survey; what resources were required to do the job and how adequate funding on a stable basis was to be obtained. The mood of the meeting was good. It was clear that the geoscience community in general supported the report, and the chairman's summary, published in the Proceedings of the Geological Society shortly after, included a statement that this message should be taken away from the meeting by those representatives of Government present. Taken in conjunction with powerful support from the Royal Society, this

meeting demonstrated the virtually unanimous approval of the Butler report in the geoscience community.

The Briden-Larminie paper for the Department of Education and Science, drafted in September, was refined over a period of several months. Its progress was overseen by a group of officials from the NERC, BGS and the Department of Education and Science. By November, the key issue had come down to funding the Core Programme. Practically every other recommendation became subservient to this one. Butler had identified a need for a total of £18 million for the Core Programme. Of this, £15 million, he proposed, should come by direct grant in aid; £3 million would be from core commissions. At the time there were two of these. The Offshore Survey had been funded largely first by the Department of Energy, then later by the Department of Trade and Industry (DTI). The Regional Geochemical Survey was funded by the DTI. Butler had accepted both as legitimate core activities, regardless of their source of funding. Briden and Larminie refined the definition of the Core Programme given in the Butler report and addressed some of the shortcomings in Butler's costings, but they also added Airborne Geophysical Surveys, which made a significant difference to the basic costs, and considered accelerating the Regional Geochemical Survey by introducing an element of co-funding for it from the Science Budget. They calculated a requirement for £22.7 million at full economic cost (FEC). (Accounting in NERC is based on the concept of full economic cost, which is calculated by adding to the total salary costs for the scientists employed in NERC a sum to cover all overheads. The amount added in the 1980s was usually more than the value of the salary costs.) Their breakdown was:

Onshore surveys £11.2 million
Offshore surveys £3.2 million
Geochemical surveys £1.0 million
Hydrogeological surveys £0.9 million
National geophysical surveys and monitoring £2.9 million
National Geosciences Data Centre £3.5 million

The National Geosciences Data Centre (NGDC) was the newly developed facility for containing the BGS data holdings and managing the sale of data and information. It was intended that it should ultimately become self-funding, though no time scale was attached to this.

The NERC Corporate Plan gave a planning figure of £7 million Science Budget, and about £3.5 million had been identified as core commissions from the departments. Plugging the gap between this identifiable total of £10.5 million and the requirement for a fully viable Core Programme now became the preoccupation of all who were involved. It was generally agreed that a Core Programme of less than £16–17 million FEC was not viable. If it were to become as low as £10 million it was thought that the BGS, as an institution, would not be viable.

The matter of whether the BGS should be in or out of the NERC was sidelined until the funding issue could be resolved.

Towards the end of the year the Chief Scientific Adviser to the Cabinet Office, John Fairclough, asked the Department of Education and Science for information on the funding issue for consideration by the influential Economics (Science and Technology) (Official) Committee of the Cabinet Office (E(ST)(O)). He also came to visit the BGS on 14 January 1988. The paper for E(ST)(O) was prepared by Department of Education and Science officials from the Briden-Larminie paper, but it covered a far wider canvas than the content of and level of funding for the Core Programme. Various questions were put to members of the BGS Directorate by the Director, for him to provide input into the draft paper. There were questions of detail and philosophy on the functionality of the BGS, questions about the relative proportion of a future work programme that would be devoted to capturing new data, re-interpreting old data and offering advice or selling data. Options for a scaled-down Core Programme were also considered. Issues such as whether systematic surveys could be replaced by survey on demand and whether it was necessary for the whole country to be surveyed were raised, not for the first or last time. Both of these were to be raised again and again through the 1990s. Inevitably the paper also had to present arguments concerning the privatisation or dismantling of BGS as well as about funding sources for the Core Programme. The final paper was submitted to the March 1988 meeting of the E(ST)(O) committee.

The first quarter of 1988, when this paper was being prepared, was decision time. One option for funding the Core Programme was to persuade the departments who benefited from it to transfer some of their funding to NERC to cover part of the cost of the programme. It was clear even in March that the departments were not enthusiastic about doing this, even though they had strong views, expressed to the Department of Education and Science, on what should be in the Core Programme. Although this option continued to be pursued until later on in the year, the conclusion reached by the Department of Education and Science after the E(ST)(O) meeting was that they were most likely to succeed in raising funds to cover the gap through a bid for a Public Expenditure Survey (PES) award, prepared by the Department of Education and Science. The Public Expenditure Survey was the name given to the annual process by which Government departments put in their bids to the Treasury for the funds they required to carry out their activities in the year ahead. The research councils were included in this process and often used it to bid for additional funds for special projects. Their bids went first to the Advisory Board for the Research Councils and then to the Department of Education and Science. The Department itself was responsible for bidding to the Treasury for the total Science Budget that was allocated to the research councils. If the Department were successful in acquiring the new money, it would be delivered to the BGS through the Science Budget but it would be regarded as separate from it and effectively be ring-fenced for this use only. The Department's view was that, this being so, the BGS would have to remain located within NERC even if special arrangements were made, such as ring-fenced funding overseen by a Programme Board. Thus, the

solution to the funding problem brought with it a solution to the problem of governance.

At the debriefing at the Department of Education and Science, following the March E(ST)(O) meeting, attended by Mr Hugh Fish, the Chairman of the NERC, Professor Briden, Geoff Larminie and Cabinet Office representatives, it was made clear that the main issues of funding had not been resolved, but the idea of dividing up the BGS work programme into Core, Responsive and Research programmes was apparently agreed. The Director, therefore, announced to staff that the work programme for 1988/89 was going to be planned on that basis.

The papers prepared up to this point were then used by the Department of Education and Science as a source for drafting the PES bid. The closing date for the 1989/90 financial year was in May 1988. The Core Programme was to be funded by a combination of a direct grant of Science Budget from NERC, additional monies from the PES award and core commissions. The idea of persuading any departments to transfer any of their funds to the BGS was abandoned. The two programmes that were regarded as core commissions, the Offshore Survey and the Regional Geochemical Survey, were to be left as such. However, indications were given as early as December 1987 that the Department of Trade and Industry was prepared to arrange a Rothschild back transfer to the BGS/NERC to cover the continued cost of the Geochemical Survey.

The PES bid went forward, but even after it the question of closing down or privatising the BGS did not go away. As late as August Geoff Larminie was required by the Department of Education and Science to prepare a paper on the case for and against privatising the BGS. He could find little to say in its favour.

Near the end of August, Kenneth Baker, the Secretary of State for Education and Science, wrote to John Major, Chief Secretary at the Treasury, to explain his PES bid. He stressed that it was unusual in that it was a bid made on behalf of several departments, but the main purpose of the letter seems to be to say that he was considering revising downwards the figure he had asked for in the submission he had made in May. John Major was not impressed. He concluded that the Core Programme was of low scientific research priority and unless other colleagues (presumably from other departments) were prepared to finance it from their own provisions it (the Core Programme) ought to be closed down so that money could be switched to research of higher priority. The rest of the BGS should continue on a fully self-financing basis. Had this happened, the BGS would have been put in a very difficult position. Funding the BGS Core Programme did not come high in the NERC's spending priorities and it is unlikely that much more than £5 million a year would have been forthcoming from that source. At this level of funding, strategic science would have withered to a point below viability. The Commissioned Programme may even have been separated out and hosted in a privatised body. This is exactly what had happened in Sweden in the early 1980s. The part of the Swedish story that was known in 1985 was reported in Butler's report; yet here the BGS was facing a potential re-enactment.

There is no documentation in BGS files to indicate what happened to change John Major's mind, because on 7 November Kenneth Baker, gave a written answer in the House in response to a question from Michael Latham, in which he reported the award of the PES money to the BGS. It is worth repeating both question and answer in full as quoted from Hansard in BGS Office Notice 23/88.

> **Mr Latham**: To ask the Secretary of State for Education and Science whether he is yet in a position to announce his decision on the proposal that the British Geological Survey should cease to be under the auspices of the Natural Environment Research Council; and whether he will make a statement.
>
> **Mr Kenneth Baker**: Yes. As Sir Clifford Butler's report recognised, the British Geological Survey is an important national resource whose primary function is to meet national surveying needs. It will remain within the responsibilities of my Department and as part of the Natural Environment Research Council. But changes and developments are needed. I accept the concept of a core programme of surveying as recommended by Butler; and within this, the centrality of the National Geosciences Data Centre. Further work is needed to define that programme, having regard to the priority needs of users both in the private and public sectors; and to examine the Survey's future financial and funding arrangements, including such matters as charging for goods and services. Pending completion of this further work, I am making available for the Survey, through the NERC, an additional £3 million in 1989–90, with planning additions of £4 million in 1990–91 and £5 million in 1991–92. These planning figures will be subject to review in the normal way through the Public Expenditure Survey.

This new money was to be added in the first year to the £3.2 million Science Budget identified in the NERC Corporate Plan. There is some confusion about the actual amount that the NERC was intending to give to the BGS that year. A planning figure of £7 million was identified the previous November. This was reduced to £5 million later. The confusion is about whether these high figures included the costs associated with the development of the Keyworth HQ, which was not then finished. They probably did, because £1 million was added to the designated £3.2 million for the closure of the Gray's Inn Road office in London.

In a NERC Establishment Bulletin (36/88) issued immediately after the announcement, Professor John Knill, the NERC Chairman, announced that NERC had decided in principle to set up a Programme Board to determine priorities and monitor performance of the Core Programme. It was to be in place by January 1989.

Kenneth Baker's announcement contained the message that the BGS was to be subjected to a further review to look into matters relating to charging for goods and services. The inference was that this award was only part of the settlement and that, subject to a good report from this review, there would be more. One of the first tasks of the new Programme Board was to frame a second PES bid.

The BGS had always sold its maps and memoirs and, since 1984, had charged for dealing with small enquiries. There was also a well-established

Commissioned Research Programme. The issue that emerged from Butler, and which figured large in much of the correspondence with the DES that followed, was the one of making the National Geosciences Data Centre self-financing. Indeed in the E(ST)(O) paper it was stated that the BGS should aim to increase earnings both from the UK private sector and abroad (via NGDC and 'profits' from contracts), provided the Core Programme was not harmed. The consequent increase in income could allow the NGDC to pay for itself. It was clear to everyone who had looked into it that the huge resource of data and materials held by the BGS was under-exploited, but the question of how to generate a greater income from it had not been properly addressed. Thus, when the November announcement had been made the Charging Review began.

The Charging Review team was made up of officials from the Treasury, Cabinet Office, the Department of Education and Science and the NERC/BGS. The only member of staff from the BGS to take part was Dennis Hackett, the BGS Secretary. This was the least transparent of the review groups to look into the affairs of the BGS during this period, its report having been submitted as a private paper to the Secretary of State for Education and Science. The Review Group carried out the most intense scrutiny of the Survey's finances that there had ever been. It first met in January 1989 and came to Keyworth on 2 February 1989. This was a day of familiarisation for the review group, divided between presentations by BGS staff in the morning and a full meeting of the group in the afternoon. One of the Treasury members was Colin Farthing, who raised, again, the idea of abandoning strategic geological surveys in favour of surveying on demand to be paid for directly by customers. When this whole affair was over and an award made that was much lower than that requested, it was joked that 'BGS asked for millions and were sent a Farthing'.

The Charging Review Group finished its work in May and its report accompanied the PES bid that had been prepared by the BGS Programme Board. For the Board, this was a baptism of fire. In the first few months of its existence it was tasked to plan a Core Programme for implementation on 1 April and draft a PES bid for enhancement funding for its highest-priority activities. Unlike the first, which was a general bid for funds to support the Core Programme, prepared by the Department of Education and Science, the strategy for this PES bid was very specific. There were five elements to it: to gain funds to enhance the National Geosciences Information Service (NGIS, the renamed NGDC), to accelerate the Onshore and the Hydrogeological Surveys, to restore the Geophysics Programme after funding had been transferred out of it to supplement other, higher-priority parts of the Core Programme, and for a building programme. A total of £21 million was requested, spread over three years, of which £3 million was for new building. Among the proposed building programme was a map and book store that would enable the BGS to sever its increasingly expensive links with the Ordnance Survey, who, at that time, rented space to the BGS to store all its map stocks. The bid was approved by Council on 18 May and went to the BGS Programme Board on 24 May.

Among the many detailed comments and recommendations that would enable the BGS to improve its income-generating capability, the Charging Review concluded that the Survey could not be supported solely by levying charges on its user community. It agreed that a contribution from the Science Budget was justified. The generally supportive report led to Government making a second PES award, this time of £6 million over three years. It was announced by the Secretary of State on 15 November with the words, '… to put BGS on a sound long-term footing through a once-and-for-all investment in the National Geological Information Service (sic) … to stimulate the generation of outside income which can be reinvested in core surveying activities'. The full details came in a written answer to a Parliamentary Question recorded in Hansard on 22 November:

> **Mr Hanley**: To ask the Secretary of State for Education and Science if he will make a statement on the funding of the British Geological Survey.
>
> **Mr MacGregor**: Last year, pending further work on defining the British Geological Survey's (BGS) Core Programme and its future financial and funding arrangements, an additional £3 million was made available in 1989–90 with planning additions of £4 million in 1990–91 and £5 million in 1991–92. I have now considered the outcome of this work conducted by the BGS Programme Board and by a group of officials, from relevant Government Departments and the Natural Environment Research Council (NERC), and have concluded that the Survey has the potential to generate more of its income from the users of geological information, and that this should be the source of any funds needed to accelerate the rate at which it conducts its core surveying.
>
> In order to facilitate this process, I am providing additional investment for the National Geosciences Information Service, to allow better access to, and marketing of, the survey's geological information and its interpretation. I am therefore making available to the survey, through the NERC, a further £1 million in 1990–91, £2 million in 1991–92 and £3 million in 1992–93. With these once and for all additions, the Science Budget income to the BGS should provide a secure base for the development of the Survey's activities in the years ahead.

It was clear that this was all that the BGS was going to get. Once and for all meant just that. After each of the two three-year periods covered by the two PES awards, the final annual sum was added to the BGS baseline funding, making a total, at the end of four years, of £8 million. In both cases, agreement only came after the receipt by the Secretary of State of a satisfactory report on the performance of the BGS.

The only question that now remained in the mind of the BGS management was whether success for the BGS would mean that the NERC had the freedom to reduce its Science Budget allocation to the BGS in the light of the increased earnings. It appeared from the way that the Department of Education and Science had dealt with the first bid that the award would be ring-fenced, but, ever distrustful, BGS sought reassurance. The question was publicly answered in a speech by

Robert Jackson, the Science Minister, at the ceremony on 11 July 1990 when the Keyworth site was renamed the Kingsley Dunham Centre. The full text of the speech was published in the winter 1990 issue, volume 16, number 4, of *British Geologist*, the magazine of the now-defunct Institution of Geologists. He said that funds generated (from commissions) for the core activity would be additional to the Science Budget funding of the Core Programme and not in substitution to it. He further said that this would also apply to funds received from the EC.

It was a major victory for the BGS. Additional funding had been secured, effectively to implement the 1985 Strategic Plan, albeit modified by the Butler report, the Briden/Larminie paper and the Programme Board. The fragmentation of the Survey had been prevented. The only one of Butler's original recommendations not to be realised was removal from the NERC — a move which, in the light of all subsequent developments, had lost much of its relevance, anyway.

CHAPTER 7

The Joint BGS/Academic UK Geological Mapping Committee

The establishment of the Joint BGS/Academic UK Geological Mapping Committee in 1985 came about as a direct result of a recommendation of the 1982–84 Visiting Group. The Visiting Group's aim was to bring to bear the knowledge and skill that they believed resided in the geology departments of UK universities to help with the enormous task of bringing the 1:50 000 geological maps of the UK up to date. This was not the first time that a Visiting Group had made such a recommendation. The Visiting Group to the Geological Survey and Associated Units in 1974, which was part of the 1974–1978 series of visits, had recommended in its report to Council in September 1975 that 'IGS pursues the use of university teams, on the lines of the contract with Exeter University, to increase production of maps'.

The BGS had been involved with universities in collaborative mapping projects since 1966, letting contracts for mapping in south-west England and the Scottish Highlands, but had incorporated mapping done independently by university staff and researchers in maps for some time before that. An early example is the Dulverton 1:50 000 sheet (294), incorporating mapping carried out between 1957 and 1961 by staff at Bristol and London universities. It was compiled in the early 1960s and published in 1968. The Harlech sheet (135), published in 1982, contained mapping carried out by C A Matley and T S Wilson and published in the *Quaternary Journal of the Geological Society* in 1946, as well as the work of two research students from Aberystwyth University who worked alongside the BGS mapping team. Some such maps were characterised as Provisional Sheets, because they were not the result wholly of modern BGS mapping and were based on incomplete 1:10 000 map cover. Provisional sheets produced since 1990 are compilations, which may have no or very little modern BGS mapping.

The take up in the BGS after the 1974–78 Visiting Group recommendations was not significant. Both the South-west England and Highlands & Islands field units continued to let mapping contracts at more or less the same level of overall funding after the 1974–78 Visiting Group report as before it. No other field units had joined in. Professor Leake, the 1982–84 Visiting Group chairman, had taken up this existing idea, but had pursued it much further after having been impressed by the way the French geological survey, the Bureau de Recherches Géologiques et Minières (BRGM), had integrated the universities into their mapping programme. He wished for something similar in UK, being motivated by a desire to see universities help the BGS complete mapping the

UK and for university staff and students to benefit from close collaboration with the BGS mapping staff. He broached the idea well before publication of the group's report, and in June 1983 the Director set up a working party to review the use of university staff and research students in field mapping. The working party, which consisted of Ramues Gallois, Wally Mykura and Tony Wadge, under the chairmanship of Gordon Smith, the Chief Geologist, reported in September 1983.

The BGS working party, looking into the involvement of university staff and students in field mapping, first examined six cases where this had already happened. Starting in 1966, these were all contracts that had been let to universities specifically to carry out mapping and produce geological maps. The six sheets were: Newton Abbot (339) and Tavistock (337), carried out by Exeter University; Aberdeen (77) and Ellon (87W) carried out by Aberdeen University; and Pitlochry (55SE) and the Great Glen project carried out by Liverpool University. All but one of the research assistants working on these projects were post-graduate students working for PhDs. Except for the students working on the Tavistock project, none were trained in field mapping by the BGS, although in the case of the Pitlochry and Great Glen projects the university supervisor had started his career on the BGS field staff, mapping in the Highlands. There was a BGS liaison officer for each project.

All the contracts were regarded as having been cost effective, but only three of them were judged to have been successful. In each of these three cases there had been unique circumstances that made it difficult to develop a model for future projects from them. Criticisms that were levelled at the projects included poor-quality mapping, which, in one case, was so bad that the BGS refused to release the 1:10 000 maps to the public and printed the 1:50 000 map only under pressure from NERC HQ. Problems with one of them, however, were attributed to poor specification and contract management by the BGS.

In tacit acceptance that these early experiences provided lessons for future improvement in contract management, the working party looked positively for a way forward. However, they were not at all convinced that there was sufficient expertise in geological mapping left in British universities. In the early 1980s, geological mapping, though still being taught in many undergraduate courses, was diminishing as an element of research projects as the emphasis in research shifted towards more specialised, often laboratory-based enquiry. This meant that the resource pool of academic staff who had up-to-date experience in field mapping was reducing in size. The working party was also concerned about the quality of mapping produced by a research student compared with that of a fully trained professional member of the BGS mapping staff. However, it was clear from all six contracts that an additional and very significant factor was that all the students experienced a conflict of interest between the need to complete a map and the more pressing need to get a good PhD. The latter often required the students to explore avenues that led away from mapping, while the needs of the contract brought them, often reluctantly, back to it. Furthermore, once the

students had finished their theses and had moved on into the world of employment there was no way that the BGS could call on them to complete unfinished work. The ultimate success of a project commonly depended on there being a dedicated staff member in the university department, who was both willing and able to finish off the project if students left work incomplete. The working party concluded that letting contracts to universities to operate independently was not a good idea and suggested that the way forward was to integrate university-based researchers into BGS projects, rather in the way that was taking place in the Regional Geological Surveys. They identified three ways of doing this:

- university staff would provide specialist expertise alongside BGS mapping staff
- a limited number of PhD students, doing mapping, could be incorporated in the BGS mapping team, and
- in certain areas of igneous and metamorphic terrain, requiring specialised structural and geochemical expertise, university-based teams could carry out the mapping independently of the BGS.

The working party also looked carefully at the experience in France, where the Bureau de Recherches Géologiques et Minières (BRGM), had collaborated well with universities since the early 1960s. In contrast with the situation in Britain, they found that there was still a strong geological mapping element in French universities and there was no shortage of willing staff to collaborate with the BRGM. However, the BRGM also drew expertise from industry, other government research bodies and their own retired staff. The BRGM had set a target of completing map cover at 1:50 000 scale for the whole of France in 30 years, starting in the early 1960s. There were 1128 1:50 000 sheets, each between 500 and 600 km^2 in area. Their working scale was 1:25 000, but they did not release to the public any maps at larger scales than 1:50 000, except in urban areas or where they had carried out special contracts. Each map was accompanied by a descriptive booklet, between 30 and 60 pages long, which was printed the size of the folded map and sold with it in a plastic envelope. Their average rate of progress was about 40 sheets a year. In 1982, when only 27 sheets were produced, there were 200 individual outside collaborators involved in the mapping programme. Half were from the universities and 80% of these were staff, not students, a point that seemed to have been overlooked by the NERC when it set up its own scheme. There was no quality control of university mapping until the manuscript 1:50 000-scale map reached the BRGM. University personnel were not given any field training by the BRGM and there were no field inspections, but they were issued with base maps, examples of geological maps and a 240-page book of rules for map preparation.

The mapping procedures followed by both the French universities and the BRGM staff contrasted markedly with the disciplined approach taken in BGS. In the BGS the mapping scale was, and is, 1:10 000; considerable use is made of the BGS records and archives and there is very strict quality control on the whole

procedure. The speed of mapping in France was also fast, and the working party concluded that the quality of their end product compared more closely with the, essentially, reconnaissance one-inch maps produced in the UK during the primary survey prior to 1884 than to the modern 1:10 000 survey. In the light of this and the other observations made about the way the French worked it was evident that there was little scope for bringing their practices to the UK.

In November 1983 Professor Leake wrote to the Director with an outline brief for a Joint BGS/Academic UK Geological Mapping Committee. He proposed that its responsibilities were to advertise and then assess proposals from Universities and Polytechnics to undertake geological mapping in the UK, to approve suitable proposals and monitor progress up to the publication of map and report. Priority would be given to those areas that had not been mapped for 100 years. Contracts would be for whole or part sheets. Close links with the BGS were to be encouraged, and the BGS would be asked to provide short training courses. Director passed the letter to Innes Lumsden, at that time Deputy Director of the BGS, who replied in January 1984. His letter had been put together using evidence from the working party report as well as from responses from the BGS Assistant Directors to these more specific proposals. Their reaction, predictably, varied from outright rejection to the idea to more moderate opposition. In a letter that Malcolm Brown wrote in June 1985, when the exercise was under way, he summarised the BGS view rather neatly by saying, 'My belief is that basic mapping is a BGS job, being specialised in method and technique; long-term in nature; interdisciplinary between regions; heavily dependent upon the large BGS databases; related to much commissioned work; and often rather dull for a research student to undertake'. In his letter, Innes Lumsden presented similar arguments. He did not, however, reject the idea of university collaboration, but gave sound reasons for not proceeding with the idea of contracting universities to complete whole maps. Instead, the alternative approach of integrating university staff and students into BGS multidisciplinary projects was proposed, as a much more modern and acceptable way forward.

The Visiting Group report, which came out three months later, appears to have made no concessions to the views expressed by the BGS senior management. The recommendation to set up the Joint BGS/Academic Committee was accepted by Council, apparently without modification. While it might be expected that the BGS senior management would be defensive about such as this, the men on the working party were highly experienced field staff and their report is carefully objective. There appears, however, to have been little interest in listening to them at the NERC HQ. On 28 January 1985, Dr John Bowman, the NERC Secretary, visited Exeter to deliver a presentation on the Visiting Group report. Ramues Gallois prepared an unofficial note on the meeting. In it he reported that, during the discussion afterwards, Dr Bowman explained that NERC intended that by the year 2000 there should be modern maps and explanatory booklets for all those parts of the UK that the Visiting Group had declared were inadequately covered by modern geological mapping. He emphasised that if the BGS could not do this alone then it must find

ways of collaborating with the universities or any other suitably qualified bodies to help them do it. Thus, from this uncompromising position, the Joint BGS/Academic UK Geological Mapping Committee started its work.

The committee was inaugurated as a result of decisions taken at the September 1984 meeting of NERC Council. It comprised a chairman and nine members, three of whom were academics, three from industry and three from the BGS. The committee was appointed by NERC Council, serviced by HQ staff, and it was to report to Prep Group A. There were to be two meetings a year. Funding was requested by the Visiting Group from a source other than the BGS Science Budget allocation. Their preference was for the programme to be given Special Topic status. While BGS senior management were prepared to accept university participation in their mapping programme, under conditions that they thought would lead to success, they were extremely upset by the proposed arrangements, which effectively set up an independent geological survey under the management of Prep Group A.

The first committee meeting took place on 18 February 1985 under the chairmanship of Geoff Larminie (who was later to become BGS Director). The BGS members were Innes Lumsden, Wyndham Evans and John Hull for the first meeting. John Hull was replaced by Gordon Smith after that, but all three of the BGS Assistant Directors were to retire before the end of 1987 and be replaced by other BGS senior managers. At the first meeting, papers were presented outlining the BGS mapping programme and identifying those areas that required resurvey, but the discussion was wide ranging and it appears that agreement was reached that the university projects should be 50:50 collaborative ventures with the BGS. An invitation to tender was sent out to all British universities in June by NERC HQ staff, which did not reflect this point. Though NERC HQ was challenged about the way that it had interpreted the conclusions of the first meeting when framing the invitations to tender, there was no satisfactory outcome to the BGS. It was always suspected that NERC HQ was operating to a different agenda from that of its own mapping committee.

Interestingly, not all geology departments welcomed this initiative and there were letters to the Director and to the NERC in reply to the invitation to tender, stating their opposition. Several reasons were given, amongst which was a reluctance to take part in any exercise that might lead to a lessening of the strength of the BGS and do damage to the mapping programme. The chairman of the committee of heads of geology departments (CHUGD) also opposed the plan and was reported in the newspapers, under the headline ‘NERC face “on the cheap” survey row’, as saying that strategic mapping should be handled by the professional staff of the BGS, not by university research assistants. Regardless of opinion in the NERC and the Visiting Group about the efficiency with which the BGS conducted its mapping programme, no one ever questioned either the quality of the maps produced or the high degree of professionalism of the staff making them. The timing of the invitation to tender was not good. It coincided with a period of intense lobbying by the BGS against the 1985 the NERC Corporate Plan and drew more opprobrium on the NERC, when it could have done with less.

The closing date for bids was the end of September, and the committee met to draw up a short list in October, but it was not until the November meeting of Council that a funding level of £150 000 per year was agreed. Because of the adverse publicity, the committee chairman agreed that, to ensure that the tender-assessment exercise was carried out scrupulously, the chairmen of NERC's Geological Sciences Research Grants and Training Awards committees should be added to the full Mapping Committee to make up the tender board.

After much correspondence and discussion between potential contractors and BGS managers, six contracts were let, to start on or after 1 April 1986. Each was let to a named individual within the university, who was to be responsible for the conduct of the contract. Interestingly, five of the successful bids were from departments that had had a previous association with the BGS and with whom there was already a good level of mutual understanding. Ultimately, it was this that enabled them to succeed. The contracts were:

- Foyers sheet (73E), City of London Polytechnic
- Yell, North Shetland, Liverpool University
- Ballater sheet (65E), Aberdeen University
- Bardsey sheet (133), University of Wales, Cardiff. To start 1 September 1986
- Cader Idris sheet (149), University of Wales, Aberystwyth
- Trevose Head/Camelford (335/336), Exeter University. To start on 1 June 1986.

The total value of these contracts at the point of letting was £355 000, but all of them were the subject of contract variations, including some initiated by the BGS, and eventually cost more.

Much of the lengthy correspondence between the BGS and the potential contractors that preceded the lettings was about the detailed content of the contracts, all except one of which the BGS accepted. The exception was Trevose Head/Camelford, to be done by Exeter. The Tavistock contract, which had been independently set up between BGS and Exeter University in 1977, was still incomplete, at that time, and BGS was in dispute with Exeter over the quality of the work. In the light of this the BGS senior management considered that it was unwise to let another contract to Exeter. The committee, declaring its independence of what was initially meant to be a collaborative exercise to help the BGS meet its strategic mapping commitments, thought otherwise and Exeter got its contract.

The aim of each of them was to produce a 1:50 000-scale map from 1:10 000 maps and write an explanatory text. This was called a sheet description in the tender documentation, a term not used in the BGS, and not defined in terms of length or style. At the end of a contract, the contractors were required to present to the BGS: the field notebooks, 1:50 000 progress maps and the manuscript reductions, 1:10 000 standards drawn to BGS specifications, open-file reports for each of the 1:10 000 standards, all specimens of rocks, minerals and fossils, a typescript of a sheet description and one copy of any thesis produced. Bardsey

was a fifteen-month contract, which, if successfully completed, the committee agreed was to be followed by a contract to map the adjoining Pwllheli sheet (134). The contracts for Trevose Head/Camelford and Foyers were, initially, for four years, but all the others were for three. Ballater, Cadair Idris and Trevose Head/Camelford were joint projects in which the contractor was responsible for part only of the sheet. The BGS was to map the remainder and collaborate with the contractor on the compilation of the 1:50 000 map and the writing of the sheet description. Foyers, Yell and Bardsey were fully independent, with no expected input from the BGS other than to publish the maps and sheet descriptions. In all cases, a member of BGS staff was named as a Liaison Officer. There was no job description for this post and each person did it differently. The Superintending Officer, who effectively ran the programme, was a NERC official.

When the phase one contracts had started, Geoff Larminie, now BGS Director, took a decision to reinstate the memoir, which had been abandoned on recommendation of the Visiting Group. As a result, each contract was amended to replace the requirement to write a sheet description with one to write a memoir.

In all, eighteen contracts were let in the period April 1986 to January 1990 (Table 1). Eight were independent mapping projects; seven were joint mapping projects with the BGS and there were three special projects with no mapping element. One of these was to investigate the Holocene deposits in the area around Great Yarmouth. Let to the University of East Anglia, it was meant to contribute to the Great Yarmouth sheet mapping project carried out by the BGS, but it became out of phase with the mapping, which was finished ahead of the contract. One other was let to Birmingham University to establish a resistivity soundings database. The third was let to the BGS to develop a database of geology PhD theses containing geological mapping. The total value of all contracts was £1.4 million, though this does not reflect the full cost. Excluded are the BGS overhead costs, which the BGS would have had to carry if they did the mapping themselves, and the costs of publication and printing. Part of this was to be met by the NERC separately later.

In 1993, a review of the programme was carried out by a panel under the chairmanship of Dr R Chaplow, a member of the BGS Programme Board. It concluded that the programme had been a success and that its objectives had been broadly achieved. It was declared to have been cost-effective and to have produced high-quality maps; the science spin-off to the academic community had been, in some instances, significant and of high quality; and relations between the BGS and the academic community had been enhanced. There were some caveats, however. The production of maps and memoirs had been disappointingly slow, flaws in the organisation of the programme had been evident in the early stages, and there had been no significant increase in the manpower pool of trained geological mappers. The panel recommended that the committee be disbanded and replaced by a new Advisory Committee on BGS/University Collaboration. This was to be a committee of the BGS Programme Board with the task of seeing to completion those contracts not yet finished, as well as setting up new

Table 1 Details of mapping contracts let to universities as at July 2000.

Sheet	University	Status	Start date	End date	Map published	Memoir published
Foyers, 73E	City of London Polytechnic	Independent	4/86	8/92	3/96	Abandoned
Ballater, 65E	Aberdeen	Joint	5/86	8/89	12/95	In press
Cadair Idris, 149	Aberystwyth	Joint	6.86	2/90	3/95	4/95
Trevose Head and Camelford, 335/336	Exeter	Joint	6.86	3/91	6/93	2/98
Bardsey, 133	Cardiff	Independent	9/86	—	11/93	4/94
Pwllheli, 134	Cardiff	Independent	—	9/91	6/99	In press
Yell, 130/131	Liverpool	Independent	4/86	—	3/94	5/94
Unst and Fetlar, 131	Liverpool	Independent	—	3/95	11/99	With editor
Rum, 60	Durham	Independent	7/89	12/92	8/94	2/98
Ambleside, 38	Leeds	Joint	2/87	2/91	11/95 Solid	3/00
Ambleside, 38	Liverpool	Joint	5/89	7/92	—	—
Ulverston, 48	Leeds	Joint	5/90	4/94	3/97	In press
Keswick, 29	Liverpool	Joint	5/89	7/92	10/98	In press
Schiehallion, 55W	Manchester	Independent	7/89	9/94	9/99	In press
Glenshee, 56W	Aberdeen	Joint	2/90	4/94	3/97	In press
Tongue, 114E	Durham	Independent	1/90	—	3/96	In press
Loch Eriboll, 114W Eastern part Provisional	Durham	Independent	—	3/93	3/00	NA

collaborative ventures. This recommendation was, in many ways, unavoidable. NERC stewardship of the programme had failed, other than at the highest level of financial oversight. Day-to-day contact with the contractors had been by BGS liaison officers, who took up all other management matters, often nursing troubled contracts through to ultimate success. A sum of £150 000 a year was proposed to fund the new arrangements, to be provided by the Earth Sciences Directorate of the NERC. In the event, £100 000 of the BGS Science Budget was set aside for this purpose each year, the projects being regarded as part of the Core Programme. The NERC, however, did make a contribution to the costs of completing the projects left over from the original committee.

The conclusions of the review panel, while truthfully reflecting their findings, gloss over a number of important issues. In terms of cost-effectiveness, for example, it is true that the programme delivered maps and memoirs more cheaply

than the BGS, but the relationship between cost and quality is not taken into account. The cheapest and probably most successful of all the projects were those carried out by Dr Henry Emeleus in Rum and Dr Derek Flinn in the Shetland Isles. In both cases a lifetime of knowledge and experience was being captured for the cost of a small amount of fieldwork and the preparation and publication of the maps and memoirs. The Schiehallion (55W) map and memoir, also an independent contract, captured a lifetime of work by Dr J Treagus of Manchester University. Among the others, the most successful and most easily managed were the joint projects and of these the best were those with the highest proportion of university academic staff time in them. The most outstanding of these in terms of operational efficiency and quality, which compared directly with a map produced by the BGS, was the Ulverston contract, carried out by an academic, Dr N J Soper, and Iain Burgess, a retired member of the BGS field staff. This bears out the experience in France, where such combinations are common among their collaborative projects. In terms of cost, however, this project was only cheaper than if it had been done by the BGS because of the lower overhead costs attached to universities, which, unlike the BGS, do not necessarily reflect the true level of their overheads.

Rather less successful, except for Schiehallion, were those projects that were left entirely in the hands of the contractors. Amongst those, the worst were those that were carried out primarily by research students. In the contract for the Foyers sheet, let to the City of London Polytechnic, some of the original mapping was found to be so poor that it had to be redone. A 1:50 000 map was delivered, but the memoir was abandoned. This is the only case of non-delivery in this whole programme.

In general, it was the memoirs that caused most problems. These are high-quality BGS products and they pass through rigorous quality control. Even when the first draft is well written, the manuscript is subjected first to scientific then general editing, each time requiring the authors to work on the text. Later, each proof has to be checked. Almost without exception it is these later stages that were difficult to manage and caused long delays in the production schedule. The original intention of the Visiting Group was that this stage should be included within the project schedule. This reflected their lack of understanding of the complexity of map and memoir production and the approval chain that all BGS publications have to pass through. Had it been possible to tie in the university contractors this way there would almost certainly have been fewer delays in completion of the publications.

The explanation for these conclusions contains no surprises; indeed they were identified by the working party in 1983. All the staff, students and post-doctoral research assistants (PDRAs) were accustomed to a large degree of academic freedom and for various reasons some either had difficulty with accepting the discipline required to collaborate with the BGS or would not accept it. The PhD students, quite understandably, wanted complete freedom to pursue their research in a way that was dictated by them and their university supervisors and,

as hardly any of them had experience of mapping before they began, their approach varied and usually lay outside the norms for a BGS mapper. Training in field mapping was provided for many of the students, but there was no substitute provided for the close supervision given to new recruits into the BGS.

In general, PDRAs were using this opportunity to improve their CVs and their chances of gaining permanent employment. It was not at all uncommon in the 1980s to find PDRAs in their middle and late 30s on their third or fourth contract with a university, still searching for a full-time job. They wanted peer-reviewed publications from their contracts with the BGS and sought controversy. The BGS, on the other hand, had to ensure that each map that was produced joined up with its neighbours. There had to be consistency in the stratigraphical classification and nomenclature used on all the sheets and the characterisation of the drift deposits had to conform to BGS practice. Both of these were causes of conflict between the BGS and the PDRAs.

With regard to the academic staff, there was often a problem caused by the scheduling of their input, even within the specified limits of the contract. If they were retired this was usually manageable. After the end of the contract, when proof checking was needed, its priority was invariably low. The Pwllheli contract is a good example. It was let in 1987 and the memoir, though now written, was not in print in July 2000.

In the end, the conclusions of the 1983 working party on academic input into the mapping programme were vindicated. The review panel, in choosing to wind up the Mapping Committee, made recommendations on the conduct of its replacement that ensured that all future collaborative projects were fully integrated into the BGS Core Programme. The new committee consists of one member of the BGS Board, one academic and one member of the BGS senior management. A secretary is provided by the BGS Central Directorate Support Group. The committee makes two annual calls for proposals from universities. There has been a great diversity among the projects undertaken. They have ranged from geological mapping and compilations of whole 1:50 000 Provisional sheets through to follow-up research into specialised areas. They have been carried out by both university staff and research students. The first of these projects was started in September 1993, before the new committee formally came into existence. Including current (at August 2000) projects, there have been a total of 69 collaborative ventures since then and 47 studentships have been arranged through this scheme.

It has to be acknowledged that both the BGS and the universities learned a good deal from each other about how to operate these contracts during the period 1986 to 1993, and this had been to the direct benefit of the successor programme. It is unfortunate that interference by NERC HQ during those years probably slowed the learning process considerably and ultimately contributed little of benefit to the development of good relations between the BGS and the universities.

Chapter 8

Strategic planning, 1988

A considerable amount of activity took place in the interval between the submission of the Butler report and the announcement in the House of Commons by the Secretary of State for Education and Science in November 1988 on the outcome of the Government's deliberations on it. Amongst it was the preparation of an update to the 1985 Strategic Plan. The decision to revise the 1985 Strategic Plan and then to develop an operational plan from it, the latter to be subject to annual revision, was taken formally at an ad hoc Directorate meeting on 14 January 1988. The meeting had been called immediately after a visit to Keyworth by the Chief Scientific Adviser to the Cabinet Office, Mr John Fairclough. The Working Group was to be chaired by Brian Kelk, who had chaired the 1985 Strategic Plan Working Party. The group was to be given three weeks to prepare a draft for discussion by the Directorate. The other members were Chris Browitt and Don Mallick, both of whom had been on the 1985 team, Neil Chapman, Group Manager for Fluid Processes, Chris Deegan, Programme Manager for Hydrocarbons (Offshore) (who was, in fact, replaced by Mike Dean, also of Hydrocarbons (Offshore)), Judy Parker, from the Hydrogeology Research Group, Tony Reedman from the Wales Research Programme and Byron Lintern from the Southern Scotland and Northern England Research Programme, who was secretary.

The terms of reference given to the Working Group were:

1. Taking into account the developments of the geosciences and their applications, the report of the ABRC/NERC Study Group into geological surveying (Butler), and the BGS/NERC submission to DES on the composition of the Core Programme (the Briden-Larminie paper), to update the Strategic Plan produced in 1985.
2. To make recommendations on any redirection or re-emphasis of expertise required to pursue the strategy, particularly with respect to the Core Programme.
3. To report, in draft form, to Director, BGS by 8 February 1988.

The group met on 21 and 28 January and 3 and 4 February. Written submissions were requested from staff and the trades unions; 22 submissions were received and considered.

The draft document that went to the Directorate contained revised terms of reference for the BGS and quite a radical restructuring of the Core Programme. The Working Group argued that because geological surveying was, above all, an

integrated multidisciplinary activity it was scientifically more realistic to divide the Core Programme into units that reflected this rather than the essentially monodisciplinary units that had emerged in the 1985 Strategic Plan, Butler and the Briden-Larminie paper. They divided the Core Programme into:

Multidisciplinary regional surveys
Nationwide survey and monitoring activities
Geosciences information system
Strategic research and development

In a letter to the Director accompanying the draft plan, the chairman of the Working Group listed a number of issues that were on the fringes of the group's terms of reference, but which the group wished him to draw to the Director's attention. These included improving project management, giving greater financial and managerial responsibility to project managers, appointing a committee of the Directorate to oversee the Core Programme, improving the efficiency of office management, the introduction of a package of incentives for the increasing number of short-term contract staff being recruited and the development of a policy for selling BGS expertise via the Responsive Programme.

There was an inescapable logic to the approach they had taken in subdividing the Core Programme, and it was to be taken again in the 1999 Strategic Plan, but with a different outcome. The fringe issues also have a modern resonance, though they were not taken up at the time. The draft plan, however, when it went to the Directorate, was received somewhat impatiently. A radical change like this, though attractive, was not what the first term of reference required them to make and was not politically wise at that time. Government was still considering the Butler report and the last thing that the BGS should do at that stage was to publish a revised Strategic Plan containing a completely different structure for the Core Programme from the one Butler had put to Government.

The draft went then to the three Chief Scientists, John Mather, Richard Howarth and myself, with a brief to produce a second draft, which kept to the Core Programme structure recommended by Butler. The second draft was put to the Directorate for comment early in March; a third and final draft was then assembled and signed off by 30 March.

The document was then considered by the Director, Geoff Larminie, and the Director of Earth Sciences, Professor Briden, who could not agree what to do with it. The 1985 Strategic Plan was never published and there were indications that this one would also be suppressed. Eventually, the Director took a unilateral decision and ordered the Strategic Plan to be printed. It was published in November 1988. The date given under the Preface, 17 November, is just over a week after the announcement on Butler by the Secretary of State for Education and Science. This timing was crucial. NERC Council had already agreed to establish a Programme Board to oversee the BGS Core Programme and its first act was to define the programme. The appointment of the Programme Board was not to happen until after the Parliamentary announcement. Geoff Larminie was

determined that the Programme Board's agenda should be set by the BGS. With masterly timing, he put the Strategic Plan into the public arena before anyone else could react.

The final document differed in only minor ways from the draft prepared in March. It was much shorter than the 1985 version, being less concerned with making the case for a new programme structure and more concerned with its content. The Core and Responsive programme definitions presented were more concise than in the 1985 version and became the quoted ones thereafter. Thus the Core Programme was said to comprise those long-term strategic activities that are the proper concern of an established national geological survey. The Responsive Programme, which is underpinned by the core, is a variable, evolving programme of applied work, largely carried out on commission, in response to the short-term requirements of Government and other publicly funded bodies.

Possibly the most important part of the new plan was in the revision of the terms of reference for the BGS. Two modifications in particular reflected a considerable change in thinking in the three years since the 1985 plan was prepared.

The 1985 terms of reference were for the Core Programme alone, not the whole of the Survey. Thus the fifth term started with the words, 'To maintain the capability to carry out applied and other geological work on commission for Government departments …' In other words, there must be a capability to carry out a Responsive Programme maintained within the Core Programme, even though there may never be a Responsive Programme. In 1988, it was decided that the terms should be changed to include in them the requirement actually to do a Responsive Programme, therefore making the terms of reference applicable to the whole of the BGS. The wording, therefore, was changed to, 'To conduct, and maintain the capability to do appropriate applied and other geological work, on commission, for the Government departments and national bodies both in the UK and overseas'.

The second important change was with regard to carrying out commissioned research for the private sector. This was an issue raised in the Butler report, which clearly did not strike a chord with Government thinking, as it was emerging, or with NERC Council. Butler said, 'We see advantages in extending it (the Responsive Programme) into the private sector, although the Survey must not thereby endanger its ability to give well-informed independent and impartial advice to Government on geological matters. The BGS should not compete with private consultants through unfair use of its privileged position as recipient of data, nor for commissions for which it is not especially suited'.

This sentiment became reflected in the modified terms of reference, given in the new Strategic Plan. It was now recognised that the BGS was going to have to work increasingly for the private sector and a new term, the eighth, was added, 'To conduct, and maintain the capability to contract for, work with the private sector …' A caveat was added, more or less reflecting Butler's concerns. The separation of this statement from the term of reference about the Responsive Programme reveals the extent of the sensitivity about working for the private

sector. The Responsive Programme was still seen essentially in the post-Rothschild sense as work carried out for the public sector and not as the totality of the Survey's commissioned research.

Another significant change was in the second term. The new one read, 'To interpret the geological structure and evolution of these areas using the results of the surveys and related studies, *and to evaluate such resources of the onshore and offshore areas as may be timely*'. The part in italics was added in part to appease the BGS minerals lobby, which had never been happy about minerals being omitted from the 1985 Core Programme.

The only contentious issue taken up by the Working Group was how to deal with the Butler Study Group recommendation to establish a Science Programme in addition to the Core and Responsive programmes. The Strategic Plan Working Group could not agree with this concept, for mainly practical reasons, and decided that an element of R&D should be embedded within the Core Programme. Much of it would be conducted within programmes and projects, but they recommended that a separately identifiable portion of the Core Programme, to carry out forward-looking R&D in which new equipment, expertise or methodology will be developed and tested, should be overseen by the Chief Scientists. They regarded externally funded basic research as a component of the Responsive Programme.

With regard to the Core Programme itself, the plan follows the Briden-Larminie paper of 1988 with six main components:

Onshore surveys
Offshore surveys
National geochemical surveys
Hydrogeological surveys
National geophysical surveys and monitoring
National Geoscience Information System

The seventh part was to be the strategic R&D Programme.

The plan covered required legislation to make the BGS the designated national repository for all geoscience information, training, quality control and assurance, laboratories and other facilities and contracted-out services, but the main new area covered, as required by the second term of reference, was the skill base. The 1985 Strategic Plan attempted to cost the proposed Core Programme, but did not look at the skill base required to carry it out. The funding issue had been taken up in the Briden-Larminie paper, but the skill base had not hitherto been addressed. The Working Group identified a number of areas in which the BGS was in short supply. These included field mappers, macropalaeontologists, hydrogeologists, engineering geologists, seismic interpreters, economic geologists, computer scientists, numerical modellers, organic chemists, specialists in remote sensing and electronic engineers. They also commented on the effect of the high ratio of scientific to support staff, pointing out that it had serious consequences on, for example, data entry into the Information System.

Work on an operational plan dominated April, culminating in a costed plan being submitted to the Directorate at the end of the month. A fifteen-year view was taken, essentially because this was the time that was estimated in 1984 to be needed to complete geological mapping to modern standards. The plan was to increase spend over three years and then plateau. The components of the Core Programme identified in the Strategic Plan were closely followed. The financial input was constrained by the knowledge the BGS had of the NERC Corporate Plan planning figures and estimates of commissioned income. At that stage, there was not even a hint of any PES award, let alone its magnitude. Best-guess expenditure for the whole of the BGS in the period 1988/89 to 1990/91 was around £20 million a year. The operational plan came out with a requirement of over £33 million a year for the Core Programme alone, a 50% increase on the figure in the Briden-Larminie paper accompanying the PES bid.

As a planning exercise this was next to useless. The six Assistant Directors, who had taken part in it, had presented wish lists rather than objective demands constrained by financial reality. The detailed programme they had developed was ambitious and could probably not be done with the available staff resources, anyway. Operational planning was suspended after this until the autumn, when it was expected that firmer financial planning figures would be available.

Like the first Strategic Plan, the 1988 version covered a wide range of issues, nearly all of which were subsequently ignored, but the central element in both was the definition of what should be included in a Core Programme and this was not ignored. Because of the timing of the publication of this plan, the Core Programme described in it became the basis for the programme that the Programme Board eventually implemented.

Chapter 9

New Director, new structure: the first two matrices

Every Director since, and including, Sir Kingsley Dunham has reorganised the BGS. Indeed there are very few years in the last thirty-five when some sort of adjustment has not been made to the structure. Though there are arguments both for and against regular institutional reorganisation, there seems to be an inevitability about new incumbents within the Director's office feeling a compulsion to try to shape the organisation in their own image. Each of the major reorganisations has coincided with a maturing of thought by a new Director and, usually, there have been minor readjustments in between these.

Until Malcolm Brown's reorganisation, the fundamental management unit in the Survey had been the unit, usually, but not always managed by a Senior Principal Scientific Officer (SPSO). Subsequently this management rank was renamed Grade 6 and is now Band 3. Several units were grouped together to form a division, each of which was managed by an Assistant Director (AD), who also served on the BGS Directorate, the name used for the Survey's executive board or committee. Changes such as there had been before Malcolm Brown were generally fairly superficial. Geographically defined units, such as the components of the Land Survey, which carried out the Geological Mapping Programme, underwent boundary changes; units were merged and broken up, and the groupings of units that constituted divisions were frequently changed.

There were two types of unit: discipline based and programme based. In his retirement report, reproduced in Dennis Hackett's history *Our corporate history. Key events affecting the British Geological Survey, 1967–1998*, Sir Kingsley Dunham described the Survey in the period up to 1976 as a matrix, in which these two types of unit comprised the two axes. Discipline-based units included Palaeontology, Petrology, Hydrogeology, Geochemistry and so on, while units like those comprising the Land Survey, Continental Shelf Programme, Overseas Geological Surveys, Bulk Mineral Assessment Programme etc. were programme based. The divisions themselves matched this classification reasonably well until 1975 in that only one of them contained units from both of the axes defined by Sir Kingsley. The anomaly was the Radioactive and Metalliferous Minerals Unit, which was included in the Geochemical Division alongside three clearly discipline-based units. The responsibilities of the ADs, however, were not in any way constrained to meet the requirements of a matrix management system. For example, three ADs were in charge of regional offices and had under their management the administrative, cartographic and other staff, who, strictly speaking, belonged to

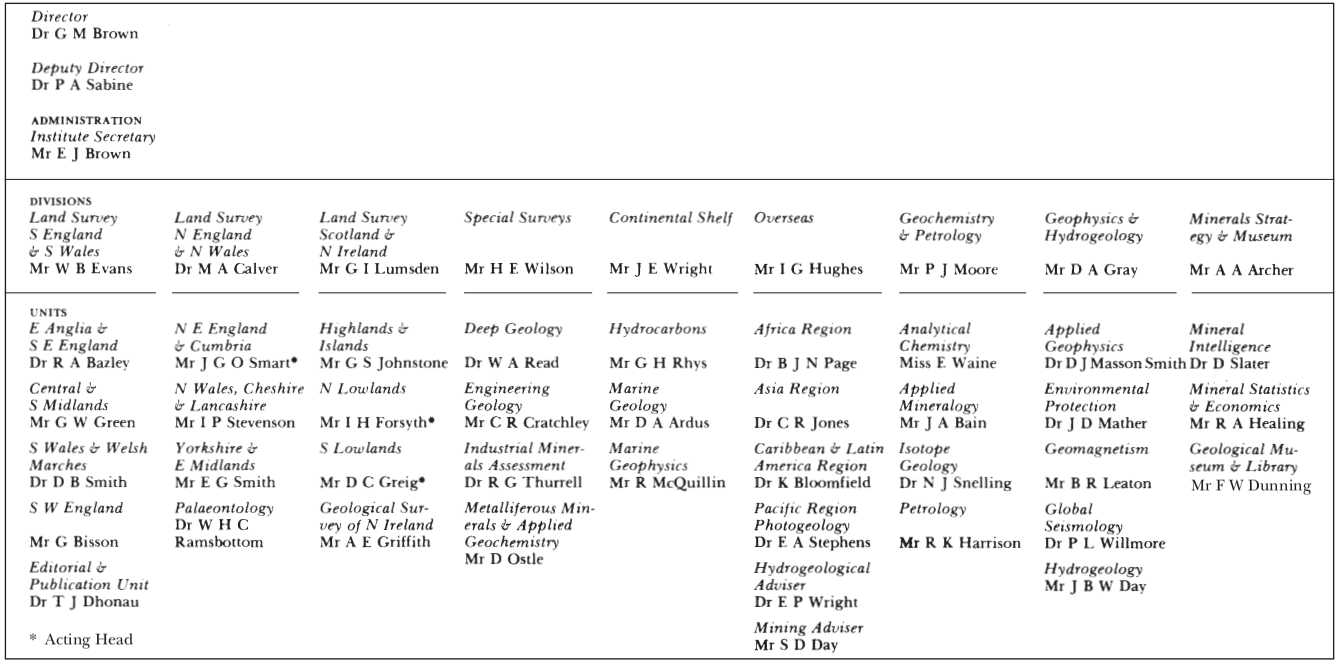

Figure 2 (from Office Notice ON/14/80) The organisation of the Institute of Geological Sciences in September 1980. This structure underwent a reshaping when the district offices were opened in Aberystwyth and Newcastle in 1981. The Land Survey divisions were regrouped into Western England & Wales and Eastern England divisions. For the first time mapping in Wales came under the management of a single officer (R A B Bazley).

By the end of 1981 there had been several staff changes: I P Stevenson was head of North-Western England; D B Smith moved to Newcastle to head the Northern England Unit; W A Read took over as head of East Anglia and South-east England and J H Hull was head of North Lowlands. Other changes were: A Whittaker, head of Deep Geology Unit; I G Hughes, head of Africa; S R C Malin, head of Geomagnetism Unit and C W A Browitt, head of Global Seismology Unit. B G N Page was given special responsibility for commissioned research overseas. The Mineral Intelligence and Mineral Statistics and Economics units were merged to form the Minerals Strategy and Economics Research Unit, under D Slater.

support or service entities that ought not to have been under their control in a matrix.

The first deliberate break with Sir Kingsley's logic came in 1976, when the Continental Shelf Division was formed by bringing together the two Continental Shelf units, which were programme based, and Marine Geophysics Unit, which hitherto had been regarded as discipline based.

The next year Austin Woodland, who replaced Sir Kingsley as Director, overhauled the structure, which, through progressive refinements in the years immediately after, completely broke away from his logic. He also made a significant change in approach to management when he devised what he called Task Forces. These were to be task orientated and, quite possibly, short lived. Two were created, Deep Geology in 1977 and Environmental Pollution in 1978. The concept was extremely short-lived. Both were converted to units soon after formation without the term Task Force ever being used in an official publication. They became headed by SPSOs and were immediately absorbed into the management structure.

Malcolm Brown followed Austin Woodland as Director in 1979. He had not served on the staff of the BGS at any stage in his career before becoming Director and he carried with him no baggage of past loyalties.

He inherited a very well established, unit-based structure at the lower management level and a mobile divisional structure above it. In practice, therefore, there should have been no organisational barriers to his reshaping the Survey to make it meet what he perceived to be changing future requirements. The difficulties he encountered from the very beginning were in persuading his Assistant Directors of the need for change. The structure, he could sort out fairly easily, but modifying the management system or changing attitudes to programme management were something different. The ADs were all long-serving Survey men and they were adept at manipulating the system for the benefit of their own division, managing their divisions as islands within the overall structure. The Land Survey, which operated a single programme divided into three geographical regions managed by ADs based in three different offices (Figure 2), shared few common standards other than the scale at which their staff did the mapping and published their maps. Even some of the symbols used on the maps were different in the three divisions. It was not uncommon for the Assistant Directors, as in the 1990s, to be referred to by irreverent staff as 'robber barons'. Divisions were even called fiefdoms, informally.

By 1981, the Director had gained a sufficient understanding of how the Survey worked and what sort of future he saw for it to be ready to make the changes. He had spoken to all grades of staff, often using the IPCS union officers as sounding boards, and found little resistance among them to the sort of changes he had in mind. It was only the ADs who appeared to be resistant.

Files for the early 1980s contain references to several ideas that Malcolm Brown had for changes that he wanted to make, but which, in some cases, did not happen even in his lifetime. He seemed to be particularly concerned about the

isolationism of the divisions. In theory, the Directorate was the forum within which the Assistant Directors reached agreement on matters that affected the whole of the Survey. For this to work there had to be mechanisms for putting cases together objectively, but, by common consent among them, there were no centralised mechanisms for deciding priorities on anything on an institute-wide basis. The main occasions for debate were the usually annual meetings of all the senior officers (the unit and divisional managers). Though this was an attractive, democratic process, the senior officers' meetings had no executive authority and ADs need not and did not feel bound by their decisions.

One of the first major corporate issues to be raised in 1980, which illustrated the distributed nature of the management system, was with regard to strategic decision-making in computing. NERC policy was determined by NERC Computer Services (NCS). A request from the NCS for the BGS to tell them its priorities in computing met with difficulties because there was not an effective mechanism for determining them. The Computing Committee, established in 1968, had not taken upon itself this task and had to be reconvened to do it. Other issues came up later. At a Directorate meeting in April 1981, the Director declared that it was essential for the BGS to make a start on developing a centralised computer database, so that advantage could be taken of fast-evolving computer technology. In addition, he wanted to begin to develop computerised map production. He set up a working party, under the chairmanship of Innes Lumsden, who was then the Assistant Director in charge of the Scotland and Northern Ireland Land Survey Division in Edinburgh, to look into both. Significantly, within the management structure there was no manager within whose remit was the responsibility to take up such matters. There were also many problems regarding staff deployment. Each year, during programme planning, the aspirations of those Assistant Directors who wished to broaden the multidisciplinary range of their work programmes were often thwarted by ADs holding the required staff, but who had other priorities and demands for them. This, Malcolm Brown saw as one of the most serious of all issues. With the demise of the very big core commissions, the structure of the work programme was becoming fragmented, bringing with it a need for greater flexibility in staffing. He had already experienced the trauma of compulsory redeployment between offices in 1982 when, during a freeze in recruitment, staff were compulsorily transferred to the Hydrocarbons Unit in Edinburgh to work on the hydrocarbons contract with the Department of Energy. He had come to the conclusion that there were better ways of achieving mobility than that.

Though Malcolm Brown was clearly frustrated by all of this he does not seem to have taken a decision to address the problems with a single, decisive reorganisation. Instead, the process of restructuring the Survey seems to have been evolutionary. It began with the establishment of the Regional Geological Surveys. The idea for them emerged out of Scotland and, during 1981, was extensively debated by the Directorate. The traditional approach to the mapping programme was to treat each 1:50 000 sheet as an individual project, even when several of

them covered common geology. The first time a regional approach was taken was with the establishment of the Southern Uplands Project, where Phil Stone, as project leader, was given the job of planning a mapping campaign for the Lower Palaeozoic rocks in the whole of the Southern Uplands, covering some thirty 1:50 000 sheets. To do this he built up a multidisciplinary team, following on practices developed in the Mineral Reconnaissance Programme, and devised the corridor mapping technique in which detailed mapping at the conventional scale of 1:10 000 was carried out in corridors across strike. The mapping in adjacent corridors was linked, over the intervening ground, by rapid-mapping techniques, including reconnaissance traverses and air-photo interpretations. It was an eminently, almost uniquely, suitable technique for the Southern Uplands, because of the structure of the rocks, but it was the regional approach as much as the rapid mapping that appealed to Malcolm Brown, who wanted to extend it throughout the Land Survey. The Regional Geological Surveys (RGSs) which emerged from this, were to be regional in scope — i.e. covering an area equivalent to that of a BGS 1:250 000 sheet, about 15 000 km^2. They were to be research-driven, time-limited and multidisciplinary. Each RGS was to be a single project, and they were all meant to establish collaborative links with universities. Although a series of 1:50 000 maps could be one of the products of an RGS this was not the main target output.

The Director focused his ideas for restructuring on them and gained approval to go ahead with the idea from Prep Group A and Council in June 1981. Six projects received Director's approval and started in April 1982: the Lake District, the Southern Uplands, Snowdonia, East Anglia, the Worcester Basin and Volos, in Greece. The Director used £800 000 to fund them, which had been made available to him by the NERC as partial compensation for the £1.6 million reduction in commissioned research income for 1982/83. He set the projects up in a special programme that was to be managed by him to run alongside the Land Survey Mapping Programme. He regarded the RGSs as the focal point for the development of the future mapping programme in the BGS and stated in a paper to the Directorate in October 1981 that as commissioned research declined he expected the RGS Programme to absorb the released staff and grow. The Land Survey ADs did not like this at all. They made a bid for linkages to be established between the RGSs and the main mapping programme and were refused. Malcolm Brown pinned a lot on the success of the RGSs. They were to take the BGS back onto the research high ground, involve universities in a meaningful way and show how multidisciplinary research should be organised in the Survey. By the time the 1982–84 Visiting Group started, the RGSs were established and working.

With the process of restructuring now under way, he announced, also at the October 1981 Directorate meeting, that he would like to form a Geophysics Division, an Information Division and a Strategic Science Administration Group. In addition, he posed some questions for the ADs to think about before the next meeting: should the unit be the primary, stable base of the BGS structure and the division a more fluid arrangement? Was there an optimal size for a

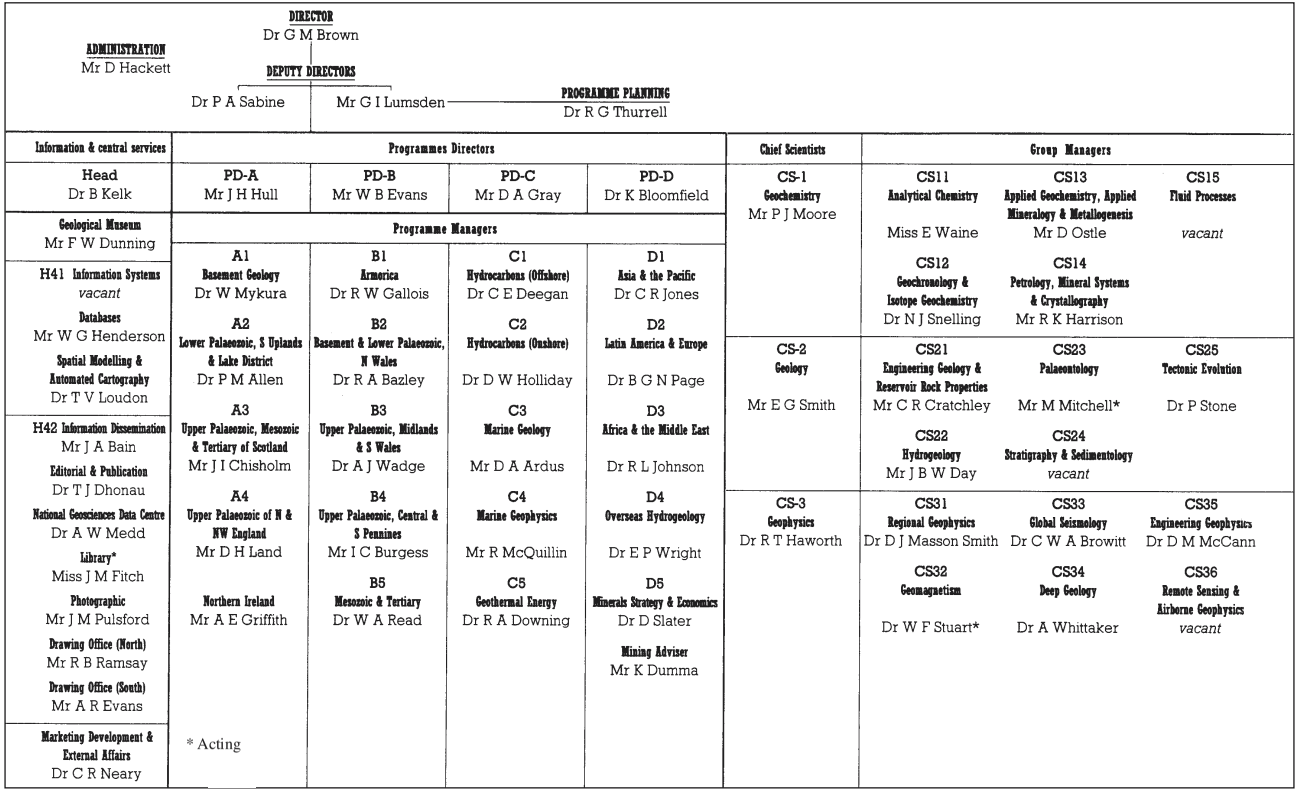

Figure 3 (from Office Notice ON/3/84) The organisation of the British Geological Survey as a matrix was implemented in December 1983. The structure here is as it was in April 1984. There was one Assistant Director post less than in the previous structure, accommodated by reducing the ADs managing the Land Survey from three to two.

unit? Which of the existing units should be merged to create space for new ones and was there an optimal size for a division?

There is no indication in the records to show that these questions were ever actually addressed in the seventeen-month period to February 1983. (Malcolm Brown himself was away from the office because of ill health for three months from the end of November 1982). That there was some action, however, is not in doubt. Peter Sabine (as Acting Director) and Innes Lumsden acted on Malcolm Brown's behalf, discussing various ideas with the NERC. Innes Lumsden had been brought down from Scotland, in January 1983, to became a second Deputy Director in order to establish a central Directorate presence in Keyworth and take charge of the move to Keyworth. By 7 February 1983 a proposal to move to a matrix management system had been drafted and was given broad approval by the Directorate. It was the Director's view, expressed in papers at the time, that the current divisional structure was insufficiently flexible to respond to the changing circumstances brought about by fluctuating funding patterns and changes in the way in which science was to be carried out. His stated aim was to bring about changes that would put career management on an equal footing with programme management. To achieve this, a matrix management structure was considered to be necessary, but it is not at all clear whether the idea to move to matrix management was his or had been imposed on him by NERC HQ. Wherever the idea came from, an unspoken motive must have been that it would curb the power of the ADs.

The first intimation for staff that there was going to be a major shake-up of the management structure and system came at a full meeting of senior staff held at the Exhibition Road office in London later in February 1983, where its introduction was announced, somewhat sceptically, by Peter Sabine. After further discussions with NERC HQ and more refinements to the proposal, a summary plan was distributed to management and the unions, who broadly accepted it, in March. The Directorate was presented with a detailed discussion document to consider in May. Some of the questions posed in October 1981 resurfaced here, together with many that were to be heard in Directorate meetings again in 1999–2000. Matters such as whether laboratories should be run centrally or not, fears about the predicted increase in the cost of administering a matrix management system, how to carry out staff reporting, and conduct job appraisal reviews (JARs) were all debated. The potential for conflict between Programmes Directors and Chief Scientists (in charge of the two axes of the matrix) was raised, and whether the management of databases should be central or decentralised. The question whether the work programme should be unit-based or project-based and many others were debated and decided upon. By 1 December the new system was in place and details of how it was to operate had been issued in two Office Notices (11/83 and 21/83).

The new structure (Figure 3) brought with it a new vocabulary. The terms 'Assistant Director', 'Division', 'Unit' and 'District Geologist' all disappeared. The BGS was divided up into eight 'Directorates', replacing divisions, to be

managed by four Programmes Directors, three Chief Scientists and the head of Information and Central Services. The tier of management below them comprised Programme Managers, who managed Programmes under the Programmes Directors, and Group Managers, who managed Research Groups under the Chief Scientists and the head of Information and Central Services Directorate. The Programme Planning and Research Marketing Group came under the Deputy Director, by this time reduced to one post because of Peter Sabine's retirement.

The way in which the responsibilities of the eight directorate heads (reduced from nine Assistant Directors) were defined was quite different from those of the ADs they replaced. All were required to be concerned with strengthening inter-directorate developments and broad-ranging institute strategies, but the Chief Scientists were given a different set of responsibilities from Programmes Directors. The latter were expected to concentrate on managing their programmes, within which projects were expected to be multidisciplinary and time limited. These programmes were deliberately not named, but given labels A, B, C and D. These consisted, respectively, of the Land Survey of the area north of a line linking the Ribble and Tees; the Land Survey south of this line; Continental Shelf and Energy Resources; and Overseas Surveys. The Chief Scientists, although they headed science directorates containing research programmes, were to provide leadership in their science and be responsible for the maintenance of scientific manpower quality. This included career management, recruitment, training and the deployment to and between projects and programmes. They were also to take charge of broadening staff expertise through links with universities, industry and other relevant research organisations and they were given responsibility for managing basic research and certain specialised surveys.

The third post was the head of Information and Central Services, a directorate that evolved from the Director's idea in 1981 to create an Information Division. His programmes were meant to be institute-wide, and he was expected to develop co-operative links and ventures across the Survey in information handling. This made the directorate corporate (like Administration) but it was made up of programmes like the programmes directorates.

Each of the heads of directorate was given some additional responsibilities. The Chief Geophysicist was responsible for computing; the two Programmes Directors for onshore surveys had responsibility between them for industrial minerals and Quaternary geology; the heads of Programmes Directorates C and D covered, respectively, energy resources, and metalliferous mineral resources and exploration. Lastly, there was to be a Programme Planning and Research Marketing Group outside the matrix, under the management of the Deputy Director.

The new arrangements were criticised immediately they were announced in the November Office Notice, and some changes were initiated soon after publication so that the structure presented in it is not actually the same as the one illustrated in the organisational chart dated July 1984. Even the unions, having agreed with it in principle in March 1983, were intensely critical a year later. They presented their critique in a paper for the Director, which he described, in a note

in the margin, as 'a dreadful little paper …' These criticisms, however, though significant, were already too late.

Deviations from the ideal matrix structure had begun to take place even before it was implemented. Others immediately followed, so that the new system soon became undermined and did not operate fully as matrix management. There were, however, two distinct benefits from the new arrangements, which lasted until Peter Cook reorganised the management structure in 1991. These were in programme planning and staff deployment. After the early demise of the Programme Planning Group, both became the responsibility of the three Chief Scientists operating as a sub-committee of the Directorate.

For the first time, the Survey's work programme was regarded as a single entity. Each year, project leaders had to make a bid for staff and resources either for an on-going project or to pursue a new idea. Each project proposal was scrutinised by the three Chief Scientists independently of each other and given a ranking. They then met to agree the rankings and the level of resources that should be allocated to each project. Only highly ranked projects were funded. Progress reports were required on each project. This was a revolutionary procedure and it led to a serious rationalisation of the programme. Hundreds of small, barely functioning projects were culled and some big projects were drastically revised when the Chief Scientists thought that they showed evidence of failing.

The theory about staff deployment was that on 31 March each year the current work programme ended and all staff became available for redeployment by the Chief Scientists. Thus, it was the Chief Scientists who built project teams, as far as possible using objective criteria to make their decisions about each individual deployed. The outcome of their efforts was a work programme that was better balanced than it ever had been. It was leaner and it was prioritised according to centrally decided criteria. Projects were forced to end when their useful life was over and could not, as before, drag on for ever at a notional level. There was, also, fairness in the allocation of staff to projects.

In other respects the new system did not succeed. It is clear from all contemporary accounts that most of the senior management either did not want it or were lukewarm about it. In the face of this sort of opposition the new system had to be robust and well planned and introduced forcefully, if necessary. There is no evidence that any of these applied. As early as May 1983, when the Directorate discussed the detailed proposal, important issues were raised and either left unresolved or resolved in a way that was contrary to the needs of a matrix. For example, the potential for conflict between the Chief Scientists and Programmes Directors was raised and left with the words, 'It was felt that with the right co-operation the new matrix will prove workable'. The lack of co-operation between the old ADs was one of the reasons why Malcolm Brown felt the need to change to a radical new system in the first place. Not to face up to this issue at this stage was almost fatal.

Also at that meeting, Malcolm Brown lost his chance to create a centralised geoscientific database. Again, this had been one of his ambitions, but when it was

discussed, Richard Haworth, the Chief Geophysicist, fresh from the Canadian Geological Survey, objected to it. The agreement of the meeting was that, 'individual design and data integrity should remain with the Chief Scientists. It was agreed that a centralised view on databases should be resisted'. It may well have been that difficulties being experienced with the attempts by the NERC to control computing from the centre influenced thinking on the day, but it may also have been a result of the ADs resisting the loss of some of their powers. The Chief Geochemist and Chief Geophysicist, whose staff were almost entirely located within their own directorates, never came together to discuss database development and so went their own ways. The third Chief Scientist, the Chief Geologist, did nothing at all. The new Information and Central Services Directorate, while it was meant to be institute-wide in its function, took control of the old Land Survey records and the responsibility for developing digital databases from them, but never managed to penetrate geochemistry or geophysics. Database development, at that time, had at least three foci, but in the 1990s these multiplied as individual groups took their own initiatives.

Even with hindsight, it is difficult to make objective judgements about the outcome of this course of events. The position in 1997, when a radical reorganisation was needed to deal with the fragmented data management and the lack of both corporate standards and centrally managed index-level databases, was not necessarily worse than if the Survey had had to unscramble a centralised system based on, what then would have been archaic technology and thinking. Few now would say that Malcolm Brown's intention was wrong, but many might say that his timing was not right.

Two other critical features of the matrix were distorted at an early stage. One was the definition of the basic building block of the matrix. The contenders, discussed at the meeting in May 1983, were the project and the unit. The unit won, which meant that what subsequently came to be called Research Groups and Programmes, instead of being freshly built as clusters of projects, were based on the old units and carried with them the baggage of units, which managers took great care not to lose.

The second was the Director's attempt to free directorates and programmes from the constraints of geographical boundaries. The new Land Survey programmes had been defined originally on a tectonic and stratigraphical basis: thus the old South-west England field unit had its geographical boundaries changed and became the Armorica Research Programme (Figure 3). Another was the Mesozoic and Tertiary Programme, which replaced the East Anglia and South-east England Unit: a third the Basement and Lower Palaeozoic Programme, which, with modified geographical boundaries, replaced the South Wales and the Welsh Marches Unit. There were several others. They lasted little more than a year before being replaced by research programmes that differed hardly at all from the old field units. The reasons for the reversal stemmed from the Land Survey's responsibility for dealing with enquiries, which was done regionally, for managing records by region and for having District Geologists who knew every

detail of their districts. An alternative arrangement would have been to transfer these first two tasks and responsibilities fully to the new Information and Central Services Directorate, but this was not done.

By January 1986, by which time Innes Lumsden had become Director, the programmes directorates had been given names (Figures 4 and 5). Programmes Directorate A was called Land Survey (North), Programmes Directorate B was Land Survey (South), while Hydrocarbons and Marine Surveys and Overseas Surveys replaced programmes C and D respectively.

The centralised Programme Planning and Research Marketing Group, with an SPSO in charge, fell apart quite quickly. The Chairman of NERC had not agreed that they should be together in the first place. His view was that marketing, which was taken out of the group and put into the Information and Central Services Directorate, should be strengthened and led by an SPSO. The Programme Planning Group lost its SPSO head and the function became, eventually, the sole province of the three Chief Scientists. Again, it is evident that those of the old ADs, who were to become Programmes Directors, very much resented not having control over their own programme development. This remained so until the dying days of the system. There was, however, too little distinction between the jobs of the Programmes Directors and those of the Chief Scientists. Both had charge of large programmes. Indeed, the programme structure of 1984 bore many similarities to the 'matrix' described by Sir Kingsley Dunham in 1976. The new directorates were his divisions by another name. When Wyndham Evans retired as head of Programmes Directorate B (PD-B) in 1986 he was replaced by Gordon Smith, who brought with him to PD-B the responsibilities of the Chief Geologist. There was then complete fusion of functions along the two matrix axes and their distinction was lost. The research groups that Gordon Smith had managed in his Geology Directorate were transferred into Information and Central Services, and the Geology Directorate disappeared.

A fairly serious weakness in the new system related to the way in which the Chief Scientists were able to deal with staff career development. The three elements to this were the Annual Confidential Report (ACR), Job Appraisal Reviews (JAR) and the career interview.

Staff reporting was done on an annual basis. For each member of staff an ACR was prepared in which there was a commentary on the individual's performance during the year. A reporting officer, usually the person with direct management responsibility for the individual, had the job of writing the initial report. The next manger up in the hierarchy acted as a countersigning officer, commenting on that report. The role of the Assistant Director was to ensure common reporting standards across his division. In the new system, the Chief Geochemist and Chief Geophysicist had the advantage of overseeing the careers of staff who were almost all in their own directorates. They carried on with the same responsibilities as before. The Chief Geologist's responsibility, however, was for staff spread over five directorates. He had no power to overrule line managers within those directorates. He came in as third signatory for staff in the directorate he

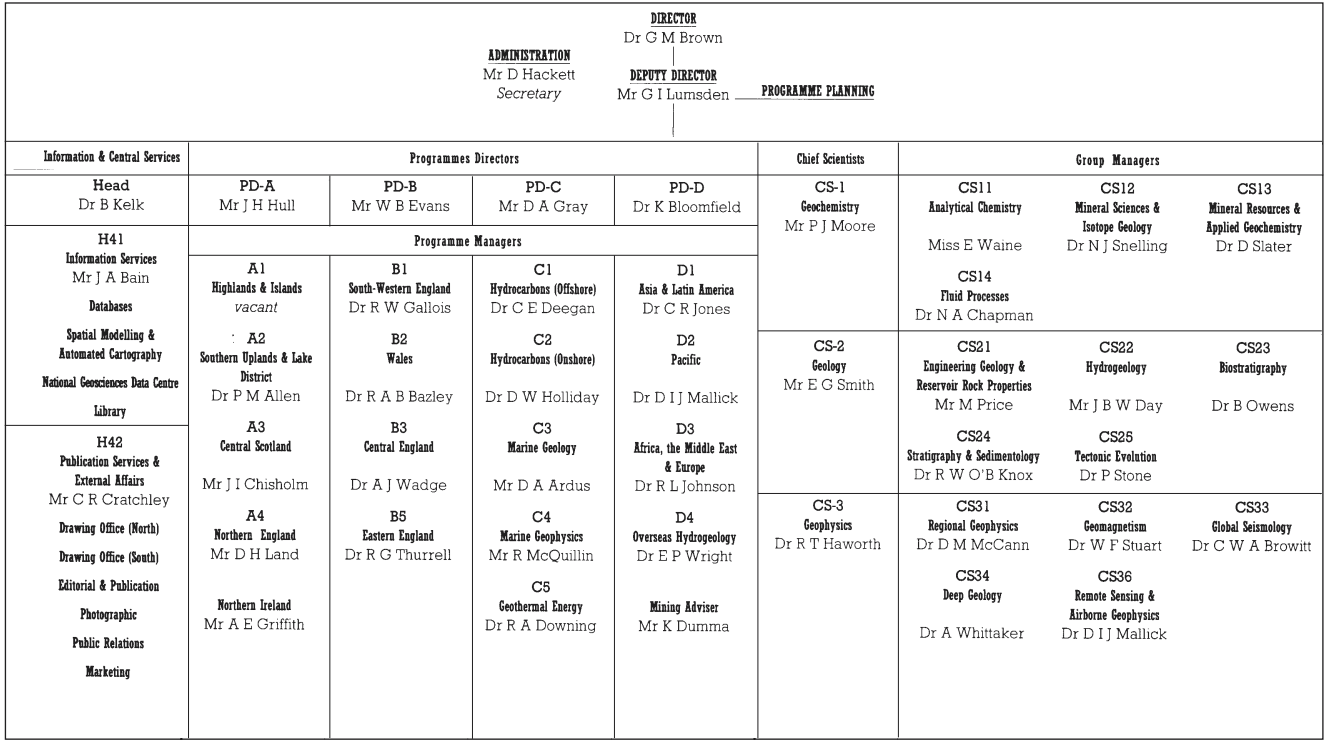

Figure 4 (from Office Notice 0N/5/85) The first reshaping of the matrix, April 1985. One of the two Deputy Director posts was lost; Programme Planning was reduced and the Land Survey research programmes were given geographical names. The Palaeontology Unit changed its name to Biostratigraphy.

managed, but was fourth signatory on all the others and was not allowed to coordinate the reporting below him where it was cross-directorate. Similarly, the Chief Geologist was not involved in Job Appraisal Reviews for staff outside his directorate and he had minimal influence over training. The Chief Scientists did carry out career interviews, however, and they spoke about all the staff in their discipline at the Career Management Panel meetings, held every autumn.

There were many lesser issues that added to the list of potential failings in the new system, but none of them would have mattered much, or even have existed, if Malcolm Brown's senior managers had been behind him in the reorganisation. The position he was in was summarised well in the union statement that Malcolm Brown described as a dreadful little paper:

> The previous divisional structure was said to have encouraged empire building by divisional and unit heads, and rigid demarcation of work between divisions resulting in poor interdivisional communication. It discouraged interdisciplinary science and the freedom of staff to vary their careers in a way that could be mutually beneficial both to themselves and to BGS. So far management seem to have failed to communicate the rationale for the new structure to staff. This is shown by the commonly voiced criticism that the restructuring appears to have been applied from the wrong end, i.e. from the top downwards. Such critics say that the staff groupings dictated by the work should have been identified first and then provided with a managerial structure that would best promote the execution of that work. It is also clear that previous inflexibility was probably less due to the structure than to the inflexible attitudes of certain managers, and until these retire or are transferred, the desired changes will not take place.

The matrix management structure was formally demolished in 1991. There were several adjustments made to it before then, but nothing major happened until Geoff Larminie took office as Director in 1987. For the most part, his time was

Figure 5 The second reshaping of the matrix, January 1986. The Programmes Directorates were given names. The post of Deputy Director was lost and the rank of the Director's post was downgraded. The Geology Directorate was lost and its component groups transferred to Information & Central Services. The Tectonic Evolution Group was dissolved.

By March 1988, D I J Mallick was in charge of the Highlands and Islands Programme, and Southern Scotland was merged with Northern Ireland, under D J Fettes, to create the first cross-border Land Survey unit. P M Allen had become head of Land Survey (South). Hydrocarbons (onshore) was dissolved. Marine Operations became Marine Geophysics and Offshore Services. Remote Sensing and Photogeology under B J Amos, was transferred out of Geophysics Directorate into Overseas. Hydrogeology, under W M Edmunds, moved into Geochemistry Directorate, now headed by J D Mather. Analytical Chemistry was merged with Mineral Resources and Applied Geochemistry. B G N Page headed Pacific and was also responsible for Marketing Development and External Affairs, and R Herbert was the new Overseas Hydrogeology Advisor. I R Basham was head of Minerals Science and Isotope Geology.

More changes of managers came in May 1989. S Brown headed Hydrocarbons. C R Jones took over as head of Overseas Directorate and J D Bennett replaced him as head of Asia and Latin America. S S D Foster was head of Hydrogeology. Reservoir Rock Properties was disconnected from Engineering Geology and dropped, while M G Culshaw took charge of Engineering Geology.

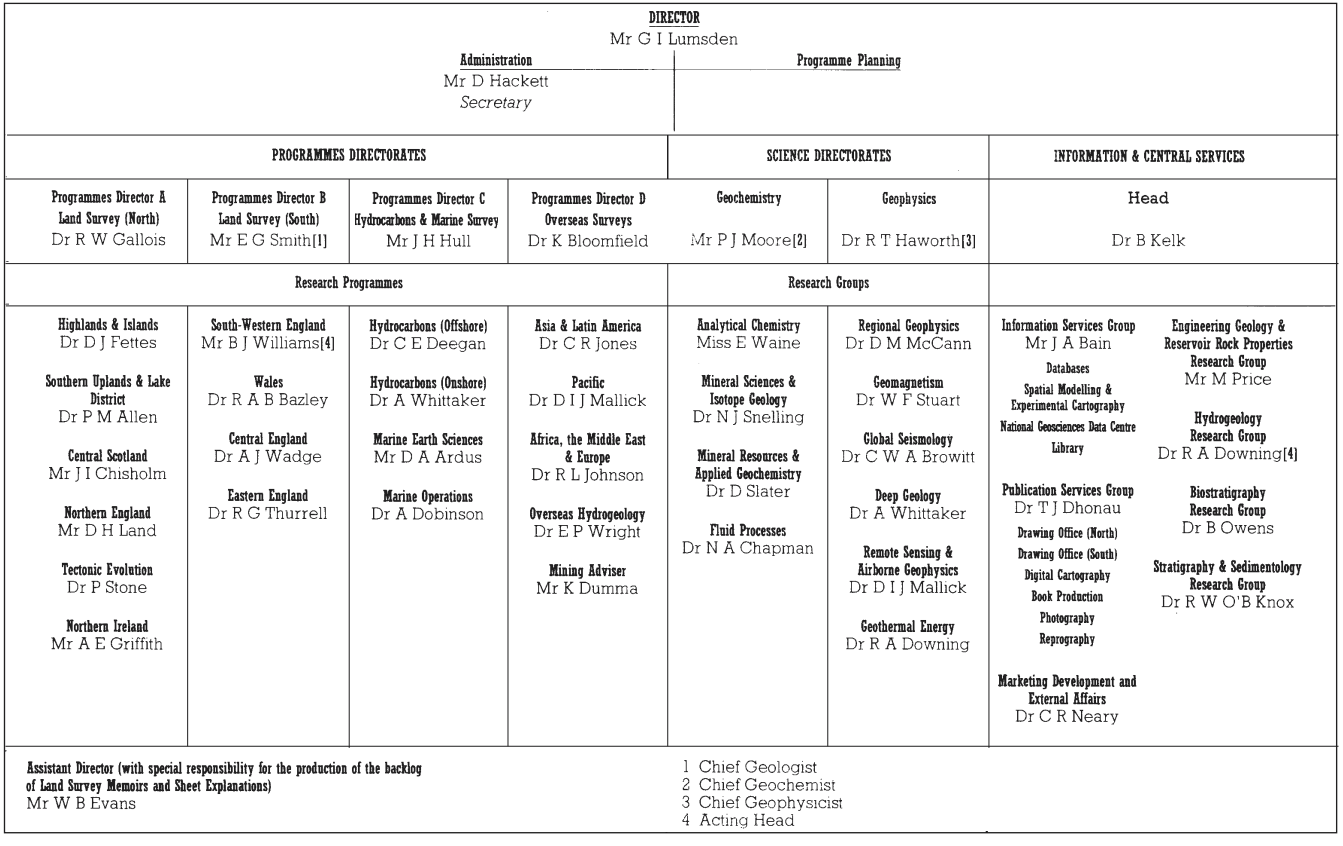

Figure 5 (from Office Notice ON/2/86) The second reshaping of the matrix, January 1986.

filled with more important things than tinkering with the management structure, but he did develop concerns about the directorate structure he had inherited. The one that bothered him most was the managerial separation of the land-based and offshore survey programmes. When he was required by NERC HQ to lose one of the Grade 5 posts he decided to restructure, which he did with two main themes in mind. One was to integrate land and marine surveys; the other was to bring under common management those research groups and programmes that had a common survey interest. Thus, the three Programmes Directorates A, B and C were fused (Figure 6). Hydrocarbons was taken out and put into the Geophysics and Hydrocarbons Directorate; the rest were divided into two and put into Land and Marine North and Land and Marine South. Except for Hydrogeology, which went into the Geochemistry and Hydrogeology Directorate, the research groups that had found their way into the Information and Central Services Directorate were moved into Land and Marine Surveys South. The Deep Geology Research Group, which was transferred from the Geophysics Directorate, was also put into Land and Marine Surveys South, being merged with two other groups, Biostratigraphy and Stratigraphy & Sedimentology. Thus, engineering geology, biostratigraphy, sedimentology, deep geology and geological mapping all came under common management for the first time ever. This was the first step taken towards integrating those activities that had a bearing on the survey and understanding of the three-dimensional crust beneath land and sea. The only group that had been left out of this new arrangement, the inclusion of which would have completed the transformation, was Regional Geophysics, but to have removed that from the Geophysics Directorate would have made this directorate very small and out of balance with respect to the other directorates.

This new structure came into effect on 1 December 1989. It was basically an operational structure that took into account scientific and commercial objectives. It sought to deal with the problems of inflexibility in staff deployment which inhibited the creation of multidisciplinary teams, by bringing together under common directorate heads as many as possible of those science disciplines that were required to work together in pursuit of the directorate's scientific and operational objectives. These included the production of land-use maps for planners, understanding the three-dimensional crustal structure for resource studies and onshore/offshore matters, particularly in relation to the coastal zone. In doing this it came close to meeting the rejected first recommendations by the 1988 Strategic Plan Working Group on Core Programme structure. As a solution to some of the problems that beset Malcolm Brown this structure might have worked, but it lasted little over a year and was not properly tested.

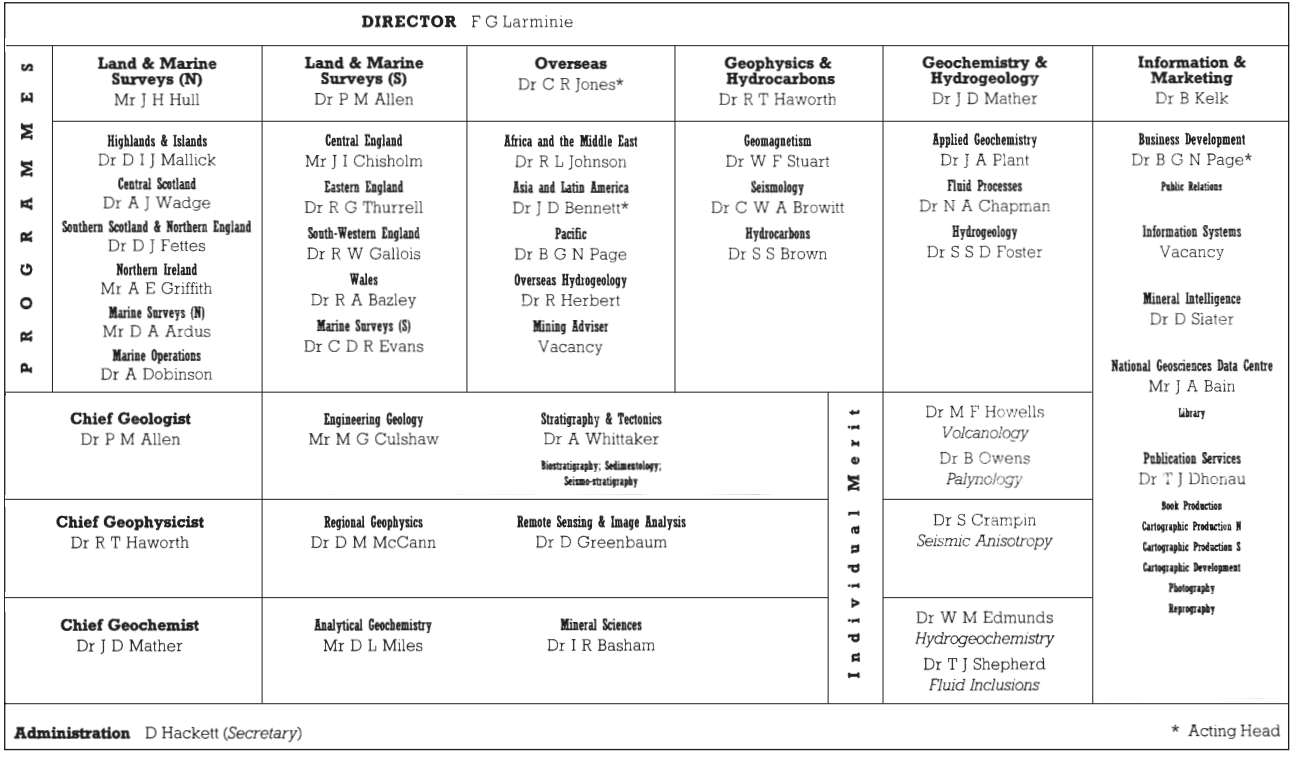

Figure 6 (from Office Notice ON/24/89) A new organisational structure, put in place on 1 December 1989. This produced a complete overhaul of the system. While the new organisation was presented as a sort of matrix it did not function as one. The number of Assistant Director posts was reduced to six. The once powerful Palaeontology Unit was now a component of Stratigraphy and Tectonics Group.

Chapter 10

Commercialising a geological survey

The conversion of the BGS from a wholly Government-funded Geological Survey to one which is either accused of being commercial or complimented for it, required changes in structure and culture as well as in the organisation's approach to some ethical issues. Many structural changes have been made, but in any organisation in which the percentage staff turnover is measured in single figures, and the majority of staff remains with it for nearly the whole of their careers, cultural change is bound to be slow. Some issues, such as the Survey's interaction with the private sector and how to maintain its impartiality to advise Government still remain open to debate.

The process of commercialisation can probably be traced back to before the Rothschild transfer. From the late 1960s, the work programme was clearly divided into two parts: in one were those programmes that were wholly funded by the Science Budget and in the other those, such as sand and gravel assessment and overseas work, which could clearly be viewed as meeting specific departmental policy goals and were funded by departments. There was no argument that these should be funded in any other way. Thus, the Survey accepted this broadening of its work profile and, in doing so, staff began to learn how to deal with the specific demands of customers.

The way in which the Rothschild transfer was implemented threw this simple situation into confusion by creating 'core commissions' — projects which would normally be done by the Geological Survey as part of its Core Programme and funded by the Science Budget but which had become funded by Government departments. Further confusion was created when, during the consultation phase of the Rothschild transfer, the concept of co-funding was introduced, by which the BGS made a financial contribution from its Science Budget to an externally funded commission. As long as it was a core commission to which Science Budget was being added there was no problem with implementing the concept.

The next step in the commercialisation process came as a result of the decline in the level of income from commissioned research that began in 1981. Not only did the consortium that funded the Onshore Geological Mapping Programme collapse that year, but several other large commissioned projects had their funding cut. Evidence that this was going to happen came in 1980 during discussions with departments over forward planning for the year 1981/82. The Directorate reacted by calling a freeze on recruitment and filling vacancies by compulsory transfers. In August the next year, the Director was informed that

within the Department of the Environment, in an attempt to reduce the R&D budget, ministerial approval was now required for contracts and contract variations as low in value as £10 000.

A much bigger drop in commissioned income came to the attention of the Directorate in October 1981, when the Director was informed that for the financial year 1982/83 the commissioned research budget was expected to be lower than in the current year by £1.6 million. Added to the reduction in the level of the Science Budget allocation to the BGS from the NERC, the total reduction he had to plan for was £1.75 million. The NERC had agreed to partial compensation by allocating an extra £800 000 to the Science Budget, mostly for staff costs, for that year, specifying that it was to fund the Regional Geological Surveys. The balance had to be covered by other means.

The full package of actions needed to address the cuts that was agreed by the BGS Directorate was to remain familiar to all successive Directorates for eighteen years. It included reducing staff levels and reductions in all areas of expenditure, including capital. Reductions in staff were to be achieved by a mixture of a partial freeze on recruitment, natural wastage and voluntary premature retirement (VPR), which was introduced to the BGS by the NERC for the first time that year. Fourteen staff were lost by this means. The Directorate also expressed determination to win commissioned research income from new sources. At the end of the crucial Directorate meeting in October 1981, it was agreed that £150 000 of the £950 000 planning deficit should be found from new commissioned research receipts. Although the Survey had been positive in its quest for new commissioned research since it was re-formed in 1965, this was the first time that it had to seek it out of necessity and set a target for it. To do this required a totally different mindset within the Survey as well as outside.

There is probably never a good time for an organisation to make the internal and cultural adjustments that were necessary to deal with this sort of change, but the early 1980s were probably the worst that could be chosen. There were too many conflicting pressures under which the organisation operated throughout the whole of that decade. In particular there were mixed messages coming out of Government itself. The new, market-centred economic policy, introduced after the election of the Tories in 1979, was penetrating different Government departments at different rates. The Department of the Environment was among the quickest to respond to them, the Department of Education and Science one of the slowest. Both departments were important to the BGS.

A mechanism used by Government to introduce uniform standards across all departments to compensate for this uneven response, was the Rayner Review in 1982. This had a major impact on the management of Government R&D and, as a consequence, on the way in which research was commissioned from organisations such as the Survey. Initially looking at support services in R&D within Government, Rayner's recommendations did not apply to the research councils, but to departmental research. He recommended that a task for top management in departments was to ensure that their research projects were relevant to their

priorities, that technical and financial progress were being monitored, that costs were being held to the essential minimum, and that results represented good value for money and were being applied. At the very time that the Survey had established a need to pursue new opportunities for commissioned research, new policy guidelines within Government made it more difficult to achieve results from that quarter. Moreover, Rayner completely killed off the idea that departments should think of funding strategic science that was not entirely in their own, sectional interests. For the Survey, this meant that the only possible source of funds for its core activities, which by definition were multi-departmental in their application, was the Science Budget, and that was on the decline.

The Department of the Environment's reaction to Rayner was almost immediate in its impact. Prior to 1981 links between the survey and all the departments were strong and it was usual for contracts with them to be negotiated on a single-tender basis. The Survey was the preferred contractor, effectively, for all the geoscientific research that the departments would wish to commission. In 1981, stimulated by the Department of the Environment, the consortium that funded the Geological Mapping Programme collapsed. This had a major, quite destructive impact on the Survey, but there was one significant benefit. The DOE had decided, in establishing its own geoscientific research priorities, that it would begin a programme of what was then called environmental geology mapping. The objective of this programme was to devise a set of geoscientific maps which would help urban planners in their decision making. Initially, a partnership arrangement was established between the BGS and the DOE in which the BGS co-funded these projects by covering the cost of the geological mapping required to carry out the contract, while the DOE covered the cost of developing the applied geology maps. The funding split was commonly 50:50. Partly as a response to Rayner, however, the DOE decided to introduce competitive tendering for its research programme soon afterwards and there were some areas of geoscientific research of interest to DOE within which the primacy of BGS was not accepted. These started to be put out to competitive tender, and soon universities and private-sector companies were competing against the BGS for geoscientific contracts (e.g. for sand and gravel assessment) and winning them. Competitive tendering for applied geological mapping came soon afterwards. At a meeting to discuss contract funding between the Chief Scientist of the DOE and the BGS/NERC in August 1981, he admitted that he thought the only area where BGS could be regarded as having unique experience at that time was in radioactive waste disposal. He did not include geological mapping, which surprised BGS managers.

With work becoming harder to get from Government, the private sector was an obvious alternative source of funding, but work done by the BGS for the private sector in 1980 was, in general, limited to enquiries and it did not figure largely in the consciousness of the organisation. At that time, the half-day rule applied, which meant that an enquiry that took less than half a day to deal with would be done free of charge. If an enquiry took half a day or more charges were

levied. Many enquiries came from civil engineering and geotechnical firms and consultancies, which were firmly in the private sector. The BGS was unique in the NERC in having this kind of business.

The importance of repayment work of any kind for private-sector bodies was barely recognised either by the Department of Education and Science or the NERC in 1980. In December that year a letter to all institute directors from NERC HQ informed them that, after protracted communications with the DES and Treasury, all delegated powers to accept contracts for what was called 'commercial enterprises' had been removed from both NERC HQ and the institutes. The definition of 'commercial enterprises' was not clear, but it seemed to cover all dealings with the private sector and a wide range of quasi-government bodies such as the Central Electricity Generating Board, the National Coal Board, British Nuclear Fuels, Water Authorities and the Local Authorities. For the BGS, this meant that a half-day repayment project dealing with an enquiry from a local authority should be referred through NERC HQ to the DES/Treasury for approval to proceed. In fact, the notice from the DES/Treasury was never issued in the BGS, but during an audit in 1982 it came to light that the BGS was in breach of protocol as though it had been and steps had to be taken to clarify the position. What emerged was that the BGS would have delegated authority for minor repayment projects up to £2000 in value and that the quasi-government bodies were not to be classified under the heading 'commercial enterprises'. Above £2000, approval would have to be sought from the NERC for any contract up to £50 000 that fell into the class 'commercial enterprises'. Above that amount, the approval of DES was required. Delegated authority remained with NERC for contracts with the UN and the EU provided that the research was to be conducted in the UK. There were no problems about research for Government departments.

This confusion reflects more on the lack of understanding in the DES and the NERC of the business potential of the BGS than it presented a barrier to developing the business — though gaining approval for non-governmental contracts, following these guidelines, could become so slow as to be counter-productive. What had more impact was that in the guidelines that were drafted by NERC HQ at the end of 1982 for implementation in the BGS regarding repayment projects, there were constraints on the conditions and type of business that the BGS could pursue as a 'commercial enterprise'. Among the conditions for accepting a project, three were:

- The work should significantly widen the scientific horizon of staff engaged in it. Extensive work of a routine nature should not normally be encouraged.
- The work must avoid, as far as possible, direct competition with interested UK private sector advisory and R&D organisations.
- It must not weaken in any sustained way the capacity of the BGS to carry out its basic scientific programmes.

Though not exactly a deterrent, these conditions were hardly an encouragement to expand business, but Malcolm Brown reported in the annual report for

1982 and 1983 that even then NERC Council was encouraging him to make good the fall in commissioned income from Government departments with earnings from other sources. By 1985 the NERC had included in its first Corporate Plan its aim to increase its commissioned earnings from 25% of its budget to 30%, though it did not target the private sector in this aim.

The matter of the BGS competing against the private sector for contractual work was to come up a number of times in the years to follow. It was addressed by the 1982–84 Visiting Group, which considered that the BGS should not do it. In 1987, Butler said, 'BGS should not compete with private consultants through unfair use of its privileged position as recipients of data, nor for commissions for which it is not especially suited'. While this was being debated, the private sector, which was gradually being enlarged by the privatisation of one-time government and quasi-government bodies, was competing vigorously against the BGS for contracts such as those for applied geological mapping. If there is any category of work with respect to which the BGS had both a demonstrable track record of achievement and a privileged position because of its data holdings, this was it. Whatever high-minded ideals the DES, Treasury, NERC and various advisors might have had for the BGS about this issue, the private sector was not adhering to them.

With regard to acquiring commissions from the private sector, Butler said, 'We see advantages in extending it (the Responsive Programme) into the private sector, although the Survey must not thereby endanger its ability to give well-informed independent and impartial advice to Government on geological matters'. This is an ethical matter that is still current, and opinion in the BGS was as divided then as now. The Environmental Protection Unit, established in 1979, was set up to carry out research in radioactive waste disposal and landfill pollution, but when UK Nirex Ltd was created to deal with radioactive waste disposal there was no unanimity within the BGS senior management about the efficacy of the BGS being involved with them. In the autumn of 1984 the Department of the Environment, the department to which Nirex was responsible, agreed to retain the BGS as consultants in this field. At the same time, however, the Survey was being invited to act as subcontractor by companies responding to invitations to tender for research from Nirex. A meeting was held between John Moore, Chief Geochemist, and DOE officials to discuss it. The DOE view was that they were happy for the BGS to be involved with Nirex regarding data handling, but were cautious about the BGS being involved with data interpretation. Their concern, the same as expressed later by Butler, was that the impartiality of the BGS could be endangered by its commercial involvement with Nirex. Professor John Knill, while he was Chairman of NERC, held a similar view. Within the BGS, there were also some managers who, for several years, would not take part in any contract work for Nirex. It was not until the early 1990s that the ethical considerations diminished sufficiently in importance relative to other pressures, largely under the impact of the Price Waterhouse study, for barriers to involvement with Nirex to fall down in all parts of the BGS. Nonetheless, the ethical question has still not been answered; neither has it gone away.

There were two significant actions taken by the BGS in the early 1980s that broke with tradition and at the same time displayed a determination to tackle the funding issue positively. Both impinged directly on the public-service culture that prevailed throughout the BGS. The first was to abandon the half-day rule and charge for all enquiries; the other was to appoint a member of staff with responsibility for marketing.

The idea of charging for all enquiries was first raised informally with the Director by Denys Smith, the head of the Northern England Unit, based in Newcastle, early in 1982. It was debated by the Directorate in March that year and rejected. In October it was back on the agenda, but the 1982–84 Visiting Group also picked it up and it became one of their recommendations that the BGS should investigate the feasibility of doing it. The job of organising it was given to Brian Kelk, head of the Information and Central Services Directorate, and it was introduced in November 1984. Despite quid pro quo arrangements for companies that regularly provided the BGS with site investigation data, and waivers of various kinds introduced to minimise the burden on certain classes of enquirers, the change was not welcomed and grumbles were heard about the new arrangements even ten years after their introduction. It did not help the argument for charging that in the first year that full charges were introduced, the number of enquiries plummeted and only slowly grew over a period of years to regain the 1983 level.

In Malcolm Brown's reorganisation of the Survey he devised an Information and Central Services Directorate, within which he placed two staff under the banner Marketing Development and External Affairs. This arrangement came into existence in 1984. Prior to his taking charge of this small unit, Chris Neary, a PSO, had been in charge of the the Survey's Marketing Panel. Setting up the new unit was a bold move by Malcolm Brown. The NERC had already taken an initiative in this direction by appointing a marketing advisor and there were NERC agents in Washington, to watch over the World Bank and other organisations, and in Brussels. For the BGS to go its own way, however, was a different matter and it was done only after consultation with the NERC through 1983. The marketing group grew to four by 1988, when Barrie Page, an SPSO was in charge. It changed its name to Business Development in 1989, and in 1991 it was upgraded to the status of a division with the head being an Assistant Director (Band 2).

The establishment of a group to look after marketing and external affairs was a significant structural change that also impinged on the organisation's culture, but the Survey achieved little as a result of it in the 1980s. Detailed breakdowns of income for the early part of the period are not easy to come by, but the gross figures are illustrative. In 1978/79 the income from the Department of Trade and Industry, the Department of the Environment, the Department of Energy and the Overseas Development Administration constituted 95% of the total commissioned income. The amount of work done for the private sector was very small, though even in 1980 there were several small non-governmental projects being undertaken overseas for organisations such as Hill Samuel Development Ltd and Alexander Gibb and Partners. The percentage of income from the big four departments had declined to 81% in 1988/89 and income from the private sector

had risen to 11% of the total commissioned income. Almost all the work that the BGS did overseas remained funded by the Overseas Development Administration. A summary table prepared in 1992 for income, normalised at 1992/93 prices, for the period 1977/78 to 1992/93 showed that income from the four big departments dropped from £30.7 million in 1978/79 to £17.5 million in 1988/89. This fall was in no way compensated by increased earning from other sectors. A small part of it was balanced by the initial penetration of the private sector and an increase in income from the European Union from £0.23 million to £0.84 million, which was a result of a change in BGS strategy. The main part of it was matched by reductions in staff costs, capital spend and other expediture.

It was clear by the end of the 1980s that if the decline in income from Government departments were to continue and the BGS remain solvent and avoid further staff losses and erosion of its scientific skill base, the effort being put into marketing and selling was going to have to be increased in volume and quality. There were also going to have to be some major changes in the BGS culture. In fact, this was at the heart of the recommendations of the Charging Review in 1989 (Chapter 6, pages 60–61).

The Charging Review report, which was always meant only to advise the minister, was never released to staff in BGS, but it was seen and commented upon by the BGS Directorate. Some of the more important recommendations and conclusions in it were:

- Pricing policy should allow the BGS to charge all customers at the level the market will bear, including Government departments.
- Priority should be given to digitising NGIS (National Geosciences Information Service) records to increase their saleability.
- Priority should be given to increasing the generation of income through NGIS by developing value-added products and giving advice.
- Charges should include an element to cover maintenance and curation of databases.
- The BGS should seek joint funding (co-funding) for core projects.
- Increased income should be sought from newly privatised utilities, non-departmental public sector, private sector and overseas, especially from private sector, non-government aid agencies and banks.
- A full market survey and detailed market analysis should be carried out.
- The Marketing Group should have sufficient funding, expertise and seniority to function effectively in the BGS.
- A coherent marketing strategy should be developed for the BGS.
- The Marketing Group should raise internal awareness of business development tools.
- The BGS should set targets for support of the Core Programme from funds obtained from commercial activity.
- Clearly defined management responsibility should be established for commercial pricing and policy.
- An internal market between elements of the BGS should be established.

Revolutionary though this package was, even the Charging Review commented that, in carrying out a market analysis, account should be taken of the impartiality requirements of Government departments and the question of unfair competition with the private sector. Indeed, some time later, when the zeal for privatisation was at its highest, the Department of Trade and Industry issued guidelines on competition that required Government organisations and agencies not to carry out any work that could be done in the private sector. Pressures on Government bodies, including Government-enforced cost-recovery targets and reductions in the direct grants, meant that this part of the guidelines was widely ignored.

Individually, each one of the Charging Review's recommendations was to make an impact on the way the BGS operated. Some were easier to adopt than others. The exhortation to seek joint funding of core projects was to prove particularly troublesome. By definition, the Core Programme comprised strategic research that served multiple beneficiaries and should exclude the possibility of offering opportunities for co-funding, except where, for example, priority in the order in which a certain part of the programme was being carried out was bought. There was the risk that customers and competitors alike might view co-funding as a Science Budget subsidy for a commercial contract, and there was the difficult matter of how to deal with copyright and commercial confidentiality attached to the findings of co-funded research. All of these, and other attendant issues, were debated within the BGS Directorate throughout the 1990s and accord was never achieved. Even defining what should be classed as co-funding and what should not, proved contentious. As a result, success in attracting co-funding was patchy and never reached the levels that fitted the expectations of the Charging Review team.

Effectively, the Charging Review report provided a green light for the BGS to go ahead and develop its business as well as it could. The problem was that it had already tried and had not succeeded. The Business Development Group was concentrating on overseas marketing and had paid little attention to the UK market. A review of practice had been initiated in July 1989, before the completion of the Charging Review report, but that exercise was not finished by the time the report was released to the Directorate. In November the Directorate agreed 'that a rigorous independent marketing appraisal should be carried out by external professional marketing consultants as a matter of urgency …' and Barrie Page was given the task of preparing a draft specification. The Programme Board endorsed this approach. By February 1990 the specification was complete, a contract management group had been named and tender action was imminent.

These were the last days of Geoff Larminie's directorship. Peter Cook was due to replace him in early March and his belief was that the BGS needed more than a market survey. The specification for the consultancy was broadened to include business development planning and on 29 March the short-listed companies were interviewed. Price Waterhouse was successful. The impact of Price Waterhouse is dealt with more fully in Chapter 12.

In terms of pure commercialism, the BGS changed out of all recognition in the period after the Charging Review. By 1998/99 income from the big three

departments (the Department of Energy having being incorporated into the Department of Trade and Industry) was only 29% of the total commissioned income compared with 95% twenty years earlier. Income from the private sector had grown to 43% of the total from nearly nothing in 1978/79. Overseas, only half the work undertaken by the BGS was funded by the Department for International Development (which replaced the Overseas Development Administration in 1997); the rest came from development banks, other aid agencies and directly from foreign governments themselves.

Despite these dramatic changes, in 1998/99 over 70% of the BGS total income, including Science Budget and commissioned research, came from Government sources, making the Survey, still, primarily an agent of Government. A large part of that 70% was won through competitive tender and half of the income to the BGS is earned as a result of essentially commercial enterprise and activity. This is of crucial importance. Because all BGS staff are involved to a greater or lesser extent in commissioned and commercial work as well as the Core Programme, the culture of the whole organisation has been modified and can be said to have been commercialised.

Chapter 11

New beginnings

The appointment of the first BGS Programme Board in 1989 heralded a new beginning for the Survey. Its arrival coincided with the start of a period of financial stability, to which the Programme Board contributed by steering through, successfully, the bid for the second PES award (see Chapter 6), to start in April 1990. Perhaps more important than this, the Programme Board brought to the BGS the discipline of short and long-term planning within sensible budgetary limits for its Science-Budget-funded work and a relatively stable Core Programme.

The Programme Board, which came together for the first time in February 1989 met five more times that year. Although it had the responsibility for approving the Core Programme for 1989/90, year one of their programme was to be 1990/91. By then the outcomes of the Charging Review and the second PES bid would be known. The programme that they approved for 1989/90, therefore, was an interim one, which nonetheless did embody most of the essential ingredients of the programme that was to follow. The Programme Board decided to carry out some of its operations through working groups and quickly set up two: one for Strategy, the other for Output and Performance. The latter was concerned primarily with defining the Core Programme. By July, the Board had decided that this working group would better function through three task forces, which had complementary aims. These were the Core Programme, New Methods and Performance Measures task forces, all of which began to operate during 1989 with the aim of completing their tasks before the start of the 1990/91 financial year.

The Board Chairman was Mr Gwilym Roberts, a civil engineer, who was joint Chairman of the ACER Group and a member of NERC Council. The BGS Director and the Director of Earth Sciences were standing members. There were eight representatives from the geoscience community, selected so that they provided expertise and knowledge of as much of the BGS customer base as possible. Each stood in his or her own right. They were appointed for two years, initially, in order to begin an annual replacement programme of members in the third year. On the first Board were Dr Michael Ridd, a consultant in the oil industry; Dr Larry Thomas, ex-BGS and then a consultant specialising in coal; Dr William Barratt, Geological Manager for Tarmac Roadstone Ltd; Professor Michael Hamlin of the University of Dundee, a specialist in water engineering; Dr Robert Chaplow of Sir Alexander Gibb and

Partners; Mr Ian Thomas, Director of the National Stone Centre; Professor Howel Francis, of the Department of Earth Sciences, University of Leeds and a former Assistant Director of BGS; and Mr Maurice Cahalan, previously of RTZ. In addition, assessors were provided by the Department of Education and Science, the Department of Trade and Industry, the Department of Energy, the Department of the Environment, the Ministry of Defence and the Department of Economic Development (Northern Ireland). The secretariat consisted of Dennis Hackett, who was the BGS Secretary, Edmund Nickless, from NERC HQ and Andy Howard, a BGS member of staff who it was planned should take over from Edmund Nickless eventually.

The terms of reference of the Programme Board made it advisory to Council. It was tasked to oversee the Core and Research programmes only and had no right of access to information about any commissioned research other than the core commissions. However, it was expected to monitor the balance of core, commissioned and research work within BGS and advise Council accordingly. This was never easy for it to do and, in fact, it was never properly done. The key element of the terms of reference was the requirement to report to Council on the performance against defined objectives and targets within the Core Programme. This was how Council achieved the objective it set itself after the 1982–84 Visiting Group to establish a mechanism for monitoring the way the BGS spent its Science Budget.

The Programme Board approached its task methodically. It agreed revised terms of reference for the BGS and set aims and objectives for the Core Programme before turning its attention to its content. The terms of reference that then existed were the ones that had been presented to and established by Council in July 1985. Later, they were to be modified again following implementation of the recommendations embedded in the White Paper *Realising our Potential* (Cmnd 2250) published in 1993.

It was agreed by the Programme Board that the biggest slice of the budget for the Core Programme should be divided between the Onshore Surveys and the National Geosciences Information Service (NGIS), to reflect the priorities both in the Butler report and of the 1982–84 Visiting Group. The National Geosciences Information Service was the new name for a programme that included the National Geosciences Data Centre. Originally, it had been called the National Geoscience Information System, a name that carried with it the vision of the early 1980s for a BGS-wide database as a component of a computer-based information system. This name, however, was changed for political purposes to the National Geosciences Information Service and the vision was lost.

In addition to the Core and Responsive programmes there was also to be a separate R&D Programme, which was a derivative of the Science Programme that Butler recommended should carry out basic, underpinning research to support the whole of the BGS Core and Responsive programmes. For management purposes it was joined with the Training Programme.

When, first the Output and Performance Working Group and, later, the Core Programme Task Force began their work there already was a Core Programme in

existence. Although the programme had formally existed for only one year and the term Core Programme had gained its current use via the 1985 Strategic Plan and the Butler report, it had been in common use among the Directorate for about a decade. In meeting papers from 1979 onwards, there is frequent mention of a Core Programme, used synonymously with the Science-Budget-funded Programme. At best, this was a loose federation of scientific activity, which was under constant threat from other pressures, such as staffing demands for the Commissioned Research Programme. It was never a managed entity. In early 1982, concern for the integrity of this programme reached a peak and Eric Brown, the BGS Secretary, was asked to explore mechanisms for protecting the Science Budget Programme from fluctuations in commissioned research activity. He came to the conclusion that two thirds of the Science Budget programme could be protected. It would be necessary to designate the other third as a 'buffer', which would absorb cuts in the CR programme, if required, or provide staff for it in periods of high CR demand. His proposal was for the ADs to designate their Science Budget projects as either 'core' or 'buffer' and submit to the Director a scientific justification with staffing requirements and costs for the 'core' projects. The Director would then combine them into a formally protected Science-Budget-funded, Core Programme, which would be ring-fenced, but which could also be positively managed. This idea was welcomed by the Directorate when it was discussed in March 1983, but nothing came of it.

It is a pity that the idea of defining a 'buffer' zone was never taken up. Neither the 1985 nor 1988 Strategic Plan teams, nor Butler, adopted it and it was not considered in the version of the Briden-Larminie paper that was used by the Programme Board to develop its Core Programme. The Core Programme, therefore, has always implicitly contained a 'buffer' within it and it has suffered as a consequence.

The first formally defined Core Programme to be implemented was for 1988/89, the year before the Programme Board came into being. Programme planning had begun in November 1987 following the conventional procedures in which the three Chief Scientists had ranked all the project bids from themselves and the Programmes Directors. Those projects that had been classed as essential and ongoing by them were incorporated into the Core Programme under the sub-programme headings that had been put forward in the Briden-Larminie paper to the Department of Education and Science (see Chapter 6).

A key decision taken that year was to redefine all the projects in the Onshore Mapping Programme to conform with the regional sub-units used in Plan 2000, a revised version of which had been submitted to the Butler Study Group who regarded it as critically important evidence. Adopting the Plan 2000 programme structure led to a significant adjustment to the way the Land Survey was organised. Other parts of the programme were less severely affected.

Because of the haste with which the Programme Board had to act, the Core Programme it approved for the year 1989/90 was effectively the one the BGS Directorate had already planned. They agreed to the six components presented in

the Briden-Larminie paper, but replaced the National Geoscieces Data Centre with the NGIS programme. The planning budget they approved for the Core Programme and the R&D and Training Programme together, including the core commissions, was £8.5 million (cash costs, not full economic cost, which includes overheads). Of this, by far the largest slice, £3.5 million, went to the Onshore Surveys Programme. The NGIS Programme took £1.5 million.

In percentage terms the division of funding between Science Budget and core commissions in 1989/90 was:

	Science Budget	**Core commissions**
Onshore surveys	90	10
Offshore surveys	7	93
National geochemical surveys	22	78
Hydrogeological surveys	90	10
National geophysical surveys and monitoring	88	12
NGIS	90	10

The Offshore Surveys Programme was still funded mostly by the Department of Energy as a major core commission. The National Geochemical Survey was also a major core commission, but was about to become the only Rothschild back transfer. In the other parts of the programme, the core commissions were mainly small commissioned projects that were classified as contributing to the Core Programme.

The job of the Core Programme Task Force was to advise the Board on the allocation of resources to a three-year programme commencing 1 April 1990, with the long-term aim of completing survey coverage of the UK in a 15-year programme. To do it, the Task Force set objectives for each element of the Core Programme and agreed long- and short-term output targets. Before any programme could be finalised, however, the recommendations of both of the other task forces had to be known. The New Methods Task Force was to advise the Board on methods of maximising the quality and usefulness of outputs within the 15-year programme; while the Performance Measures Task Force was to develop measures of input, output and performance for the Core Programme.

The Programme Board showed most interest in the Geological Mapping Programme and it was into planning this that most effort went. Plan 2000 had to be the starting point, but that had been costed at £4.6 million a year in 1986. The Programme Board, constrained by the need to increase the Science Budget allocation to the NGIS Programme, was unable to allocate any more than £3.5 million to the whole of the Onshore Surveys Programme. The 15-year plan, therefore, had to be a much-reduced version of Plan 2000.

Plan 2000 had been based on a thorough evaluation of the quality of map and mapping on every single 1:50 000 geological sheet in Great Britain. In many ways it was a seminal document, putting into words concepts and ideas that had

been understood largely only intuitively up until then. The opening words of the paper, for example, said, 'A geological map is a model of our understanding of the geology of an area. It therefore embodies the geological concepts and the information available at the time it was compiled'. This very neatly laid out the rationale used by generations of Survey staff since De la Beche to justify their belief that a geological survey can never be finished. It was argued in Plan 2000 that all maps should be revised at intervals of not more than 50 years, and in conurbations and on the coalfields the interval should not exceed 25 years. The authors of Plan 2000 concluded that of the 608 1:50 000 sheets covering Great Britain, only 125 could be classed as adequate to answer questions raised today. Of the rest, 142 sheets were not even available in published form. In terms of land area, 70% of the underpinning 1:10 000 database was deficient in terms of the user requirements of the day.

There were two main parts to the plan. The first was to carry out a programme of resurvey on those sheets considered inadequate to meet modern standards; the other was to initiate a programme of continuous revision to ensure that those sheets that did meet modern requirements did not lose their currency with time. The plan was broken down into 27 regional project areas, each of which was geologically internally consistent. Each project team was to be multidisciplinary, following the model laid out in the Regional Geological Surveys.

The Core Programme Task Force approached the matter of prioritisation of the 1:50 000 sheets, so as to reduce the size of the resurvey programme, in a number of ways. The first was to use a scoring system that had been developed the year before for a different purpose, and applied to every 1:50 000 sheet in England and Wales. Scores were made up from three classes of information. These were the state of the existing mapping, environmental factors and scientific interest. State of mapping took account of the scale of existing maps, the date of the last survey and the quality and the size of the database that had accumulated since the last survey. Environmental factors included the proportion of urban development, hazard potential, resource potential and the number of enquiries received on each sheet. Variations to the system had to be introduced to apply it to Scottish maps because of the practice of mapping the solid and drift at separate times and publishing separate maps for them in Scotland. Also, reconnaissance mapping in much of the Highlands was carried out using six-inch maps for recording data even though the resolution was more appropriate for a smaller-scale map. In the event, the Board used only the environmental factors and scientific interest to develop what became known as the 'needs' score. The system was applied only to those map sheets that were categorised as unsatisfactory in Plan 2000.

Secondly, account was taken of the need for the BGS to maintain its skill base in all parts of the geological column and all geographical areas of the UK. This would lead, naturally, to some map sheets being included in the programme regardless of their scores. Finally, it was agreed that over a hundred sheets that were either partly surveyed but in abeyance for various reasons, or were currently under active survey should be included in the programme.

In the plan that was eventually put to the Programme Board, the area of Great Britain categorised in Plan 2000 as having unsatisfactory mapping was divided into 32 areas, eleven of which contained only sheets with low 'needs' scores. These were omitted from the resurvey programme. The remaining 21 were divided between three different approaches: there were those sheets that required full 1:10 000-scale resurvey; those sheets only part of which required full resurvey; and those sheets that could be adequately covered using the rapid mapping technique that had been developed for mapping the Southern Uplands and, later, applied to Central Wales. The Programme Board decided that the sheets with low 'needs' scores that had been omitted from the resurvey programme should be tackled by doing desk compilations using data from all sources in and outside the BGS, and that the staff effort on each sheet should be limited to three person-months. No field work was to be allowed on any of them. When published, the desk compilations were to be classified as Provisional sheets.

This way, a programme of multidisciplinary geological mapping was developed within the allocated budget that would lead to the whole of Great Britain being covered by geological maps suitable for modern purposes by the year 2005. In it were 300 1:50 000 sheets, of which 106 were to be desk compilations and 194 to be completed by rapid mapping, partial revision and full resurvey. The Programme Board required output to be at the rate of twenty map sheets a year, together with between ten and twelve memoirs a year describing the geology on a sheet-by-sheet basis. This annual output of memoirs reflected the fact that on average eight of the twenty maps published would be Provisional sheets for which a memoir was not required and that some memoirs would cover more than one map sheet. It was also part of the programme that the draft 1:50 000-scale map and a memoir manuscript should be produced within a year of completion of field work. This was the first time that a memoir had been regarded as an obligatory product of a mapping project. Each Provisional sheet was to be accompanied by an open-file dossier of information. It was also intended to revise about half of the Regional Guides, but this was a low-priority task and it was not firmly embedded in the programme.

There were three other parts to the Onshore Surveys Programme: continuous revision, the Onshore Surveys Database and overview studies.

The objective of the database subprogramme was to build and maintain computer databases in support of the mapping programme. The overview subprogramme contained several projects that were essentially regional in approach. Among them were the three-dimensional analysis of the exposed and concealed Upper Palaeozoic basins of the UK, seismic surveys in support of this project, a drilling programme to support both the mapping programme and the other overview studies, a systematic study of engineering properties of UK geological formations and regional sedimentological, stratigraphical and biostratigraphical reviews.

Continuous revision had been part of Plan 2000, but it took on a different significance in the new programme. The long-term aim was for each sheet that was completed by resurvey to be kept up to date by a process of periodic revision,

so it would never have to be resurveyed again. It was envisaged that this subprogramme would start small and gradually grow, taking over from the survey subprogramme as the main activity in the Land Survey after 2005. Traditionally, each District Geologist (This was the original name for the managers of the field units. They came to be called Research Programme Managers after the 1983 reorganisation, then Regional Geologists and, after 1991, Group Managers.) in the Land Survey had maintained a set of 1:10 000 and 1:50 000 'correction copies' on which he marked any changes and improvements that came about as a result of new information being acquired. In time, when there were sufficient alterations to justify it, the maps were redrawn and reprinted. Since the late 1970s, budgetary difficulties had rendered this practice almost obsolete. A review of the practice and processes of map revision had been carried out in 1988 and it was concluded that it was economically realistic to carry out continuous revision only in a digital environment. An R&D project, part funded by the Department of the Environment, had been started in 1988 to develop a method of generating applied geology maps for urban areas digitally from computer databases. Using knowledge gained from this research, the wholly Science-Budget-funded Digital Map Production Implementation project (DMPI) was established as a joint venture between the managers of the Onshore Surveys Programme and the NGIS Programme. It was tasked to report in March 1991 on how to act upon the recommendations of the review into continuous revision. Its remit was to develop a methodology for digitising all the information on 1:10 000-scale maps and storing it in databases that could be interrogated to produce maps displaying any of that information. The simplicity of this remit belies an immensely complex project. It was, however, to provide the basic infrastructure for a database of geological information on 1:10 000-scale maps which could be used in continuous revision.

The NGIS Programme effectively incorporated all the elements of the Information and Central Services Directorate and, despite having been unchanged since it started in1984, was in a severe state of flux in 1989. The main components of the programme were:

- Information Systems, concerned with the design, development, implementation and maintenance of computer systems
- the Information and Advisory Service, which was the public face of the BGS and dealt with sales of products and management of the enquiry service
- the NGDC, containing all the paper records and material collections such as rocks, fossils, borehole core and so on
- Publication Services, which looked after the preparation for publication of all the maps and mainstream books and reports produced by the BGS
- Marketing.

The Core Programme Task Force asked for a development plan for the NGIS Programme to be prepared, but the New Methods Task Force also had an input

into its future. One of its recommendations, for example, was that Publication Services should have a programme that matched the 15-year mapping programme to ensure that it had the capacity to handle and publish a minimum of 20 1:50 000 geological maps a year. This directly addressed the fear expressed by the 1982–84 Visiting Group that, unless it was properly managed, the output from the current mapping programme would merely be added to the backlog. Recommendations of the Charging Review were also expected to influence the way in which the NGIS Programme developed.

Despite going through several iterations before the Task Force finally endorsed it, the NGIS development plan was not fully accepted by the Programme Board. They demanded more work on it during 1990 to define more rigorously the longer-term milestones, targets and outputs. When the work programme for 1990/91 was finally agreed, the supervision of four, major consultancies was included in the NGIS Programme. These were Price Waterhouse on business development, the Central Computer and Telecommunications Agency (CCTA) scoping study on information systems and two contracts let to Logica on digital map production and a data architecture for the BGS.

The managers of the NGIS Programme were not in an enviable position. Since the creation of the Information and Central Services Directorate it had received neither the funding (capital or other-recurrent) nor appropriately trained or motivated staff to do the job that needed to be done. During the preparation of the second PES bid the overall, far-sighted aim of the NGIS Programme was explained as to develop an integrated information system to allow information from all activities within the BGS, and from sources outside it, to be brought together for processing, analysis, modelling, presentation and communication. To an external enquirer, the system must appear as a single database, with transparent links between the component parts, and the system must be able to respond quickly to demands for the most up-to-date information, interpretations and, increasingly, 'customised' products. This had been the aim for the NGIS Programme since 1983 and very little progress had been made towards achieving it. Several key activities were grossly under-resourced. Among these the high priority ones outlined in the PES bid were:

- rationalisation of the storage, methods of curation, conservation and maintenance of the traditional reference materials held by the BGS
- clearance of the accumulated backlog of untreated and unregistered materials and records
- development of a single, but distributed, digital database system
- development of a digital index to all records and material holdings, particularly for the external user
- digitisation on acquisition of all new point-source data
- development of electronic document storage
- modernisation of the cartographic and book production systems
- improvement in the sales and marketing capability
- new buildings in both Keyworth and Edinburgh for material and records storage.

There are several reasons to explain the slow progress made towards achieving any of these, but one is endemic in the BGS: within the culture of the organisation highest emphasis was placed on the acquisition of new data, not on its care after first use. To a large extent, the Programme Board endorsed this, despite Butler giving highest priority to the development of the NGIS Programme. In its response to the Charging Review report the Board, whilst agreeing that the enhancement of the NGIS Programme was a key element in realising the BGS's income-generating potential, stressed that the income generation model must not require a reduction in the level of support for core surveying. They resisted any internal redistribution of resources from core surveying to the NGIS Programme. The Board wanted, more than anything else, to see the mapping programme become successful. An early decision of the Programme Board had been to divide the Science Budget funding into three main tranches: 40% for the Onshore Surveys; 40% for the NGIS Programme, and 20% for the rest of the Core Programme. In 1989/90, without the benefit of the second PES award, the division was 55:20:25 respectively. Though the NGIS Programme share did rise to 35% in 1990/91, the Onshore Surveys component did not decrease, the Programme Board having decided not to implement its earlier decision.

The new PES money came as £1 million in 1990/91, £2 million in 1991/92 and £3 million in 1992/93 and was directed exclusively towards the NGIS Programme and the enhancement of the Onshore Surveys Programme. It brought immediate benefits to the NGIS Programme enabling action to be taken in most of the high priority areas identified in the PES bid. None of them is particularly glamorous, but each one contributed to the building of the foundations for the new NGIS Programme. New staff were recruited and capital equipment was purchased to make a start on clearing the borehole registration backlog, and to enhance work already in hand on building digital indexes to a wide range of records, in particular the borehole registers. The CCTA scoping study and the Logica consultancy on data architecture were key in this area and, ten years on, the benefits of both are still evident. They brought with them a new way of thinking about dealing with digital data. This area, though no longer in its infancy, was still young then and there was little expertise in it within the BGS. There was, with the Logica consultancy, a transfer of knowledge that put the BGS among the leading organisations in data management within Government and paved the way for the major changes that were to take place in 1999 and 2000.

A new publications distribution building was erected in Keyworth to enable the BGS to take on the responsibility for the distribution of its maps and books, until then in the hands of the Ordnance Survey (OS) and her Her Majesty's Stationery Office (HMSO). The OS had been progressively increasing its fee for looking after the BGS map stock and was doing less and less about selling them. The BGS did not regard selling maps and books as part of its core business, but with the two available agents clearly losing interest in doing it for the Survey, some rethinking was necessary. In building the new publications store, the BGS took on full responsibility for running its own sales and mail-order business.

The most significant change to take place as a result of the acquisition of the new PES money was in the Drawing Office. There is a long history to the development of digital map production techniques in the BGS. The first geological map produced outside the BGS by the NERC Experimental Cartography Unit by digital methods was the Abingdon 1:50 000-scale sheet (253), published in 1971. Though it was a successful experiment, in that it did produce a publishable map, the process was extremely expensive and offered no prospects of being implemented routinely for production. Geochemical atlases were tackled next and this was successful, with digital methods becoming routinely used in their production from the mid 1970s. By the mid 1980s, technology had advanced sufficiently for the digital production of geological maps to be considered a realistic possibility and in the period 1985 to 1989 a considerable amount of experimentation was done in the BGS. The first 1:50 000-scale map production system, usually referred to now as DMPS 89, was in place in 1989. A huge programme of capital expenditure in 1990 enabled the BGS to phase out manual cartographic production and to replace it completely with digital production. DMPS 89 was strictly a production system for 1:50 000 maps, but in 1991, on completion of the DMPI project, which was based on 1:10 000-scale maps, it became possible for digital map production to be done from digital geological databases. Over a period of several years the two systems converged, leading to the establishment of DMPS 98 as the basis for the production of all BGS maps at all scales.

What is remarkable about this is that the BGS cartographers themselves carried through these revolutionary changes. Almost all of them had been trained and were highly skilled in manual map production techniques. They then passed through a period when they learned digital map production methods. Now, they also build digital databases as well as produce geological maps. They are more than cartographers, but no one has been able to find a short name to describe the new type of work they do.

The Offshore Regional Mapping Programme was funded jointly by the Department of Energy and the NERC and was nearing completion in 1990. Funding from the Department of Energy was assured until the end of the 1992/93 financial year, when the programme would come to an end as a core commission. By then all the 1:250 000-scale geological and geophysical maps covering both the offshore and onshore area of the UK would be published, leaving completion of the regional reports and small-scale overview maps still in hand, but likely to be published soon after. The second major project was the development and maintenance of the National Offshore Archive. This was also to be funded by Department of Energy until the end of 1991/92.

Three offshore projects were to be funded entirely by Science Budget. One was a desk study of the UK offshore-designated area, west of the Scottish shelf and north of latitude 62 degrees north. This had started the year before and was aimed at attracting consortium funding from oil exploration companies to survey these inhospitable areas. This was ultimately successful. Two consortia, Rockall and the Western Frontier, were set up and have been the only mechanism by

which the BGS has been able to carry out surveys of the westernmost waters. The second Science-Budget-funded project was also a desk study, of the Quaternary geology of the Bristol Channel. Regarded as a pump-priming project, it was designed as a demonstration to attract commissioned funding for a geological survey of the nearshore zone. This area of the UK waters, lying between the high water mark and the nearest point to land that survey ships carrying out the offshore survey could reach, was variable in width and almost entirely unknown. This project was meant to begin the process of acquiring funding to carry out a nearshore zone survey. The last project was for the maintenance of the capability to carry out operations offshore.

Like the offshore survey, the Geochemical Survey Programme had been a core commission, but funded by the Department of Trade and Industry. A funding transfer had been agreed so that the project would be funded from a ring-fenced budget within the Science Budget from 1990/91. This was a systematic survey, started in the north of Scotland and progressing southwards. It was due to cover the whole of Great Britain at a sample density of approximately one site per 1.5 km^2. Stream sediment, heavy-mineral concentrates and water were collected at each site. Soil samples sometimes substituted for sediment samples. The results were published in the form of geochemical atlases. It was planned for sampling to be complete by 2007; all data packages were to be released by 2010 and the last atlas published in 2012.

Another core commission, the Offshore Geochemical Survey Programme funded by NERC and the Department of Energy, was coming to an end. This involved the study of archived sediments collected during the offshore survey on a 5 km grid. Analysis of the samples and publication of results on single-element 1:1 000 000-scale maps was due to be completed by the end of 1991/92.

A third strand to the Geochemistry Core Programme was a project to carry out research in methodology, equipment and software development to underpin all aspects of the geochemistry contribution to the Core Programme.

The Hydrogeological Surveys subprogramme was the least well funded part of the Core Programme, although the Programme Board did identify it as a target for future development. Again, the expectation was that commissioned funding could be attracted to this programme. In the first year it consisted mainly of a series of ad hoc investigations, mostly riding on the back of completed commissioned research. It included the start of a review of the hydrogeology of Scotland, maintenance of the paper record of statutory data on well and groundwater records and the maintenance of basic laboratory facilities for the study of aquifer characteristics and groundwater chemistry.

The level of funding for the Geophysical Surveys and Monitoring Programme was reduced in 1990/91 compared with the previous year and funds transferred from it to the NGIS Programme. The validity of including in the Core Programme both geomagnetic monitoring and an earthquake monitoring network had been questioned by Butler. The Programme Board had also been sceptical about their inclusion in the BGS work programme. The questions arose because

geomagnetic monitoring was an isolated activity with no connections with any other part of the Core Programme and the UK had a very low level of seismic risk. Managers of both parts of the programme were told to find external funding or see their projects closed down. There had already been some success in this with regard to geomagnetic monitoring and a target of 50% external funding was set for the seismic monitoring network by the end of the financial year. The National Gravity Survey was almost complete, with only a few areas of infill and low priority areas still to do. No or little action was planned on this. However, effort was to continue on the development of the databases for national gravity, aeromagnetic data and deep seismic reflection data. Work on a geophysical atlas, synthesising gravity and aeromagnetic data, was to begin. As with the other parts of the programme there was a project devoted to the maintenance of capability to carry out geophysical research and surveys.

The full Core Programme, as defined in 1990/91, was modified only slightly in later years, with the main elements of it remaining intact. Significantly, apart from geomagnetism and seismology, which managed to keep hold of their Science Budget allocation by tying it into co-funding ventures, those parts of the programme that were poorly funded in the first year did not prosper. In spite of considerable effort by the manager of the nearshore-zone survey, external funding was not acquired at anywhere near the level required to carry out the programme as planned and it struggled from year to year. There was only a minimal replacement of the funding for the offshore survey that had been provided by the Department of Energy, when that contract ended and there has been only a small programme of offshore map revision since then, though the mapping consortia operating in western waters has been highly successful. The overview projects were transferred out of onshore surveys and became attached to other parts of the programme. The Upper Palaeozoic basins project was merged with research in hydrocarbons and the emphasis changed from a study of three-dimensional geology onshore to offshore, where it was hoped to use the funding to build partnerships with industry to work offshore. Hydrogeological surveys were given a small funding boost, but the monies were used to develop co-funding ventures, leading to an ad hoc programme with no clear theme. Lastly, after more than a decade of effort, a co-funded arrangement was made with World Geoscience to carry out a high-resolution airborne radiometric and geophysical survey over part of the English Midlands in 1997. This was the first geophysical data acquisition project onshore since the end of the gravity survey.

There is one clear conclusion that can be made from this. It is that after ten years of effort, attempts to enlarge the Core Programme with co-funding have not been very successful and probably never will be much better than they are now. The expectation that it might have been otherwise was part of the political dogma current at the start of the programme. Butler gave highest priority to the NGIS Programme and the Onshore Mapping Programme. The Science Budget allocations from the NERC were only ever sufficient for these two, together with the Geochemical Survey (which received the PES transfer) and the geomagnetic and

seismic monitoring elements of the Geophysics Subprogramme, to be funded at a viable level if other parts of the subprogramme were starved of funds. The outcome has been an unbalanced programme, with the poorly funded parts seriously lacking in direction. The five-year review carried out in 1995 did not address this imbalance, but, since the 1997 Science and Management Audit, programme review groups have been set up to carry out thorough investigations of every part of the programme. First to be completed was the combined review of coastal geology and engineering geology. This was followed by urban geology and then, thirdly, the Onshore Mapping Programme. Each one has resulted in proposals for new, well-structured, cohesive programmes that address some of the deficiencies in those they replaced. The first two were used as inputs into thinking about the new programme during the third strategic planning exercise.

Chapter 12

The Price Waterhouse report and its aftermath

Though many of the right initiatives had been taken early in the 1980s to improve the BGS's position in the market and replace commissioned research income that was being lost as the big Government contracts fell away, the cumulative achievement since then had not been very great. Those staff involved at the time, particularly in the Marketing and External Affairs Group, may argue that their efforts actually broke the back of resistance to the idea of a public service body doing marketing, so that change in the 1990s came about more easily as a result. This may be so, but there was still, in 1990, a considerable amount of resistance to the changes that were required within the BGS to align the organisation with the market philosophy of the Government.

There were good and obvious reasons for this. Most of the BGS science staff were middle aged and long serving. Many of them had been recruited into the Survey at a time when they had a choice between academia, private sector and public service. They came to the BGS because their preference was for public service. Geologists in general have a capacity to tolerate solitude. They are not usually gregarious people and those for whom the public service was first choice are rarely entrepreneurial. The administrative staff were also well imbued with the Civil Service ethic. Thus, there was existing in the BGS a powerful institutional culture that was intuitively resistant to the kind of changes that were required in government organisations by the new Tory politics. Despite the fact that all the essentials for change had been contained in the Charging Review report, the authors of that report themselves considered that the process of exposing this culture and raising the awareness of staff to the opportunities associated with change could only be led by outsiders, who were perceived to be expert in the field and impartial.

The matter of bringing in consultants to advise the BGS on marketing and business development had actually been discussed in the Directorate before the completion of the 1989 Charging Review report (Chapter 6) and its contents made known to managers. Brian Kelk had already let a small contract for advice on marketing, but others on the Directorate considered that something much bigger was needed. The Charging Review group thought the same. Recommendations in its report informed the choice of wording of the Secretary of State for Education and Science in his announcement on 15 November 1989 that he was awarding the BGS £6 million over three years to stimulate the generation of outside income which can be reinvested in core surveying. Both the

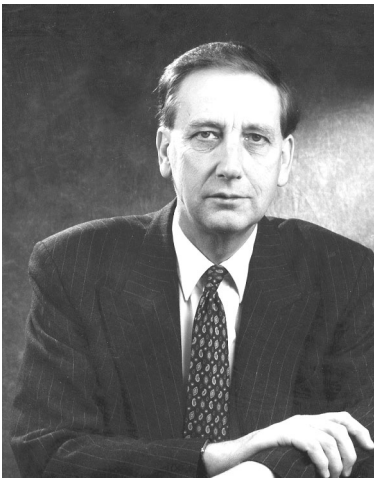

Plate 5 P J Cook, Director from 1990 to 1998.

Peter Cook was born on 15 October 1938. He graduated from Durham with a BSc, later a DSc; he took a MSc at the Australian National University and A PhD at Colorado. He joined the Bureau of Mineral Resources, Australia, in 1961, leaving in 1976 to take up a post as senior research fellow in the Research School of Earth Sciences, Australian National University, until 1982. He returned to the Bureau of Mineral Resources in 1982 and served as a Chief of Division and Chief Research Scientist. In 1989 he took a year out as a professor at the Louis Pasteur University, Strasbourg. He was awarded the CBE in 1996.

Directorate and the Programme Board agreed that funds for buying in advice on how to do this should be the first call on the £6 million.

Price Waterhouse was commissioned in April 1990 and they submitted their report in November that year. The choice of a high-profile organisation, such as they were, was deliberate. There was a feeling in the BGS that it was important not only to react positively to the Charging Review recommendations, but also to be seen to be doing so. There was no better way of progressing than by bringing in a top-flight firm of management consultants, such as Price Waterhouse, who would give the BGS some credibility in political circles. This may seem to be somewhat cynical, but it strongly reflects the mood of the time.

The overall manager of their team was Mr Ian Beasley, a partner in the firm who, for part of his previous career, had served as a Grade 3 civil servant in Whitehall. Mr Adrian Haberberg, who was effectively resident in the BGS at Keyworth for six months, carried the main burden of the consultancy, though in the first weeks several additional consultants were active at any one time on foundation work. The remit presented to Price Waterhouse was to assess the BGS's current and potential capabilities, determine the markets for the Survey's products and services, and identify problems and opportunities in those markets.

They fulfilled their remit, and more. As experts in the field they understood the importance of the cultural change required for the BGS to sustain commercial success into the future. They conducted the consultancy at different levels. On one level, they initiated the process of culture change, involving in it staff at all levels from the new Director, Peter Cook (Plate 5), down. On another, they sought business opportunities, and on another they looked at the structural requirements for ongoing success in the future. Their method was to interview staff individually and in groups, interview customers, hold workshops and seminars and lead brainstorming sessions. Some of the last were with the Directorate alone to

formulate mission and vision statements. Teams of staff were put to investigate potential business opportunities, carry out market research and write business plans for them. In addition, many administrative staff, particularly in Finance, carried out financial analyses of past performance in ways that had never before been tried. At the end of the exercise, most staff, in some way or other, had been touched by the process.

The final report ran to 272 paragraphs with five appendices. There were several other volumes, some of factual information only, accompanying it. It concluded that there was the potential substantially to develop the BGS's commercial base over a three to five year period. Six opportunities were identified for immediate development and business plans for them accompanied their report. Four more were identified for development at a future date. There was a caveat, of course, that staff had to be given the resources they needed to achieve the business-plan objectives. The report went further. The consultants did not think that the BGS had a management system that was appropriate for a commercially ambitious organisation and regarded it as important that the Survey put into place the infrastructure necessary for the successful development of its commercial activity. There were four key elements to this:

- flexibility was needed in the manpower allocation process
- a new marketing structure was required
- planning and budgeting systems must be decentralised
- staff perception that commercial achievements are given less weight than scientific achievements had to be corrected.

The Directorate and the Programme Board accepted the report, although with reservations about some of the 63 recommendations. By Christmas 1990, some nine months after his appointment, the Director, Peter Cook, announced a new management structure for the BGS (Figure 7). A Business Planning Working Group was then set up to devise new systems and procedures for running commercial activity within the BGS to be implemented in April 1992.

The impact of the Price Waterhouse recommendations was profound. Hardly any aspect of life and work in the BGS was untouched by them. In essence, the 63 recommendations can be distilled into four major tangible outcomes:

- reorganisation of the management of the BGS along market-facing lines
- introduction of annual business planning
- target setting for levels of commercial earned income
- introduction of an internal market for staff and services.

Price Waterhouse recommended that the management structure should reflect customer sectors; in other words there was to be a direct, structural link between the BGS and the outside world. The notion that customers did not care how the BGS was structured as long as the goods were delivered was disregarded. Instead, the expected benefits of the psychological impact on BGS staff of finding

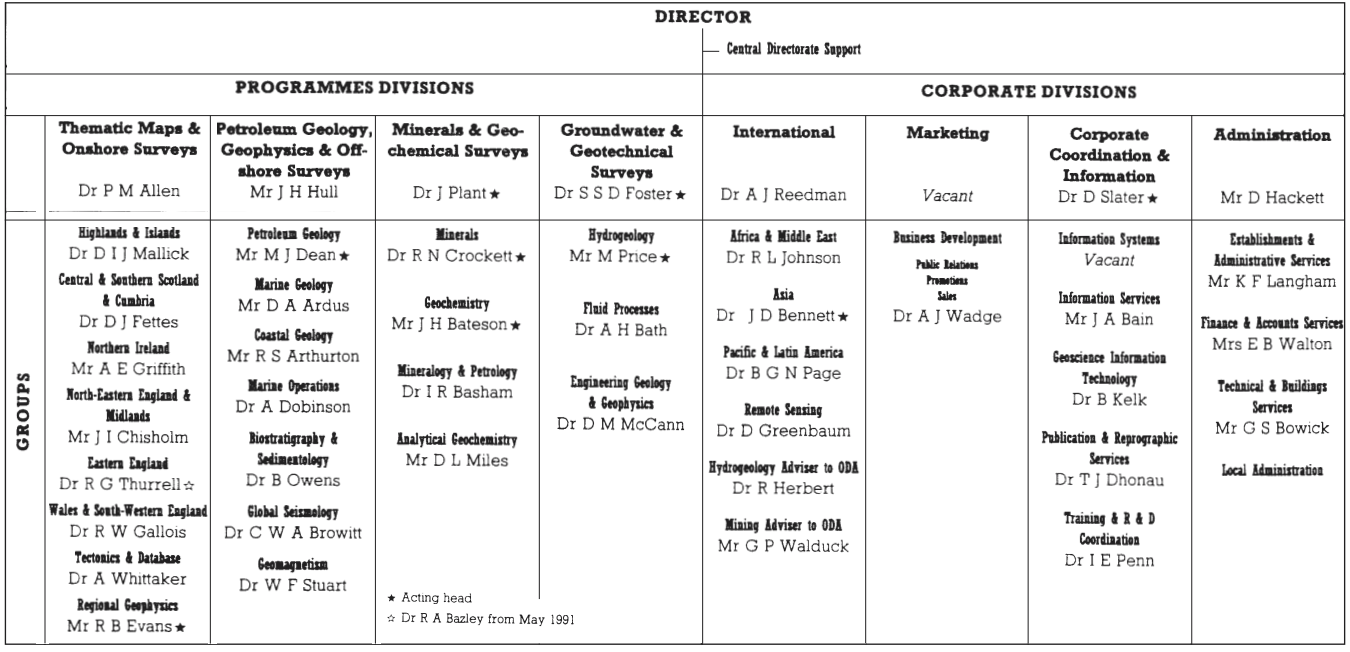

Figure 7 (from Office Notice ON/31/90) The organisation implemented on 1 January 1991, following Price Waterhouse. The nomenclature was changed, and matrix management was replaced by a hierarchical management system. The NERC had agreed to reinstate one of the lost Grade 5 posts for the head of Marketing, but the Grade 6 management posts in the Land Survey were reduced from eight to six. The Coastal Geology Group was founded.

Many changes took place before the next management restructuring. In 1992 T J Charsley became head of North-eastern England and Midlands; M K Lee took over Regional Geophysics; D J Kerridge became head of Geomagnetism; D Slater became head of Minerals; J D Baldock became head of Geochemistry; D J Morgan became head of Mineralogy and Petrology; D R C Grey took over Hydrogeology; and R B Evans took over Asia. B Stephenson became head of Marketing, and D C Ovadia was appointed to head Information Systems.

By June 1993 there were five other management changes: R A B Bazley headed Northern Ireland; R Shepherd-Thorn headed Eastern England; G P Riddler headed Minerals; A Dobinson headed Information Services; and C A Green was head of Publications and Reprographic Services.

that they were organised in such a way as to maximise their interaction with customer sectors was in the forefront of their minds. Price Waterhouse regarded the Group in the BGS as the basic business unit and the report recommended that planning and budgeting systems be decentralised so as to fit a group-centred model. Essentially, an internal market economy was to be created. Groups were to trade services and staff among each other as well as outside the BGS. There were to be minimal restrictions on the growth of groups so that they could meet increased demand in the market for their products and services. Ideally, groups should be free to hire and fire as necessary and their recruitment policies should reflect market demand and not be constrained by scientific discipline. Unsuccessful groups should be allowed to wither away. Group Managers should be allowed to retain a portion of their profits from commercial activity for the development of their group. There were to be limits on the levels of central support in the budgeting process to ensure that budget holders (Group Managers) 'owned' their budgets and accepted responsibility for income as well as costs. Groups were to be given a target figure to be taken from their commercial earnings for their contribution to the central running costs of the Survey. This was called contribution to overheads

Both the NERC and the Treasury imposed limits to the full implementation of the Price Waterhouse recommendations, particularly with regard to staff and financial management, which made the implementation of the full group-centred model impractical. There was also some very valid internal resistance to the full model, most of which was aired during 1991 when the protocols for the new commercial management system were being developed by the Business Planning Working Group. In essence, what the BGS did was turn the consultant's report into something that was practical to implement in the environment within which the BGS operated. In some ways, the fact that this had to be done was a criticism of Price Waterhouse, who ought to have been fully familiar, at least with the financial constraints that apply to Government bodies. Perhaps they had knowledge of something concealed from the BGS. Certainly, had the BGS succumbed, later, to the pressures to become privatised, the full suite of recommendations made by Price Waterhouse would have been completely relevant, but at the time they were introduced they were not.

In the new, market-oriented management structure (Figure 7) there were seven programme and corporate divisions, each managed by an Assistant Director. This terminology was taken straight from the structure before Malcolm Brown. 'Groups' replaced the 'Research Groups' and 'Research Programmes' in his structure, and all the managers at that level were called Group Managers. There were four programme and three corporate divisions. It was the programme divisions that were designed to be the main market-facing entities and, in theory, there was to be little or no overlap in the market interest of each of them. Some of the groups, however, were also structured to be market facing.

The four programme divisions were Groundwater and Geotechnical Surveys (GGS), Minerals and Geochemical Surveys (MGS), Petroleum Geology &

Geophysics and Offshore Surveys (PGGOS) and Thematic Maps and Onshore Surveys (TMOS). The first choice of a name for the last division was Land Use and Onshore Surveys, but approval for this was not received from NERC HQ. Dr Bernard Tinker, who was the Director of Terrestrial and Freshwater Sciences Directorate, would not agree to the term 'Land Use' being used in any other directorate than his. On the recommendation of the Director of Earth Sciences, it was changed.

The three corporate divisions, each managed by an Assistant Director, were Corporate Coordination and Information (CCID), Marketing, and International. Though it was always expected to be a small division, Marketing was given independent status. Its head was given the rank of Assistant Director and a place on the Directorate to ensure the status of this discipline within the Survey.

In this reorganisation, the final remnants of the matrix management system were unstitched and the BGS returned to a conventional, hierarchical management structure. The posts of Chief Scientist were abolished, programme planning was carried out by the full Directorate, and staff deployment was controlled by the Group Managers within the internal market. The Core Programme was redesigned at the margins so that whole programme elements were managed entirely within a single division and managers were given their heads to develop their group's commissioned research programme in any way that they saw fit. This certainly encouraged enterprise, and the entrepreneurs were able to flourish, bringing undoubted benefits to the BGS. But, and there is always a but, the interaction of this freedom with the other innovations brought into the process of managing the BGS was not always and entirely beneficial.

Price Waterhouse recommended a marketing division with eight staff. They argued that a centralised marketing group was necessary because the ADs were not yet experienced enough to deal with marketing within their own divisions. This issue, whether marketing should be led from within the divisions or from a central group, raged throughout the 1990s and was sufficiently emotive in 1991 to stop the full implementation of the Price Waterhouse recommendations on marketing.

Their proposal was to have an international marketing manager and two product market coordinators, one for environment and land use, the other for resources. They were to work alongside a corporate marketing manger, whose job was to liase with the Group Managers. A services group beneath these four senior staff was to cover public relations, marketing information, publication sales coordination and promotions. The Head of Marketing was, among other things, to have a major influence on the development of the BGS business strategy.

What was set up bore little resemblance to this. A Head of Marketing was appointed from outside the BGS and given a seat on the Directorate. Beneath him were three sections: business development; market research and intelligence; and promotions and public relations. International marketing remained within the International Division. Publication sales and promotion remained within Information Services Group in the Corporate Coordination and Information Division. The three posts to cover market coordination and corporate marketing

were not filled. Instead, two senior scientists were given the job of business development. The main marketing effort was to be carried out within the divisions. Funding for it was partly controlled by the Head of Marketing, who was able, this way, to coordinate some of the marketing effort.

This arrangement lasted only three years. By 1994, the Marketing Division had gone. After that, marketing coordination was done within International and Marketing Division by a member of staff operating at two grades lower in rank than Assistant Director. Promotions and public relations were transferred fully into the Corporate Coordination and Information Division. Marketing, then, became an almost totally distributed activity even though much of the funding for it was still coordinated from the centre. In fact, little marketing, in the proper sense of the term, was being done. But there was a lot of very vigorous and successful selling.

This situation was no more satisfactory than the one that preceded it. Senior managers were, by then, beginning to react against the fragmented structure and the internal competition, especially as it was becoming evident in respect to the commercial activities. Marketing information, often, was not shared. It was jealously guarded within groups and secrecy was normal. Attempts made by the head of International and Marketing Division to collate marketing information for the purpose of monitoring progress towards meeting the BGS income target were met with less than full enthusiasm and some information was always held back. What was clearly missing, and missed, was any mechanism for gathering information that the BGS as a whole could use to determine its corporate priorities for spending the marketing budget and to provide guidance on the sort of research and product developments that should be taken up for the benefit of the BGS as a whole.

The problem was that, throughout this period, staff that did understand the difference between marketing and selling continued to question the need for marketing. It was said that individuals who were astute enough to grasp opportunities when they arose usually brought in business, and that this was all that was necessary. True marketing had been done in the development of the highly successful Geohazard Susceptibility Package (GHASP), which was made for the insurance industry. With no other good, successful examples to quote, the case for investing in marketing as opposed to relying on opportunistic selling was not convincingly made. But neither was there a convincing case against doing marketing. Some senior staff still believed that the BGS badly needed a group of individuals who were to be free to talk widely within the user community, take a look at trends, be visionary and then plan a long-term strategy for the development of products and services. The Group Managers and divisional heads were quite able to look at the short-term without aid from outside their management units, but taking a long view did not balance the books within year, and it was not often done by these managers.

In the 1997 reorganisation (Figure 9) an attempt was made to address these shortcomings by re-establishing an independent group responsible for business development. Called the Business Development Group it was headed by a

Grade 6 manager and was staffed by sector managers, whose responsibilities had something in common with the market coordinators proposed by Price Waterhouse. Public relations and the Press Officer were also part of this group.

To reach this structure an analysis was carried out of BGS business in terms of its clients, the first time it had been done this way round. It was found that practically all BGS business within the UK was conducted with clients who fell into twelve natural, client sectors. Each sector was a group of paying clients with common interests. Major sectors were central government, oil and gas companies, the water industries, and radioactive waste industries. Lesser ones were the local authorities, civil engineering companies and so on. The sectors were divided among the sector managers, who held the budget for marketing in their sectors. International marketing was managed separately with regard to work in the aid sector. However, any activity overseas that came within, say, the oil and gas companies sector was handled by the oil and gas sector manager.

Neither the Group Managers nor the Assistant Directors, all of whom saw in it a loss of some of their power, welcomed the new arrangement. After serious arguments, some of the marketing budget was given to them to aid their selling activities in any way they saw fit. The main battle, however, was for the sector managers to prove their worth. This was not easy, not least because the perception of them was that they were super salespeople not marketing people. The distinction between selling and marketing was still not being recognised, despite the best efforts of Price Waterhouse, and staff that were tasked to do marketing were being forced into becoming salespeople. Even the Programme Board, who ought to have known better, being largely from industry, became trapped into setting short-term earnings targets for the sector managers.

The first-ever business plan for the BGS was produced for the financial year 1991/92. It was built from the bottom up. Each division stated its key objectives for the year in terms of science, income generation and performance improvement, and identified the financial and human resources necessary to achieve them. The layout of the business plan changed almost annually with, in later years, individual group plans appearing and division plans being the sum of them. The document grew from a 22-page book in 1992/93 to 42 pages in 1997/98 when the NERC made it mandatory for its component bodies to write their business plans in two parts: a five-year forward look and a one-year operational plan.

In theory, the business plan should reflect the organisation's business strategy. An attempt to develop one for the BGS had been made by the first Head of Marketing, but his position was so weak within the newly formed, group-centred organisation that it was not applied. Instead, the BGS business strategy became the agglomerated strategies of the groups and divisions, among which there was very little internal consistency. An analysis of the entirety of the BGS business was not carried out again until the Business Development Group was formed in 1997. This group recognised that the objective set by the Secretary of State for Education and Science back in 1989, for the BGS to earn a surplus from commercial work that could be put towards core surveying, could never be

achieved by carrying out only commissioned research. An analysis over several years showed that average earnings for commissioned research no more than covered the full economic cost of the activity. The only way that a surplus could be generated was by developing value-added products. The business strategy that they proposed, therefore, recognised that extra effort should be put towards building a capability to generate value-added products. This remained the business strategy until 2000, but, as ever, it was almost impossible to pursue an integrated BGS policy in a distributed organisation that had practically no common aims.

Common to all the business plans, from the first to the most recent, was the inclusion of commercial income targets. Until 1996/7, these were presented for each group and division. From 1997/98 they were given in relation to earnings expected from each market sector. Only in the first year, however, was a target contribution to overheads given. It was an important recommendation in the Price Waterhouse report that groups should be given such targets. Otherwise, they would be free to find ways to utilise all earned income for the benefit of their group and make no contribution to the corporate BGS. An attempt was made in the early to middle years to calculate the profitability of commercial projects carried out in the year. A league table was set up; managers of the most profitable projects were given a reward; those at the bottom of the table had to suffer the indignity of everyone in the BGS knowing who they were. As a result, those project leaders at the bottom of the list devoted an enormous amount of time to analysing and explaining what they thought were the special circumstances that put them there. When the league table was abandoned, no further attempt was made to measure the contribution to overheads from the commissioned research programme.

Target setting provides, perhaps, the best illustration of the fundamental weakness of the Price Waterhouse report. The report was presented as a complete package by the consultants, who made no attempt to deceive the BGS into thinking that the organisation could pick out from it what it wanted and throw out the rest. By not fully taking account of the realities of working within Government or the public sector the whole edifice was put at risk even before implementation.

Setting targets for commercial earnings was not expected to be easy and it turned out to one of the most difficult tasks that faced the Directorate each year. There was more hot air, bluff, subterfuge and argument generated around it at Directorate meetings than any other agenda item and it was never really done successfully. Because of the manoeuvring by Assistant Directors, angling to get a good deal for their divisions, it was not unusual for some groups to finish the financial year having met their earnings targets, without using up all the available staff time in the group. Conversely, some groups found it impossible to meet their targets because they did not have sufficient staff. The overall desperate financial situation in some years meant that recruitment had to be frozen, which did not help these groups, but it was also not unusual for staff who were available for the commissioned research that was coming in to lack the appropriate skills for carrying it out. It was believed by many staff that in a private sector organisation this would

not happen, because of the greater management freedoms available to it. This may or may not be true, but the constraints on hiring and firing Government employees did little to alleviate the difficulties that the BGS faced.

Driving target setting was a belief that setting challenging targets was a stimulus for Group Managers to excel commercially. It never quite worked that way. The difference between a target and a realistic forecast was never openly recognised, partly because the BGS was under such intense financial pressure in the middle and later years of the 1990s that meeting the targets, whether they were realistic or not, was necessary to balance the books. The cost base was already under almost continuous attack and managers were more inclined to struggle for even unrealistic targets than further to reduce expenditure.

Price Waterhouse had insisted that the BGS should regard the Science-Budget-funded Core Programme as a contract with the NERC and rank it equally with commercial contracts, to be carried out with a mind to budgets, schedules and target deliverables just as commercial contracts were. In this respect they were at one with the new Programme Board. At the same time, the Price Waterhouse consultants were concerned with what they perceived to be the apparent second-class status of staff that only worked on commissioned research. Commercial earnings targets came to dominate the minds of Group Managers, who ate, drunk and slept them from April to January, by when it was too late to do anything about it for that financial year. Acquiring commissioned research contracts became the highest of high-priority activities, way above meeting Core Programme deliverables in those divisions that did not have a high level of core activity. Staff were taken from core projects, particularly those that were led in other divisions, to work on the group's commissioned research regardless of the consequences. Interdivisional mobility of staff required in multidisciplinary projects dwindled away as Group Managers deployed their own staff, even when they were not the best qualified, to work on their commercial projects. A prejudice grew against senior, highly experienced and skilled staff because they were too expensive to deploy in tightly costed commercial projects and some groups began to recruit junior, and therefore cheap, staff rather than use expert cartographers, for example, thereby keeping costs within group. In the end, it seemed that staff on the Core Programme became the second-class citizens and no one managed to treat the Core Programme as a contract equal to commissioned research programmes.

Included within the target culture was the idea that successful groups should be rewarded. Rewards could include freedom to recruit as needed without constraint, freedom to spend earned income on new equipment, also as needed. But also there could be a direct cash return. When discussed with staff there was by no means a consensus on the issue of reward. Many staff expressed the view that they would be satisfied by as little as the freedom to attend conferences of their choice. Corporate BGS, was neither happy nor able, by virtue of its relationship with the NERC, the parent organisation, to delegate recruitment to Group Managers. Nor was it happy to delegate control on major equipment purchasing

to group level, but there was a tacit understanding that successful groups could be given priority over others in the bidding processes for staff and new equipment. This, however, ignored the needs of low-achieving groups which required high levels of re-equipment and recapitalisation in order to become competitive. There was no effective corporate policy to deal with this. A scheme was devised and agreed in 1990 to give groups a proportion of the income earned over the average of full economic cost, but it was almost impossible to implement because the BGS financial management system was inadequate for it. When a cash reward was given to groups in two commercially successful years it was done on a flat-rate basis, every group receiving an equal amount. Only the enquiry service was managed with a reward system embedded in it that recognised success. It ran for several years and did not reward those groups that achieved less than the cost recovery target that had been set for the year.

Eventually, some Group Managers, themselves, realised the damage that was being done to the BGS by target setting. The process, however, could not be abandoned. It might not be necessary for groups and divisions to have earnings targets, but the BGS had to have one. After an acrimonious senior staff meeting in 1996, the practice was changed. Earnings targets were now set against business or client sectors. The Group Manager was tasked to end the year with all his staff having been gainfully employed on what might be called 'billable' work. This change was important in several ways. Managers did not lose their awareness of costs, but cost alone was not now the driving force behind nearly all their decisions. In another way, the change was meant to reverse a mindset that had persisted despite being challenged in the Price Waterhouse report. Some staff had become good salespeople. They entered the marketplace with an idea, a service, a product, a skill or a research idea for which they wanted to acquire funding and they often managed to make a sale. Where they remained weak was in true marketing: i.e. looking at the marketplace and learning what could be done in the BGS to meet a market need. Setting targets with respect to external client sectors was meant to make staff do this and look at the BGS from the outside in, not the other way. It had some success, but overall the change, though it did ease some of the pressures, was not the whole solution to the problems that had been created by target setting.

One of them was that the BGS still had to find a way of making a reliable forecast of its earnings potential for the next financial year. Finance Section had always done this using their experience and knowledge of trends and business in prospect. It was a fairly reliable method, but it served only as a coarse financial forecasting tool. There was no way of looking at the detail of the forecast to gain information on how to target marketing activity, predict trends or judge its reliability. Detailed retrospective analysis of business, to be used as a mechanism for determining trends, giving guidance on marketing emphasis in the future and quantifying the reliability of forecasts, was possible for international business only. This was because the right sort of data had been collected over several years. It did not become possible for UK business until after the 1997 reorganisation

when, after a detailed analysis of the Survey's business, the right sort of financial data began to be collected. Forecasts could then be made to about 95% reliability, by using, amongst other information, analyses of past trends.

The received wisdom about internal markets was that they led to improvements in the internal delivery of systems; they gave users the information needed to make a choice between an internal and external supplier of the service; they gave organisations the choice to continue to supply the service or not, and they helped users prioritise demand, when resources were limited. To a greater or lesser extent all of these were experienced by the BGS.

The internal market was created for both staff time and services. Several services were unit-priced for both internal and external customers and protocols were developed for internal trading. Chemical analyses, photographic and reprographic services and thin sections were included. To a certain extent the trade in staff time already existed. For internal financial management purposes all staff time had been priced using average staff costs for each grade for many years. Day, monthly and annual rates were published internally each year and were used in calculating project costs. The change after Price Waterhouse was in the management attitude to staff costs. Managers would seek out the cheapest staff to work on their projects and the terms 'buying' and 'selling' staff entered the Survey's vocabulary.

Internal markets are always criticised for the additional load of bureaucracy they require, but there is no doubt that in the BGS there were efficiency gains from the introduction of the internal market and there was a beneficial effect on the quality of project management. The gains from these might well have offset the increased overhead costs. The Business Planning Working Group introduced project cost analysis sheets (PCAS) to be used for each project during the planning process each year. It included all expected costs, including predicted expenditure on internal services, which were now unit-priced, and became the basis for the detailed level of financial management throughout the Survey. The impact was wide and complex. There were clear benefits in efficiency. For example, before unit pricing, an analytical chemist would be costed into a project team in units of staff time and he or she would be expected to take responsibility for seeing that the required chemical analyses were done. This did not always lead to the delivery of what the project required. Moving over to unit pricing, on its own, did not change this, but the discipline of having to devise a unit-priced service brought a sense of reality to the management of the laboratories, which allowed laboratory managers better to meet their targets in serving the science projects.

The system of preparing project cost analysis sheets worked well for the Science-Budget-funded programme but it was less than satisfactory for commercial projects, particularly where there was sales income coming into the project. Under these circumstances the system could be too restrictive, but there were flexibilities in it that clever mangers soon discovered to their benefit. Without exploiting the loop-holes in this system, in the years when there was an embargo

on spending Science Budget on capital, it is likely that some groups would not have been able to re-equip themselves and remain viable.

Once services were unit priced, project managers did compare them with outside providers and in many cases went outside as a result. Photographic services suffered this way and there was a protracted debate on whether the BGS should retain its photographic department. By a process of erosion, the size of the department was reduced and the range of services contracted mainly to those that met specialist requirements. The thin-section-making facility was also scrutinised and only narrowly avoided being disbanded. The arguments in this case were interesting. It was impossible to reduce the department to an economically viable unit that only provided specialist services with difficult rocks, say, that were either not available or not satisfactorily available on the open market. As a consequence, not only was it necessary to retain the whole facility, but it had to be enlarged by taking in work from outside in open competition with laboratories to whom in other circumstances the BGS might have contracted its own work.

The chemical laboratories also faced stiff competition from the outside. Indeed the demand for chemical analyses within the geological mapping programme and many of the large commissioned research contracts had been met by mainly university-based laboratories for many years. There were several models for calculating the pricing mechanism for chemical analyses, some of which took full account of the cost of maintaining and replacing equipment and would have priced the facility out of the market altogether. The debate was initiated, therefore, whether the BGS should or should not have its own chemical laboratories. The arguments for and against were finely balanced, but once the decision was taken to retain the labs, other arguments came into play about how they should operate. One powerful one was that in any national analytical programme there should be common standards throughout, such that analysed rocks from Cornwall could be compared with rocks from Monadhliath. It was argued that this was best achieved by carrying out all analyses in one laboratory under a single quality-control procedure. Thus, the Directorate agreed that the BGS laboratories should always be given first choice, and almost immediately, the amount of work contracted out to external laboratories fell away, effectively achieving the opposite to what was originally intended in a free-market context.

Other services did not benefit. The photographic department, already diminished by losing most of its routine photographic work, also suffered a drop in demand for field photography. The BGS photographic library of over one hundred thousand images captured since 1904 has been systematically updated by the official photographer, who visited all field areas to build up an album of pictures of rocks and geoscientists at work in the field for each area as it was being surveyed. Field staff had been taking their own cameras into the field for decades, but their pictures were generally not professional in quality and the official photographers had resisted attempts to develop procedures for taking into the official BGS collection photographs that were not taken by them. With the introduction of unit pricing coming just before the start of a period of financial

stringency, the demand for field photography stopped. It was too expensive to do and project leaders had higher-priority demands on their budgets. Eventually, field photography was dropped out of the internal market in an attempt to revive it, but a break in continuity had been created from which it is not possible to recover.

Cartographic and publication services were excluded from the unit-pricing scheme. Again, there was a good deal of argument about this. Nearly all the book publication effort and around two thirds of the cartographic effort was devoted to producing outputs of the Core Programme. Cartography in the BGS was then, and remains, highly specialised and technically advanced. Outsourcing was never a practical option because there were few other places where the appropriate skills, among which a working knowledge of geology was important, could be found. With the heavy investment in digital technology and the complexity of both the conversion from manual methods and the learning processes that staff were experiencing in the early 1990s it was never going to be realistic to calculate a meaningful unit-priced service. Efficiencies were gained by other methods. However, experienced and skilled cartographic staff are expensive, and several groups recruited and trained junior-grade staff to carry out routine cartographic procedures, rather than use the corporate drawing offices. Some groups also opted to manage their own desk-top publishing systems and handle their own product sales and enquiry services, rather than use those in the Corporate Coordination and Information Division. There were short-term cost advantages in doing this, but the medium and long-term losses more than outweighed them. Repeatedly, the inexperienced cartographic and publications staff operating in the groups encountered technical difficulties they could not handle and had to be rescued by the experts, but the main loss arising from the distributed system was the lack of corporate standards. When it became necessary to integrate work that had been done by several groups on their own systems it was expensive and sometimes technically, quite difficult.

One of the most serious consequences of the internal market was in the multidisciplinarity of the science programme. In 1989, specialist staff other than field mappers, provided about 35% of the staff effort in the geological mapping programme. In 1999 this figure had reduced to less than 15%. The imposition of strict annual targets of 20 maps and ten to 12 memoirs, which the Programme Board rigidly maintained for the mapping programme through a long period of declining budgets, first led to improvements in efficiency, then to cost cutting. For project leaders in the mapping programme, the highest priority was to meet the annual map and memoir targets. This could be done with a diminished input from the specialists with minimal loss in map quality. The main losses were in the level of understanding of the geology of the areas mapped and in the integration of geological mapping with research in other subdisciplines. The adoption of the internal services funding model for all research projects must, at least in part, carry some blame for this. For reasons not its own making, the age and grade profile for the BGS was top heavy. There were (and are) more quite senior and highly

paid Grade 7 staff than any other grade. The funding model was based on average staff cost for each grade. A simpler, less discriminatory model might have had a different effect on the proportion of staff other than mappers that it was possible to have in a project team, but though alternatives were discussed, none was considered suitable.

Probably, the weakest aspect of the Price Waterhouse model was the market-facing management structure. There were signs of its potential failure even before it was established. The largest of the divisions, the Thematic Maps and Onshore Surveys (TMOS) was, at its creation (Figure 7), only partly equipped to deal with the market sector it was to face. This division was revolutionary in one respect. It brought together under single management at AD level the whole of the Land Survey for the first time in the history of the Survey. It also brought into the division Regional Geophysics Group, to accompany the seismic interpreters in the Tectonics and Database Group. This completed the process of building a division with the full capability to carry out three-dimensional analysis and modelling of the crust that Geoff Larminie had started. What was lost in the reorganisation were those parts of the two Land and Marine directorates that would have enabled TMOS to pursue its market in land use. For nearly a decade the Department of the Environment had been commissioning the BGS to generate suites of thematic maps for planners in urban Britain. A full suite of maps would include engineering geology, potential geohazards, mineral resources, both coastal and estuarine flooding potential and a summary map showing planning constraints. The Department of the Environment's programme had been managed almost entirely within the Land Survey. Now, in the new organisation, Engineering Geology was put into the Groundwater and Geotechnical Surveys Division; Marine Geology (South) became Coastal Geology and was part of the Petroleum Geology, Geophysics and Offshore Surveys Division; responsibility for all industrial and construction minerals except sand and gravel went into the Minerals and Geochemical Surveys Division.

At a time when the BGS was deliberately decentralising and creating groups as semi-autonomous business units with a remit to face specific market sectors, it was unrealistic to expect inter-divisional co-operation in this one important area and it did not happen. Instead, there was interdivisional conflict, with three divisions competing with each other for leadership of thematic mapping contracts from the Department of the Environment. The reason for the competition was simply that there were financial and staffing benefits to the group that won and took control of the contract. A Land Survey group leading a contract might discriminate against engineering geologists in staffing the project team, while an engineering geologist leading it would ensure better representation of engineering geologists, probably at the expense of field staff.

In practice, the Director was driven by the numbers game in his first restructuring. One division with the capability to deal properly with mapping the three-dimensional structure of the landmass and land use would have been huge compared with the others and it was not managerially sound to do this.

Other weaknesses in the market-facing structure became evident soon after implementation. PGGOS, for example, was not alone in having an interest in the petroleum industry. Both the GGS and MGS divisions were also finding that their skills were in demand in the oil industry and there was a strong interest in it within TMOS. Here the seismic interpreters in the Tectonics and Database Group had close commercial contacts with the onshore industry both in the UK and overseas. This internal conflict of interest was tackled in 1994, during Peter Cook's second restructuring (Figure 8), by removing the seismic interpreters and basin analysts from TMOS and transferring them to PGGOS. This spoiled the TMOS Division's three-dimensional modelling capability, but more importantly, by separating the geophysicists from the seismic interpreters, it damaged the progress that had been made in developing a combined potential-field and seismic-interpretation capability for dealing with the intermediate and deep crustal levels. This was to become critically important once the oil industry migrated its exploration interests to the Atlantic margin. The Regional Geophysics Group, which was left behind in TMOS, continued to earn most of its commercial income from the oil sector, often in competition with interests in PGGOS.

There were two other major failures in the system, and one that succeeded despite the management structure. The failures were geophysics and information technology (IT). The success was in the handling of contract work with UK Nirex Ltd.

The Geophysics Division created by Malcolm Brown was dismantled and divided among three divisions in the new structure. Among other things, this slowed or stopped the process of integration of the Global Seismology and Geomagnetism groups into the mainstream BGS. It also made it difficult for geophysicists to pursue the business opportunity that Price Waterhouse had identified for them, which depended heavily on an integrated approach to geophysical problem solving. In the model for the new structure there was nothing wrong with groups or divisions expanding their multidisciplinary capability internally, as long as they had the revenue to sustain their expansion. There was, however, a good understanding in the BGS of the importance of achieving and maintaining critical mass among skill groups to keep their expertise levels high and up to date. Apart from information technology and information systems (IT/IS) staff, who were taken into many groups, there was little recruitment directly into groups of staff who did not have skills that conformed with the majority in the group. The pre-reorganisation Regional Geophysics Group was divided along lines that separated geophysicists with potential field skills, useful for deep crustal studies, from those with experience in electrical methods that were suitable for engineering geophysics research. In fact, nearly all geophysicists had experience in both and to separate them this way reduced their career development prospects. That the split did not lead to rivalry and competition between the two groups was due very much to the characters of the two Group Managers, who amicably divided responsibility for shared assets and did not compete against each other.

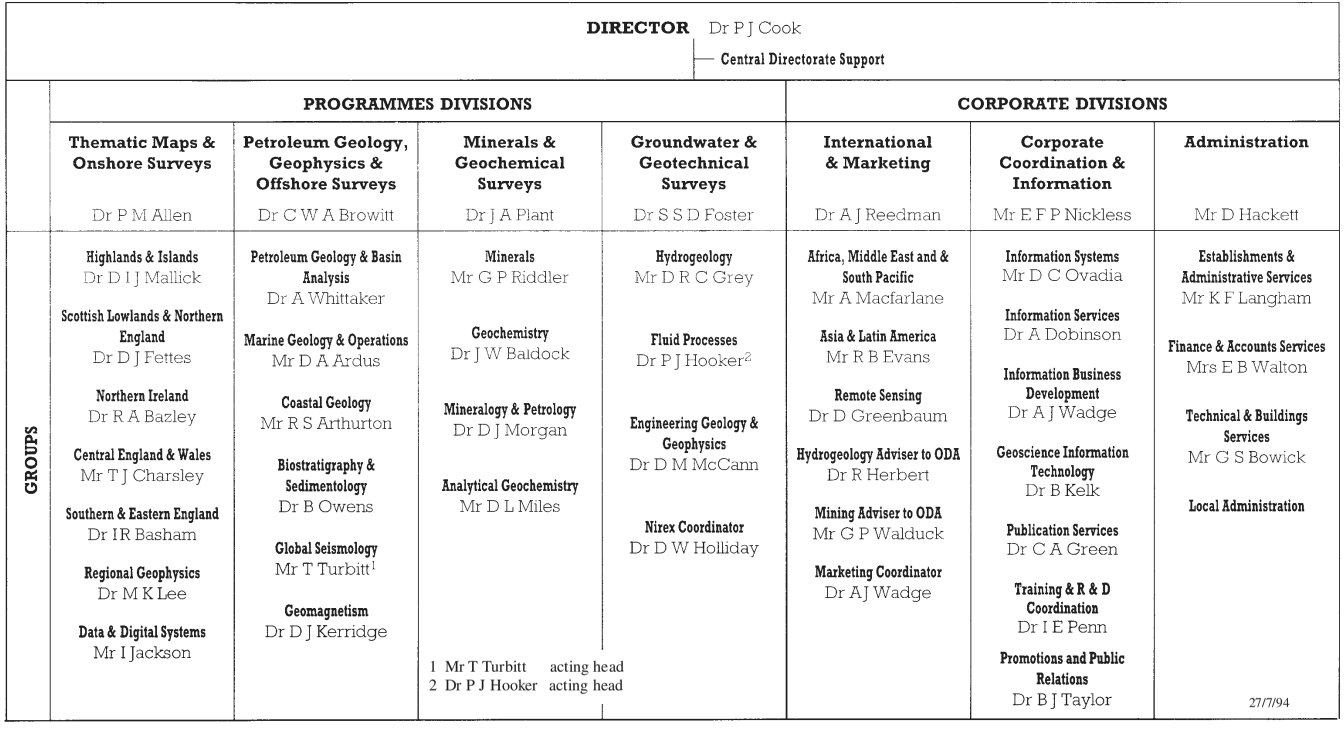

Figure 8 (from Office Notice ON/20/94 The organisational structure on 1 August 1994, following a partial reorganisation on 1 April 1994 which had reduced the Land Survey management posts from six to five, with a consequent redefinition of the boundaries. R W Gallois was temporarily head of Southern and Eastern England, before I R Basham was appointed.

Other changes, after August 1994, were: D M McCann became head of Fluid Processes; M G Culshaw headed Engineering Geology and Geophysics in 1995; in 1996 D C Booth took over Global Seismology and I N Gale Hydrogeology.

As for IT, for about twenty years NERC computing was organised along centralised lines, with NERC Computer Services (NCS) maintaining the hardware and common software. With time, they relaxed their control of software and applications, as it became more and more difficult to please the whole of the NERC with common software. The spread of PCs throughout the NERC was also antipathetic to the ideals of a centralised computer system. Within the BGS, all prospect of having a central geoscience database, such as Malcolm Brown wanted, had disappeared in 1983 by Directorate agreement. NCS had forced the introduction of the ORACLE relational database management system throughout the NERC and though this did something to mitigate the worst aspects of distributed database management, it did not fully compensate for them. Thus, by 1991, when the new structure (Figure 7) came into being, database management, computer applications and commonly used software were already largely uncoordinated across BGS and an unsatisfactory position was allowed to get worse.

By the middle of the 1990s the Data and Digital Systems Group in TMOS (Figure 8) was bigger than the supposedly central computer group, Information Systems, in the Corporate Coordination and Information Division. Both PGGOS and MGS, although they did not possess identifiable IT groups had a pool of expertise at least as big and as competent as the two divisions that had IT/IS groups. The one thing that is undisputed about IT is that it is ubiquitous and universal. No group or division in BGS acknowledged that they did not have a right to exploit it, even competitively against each other. It was not uncommon for three divisions to submit individual expressions of interest for the IT parts of big contracts. Not only were they competing with each other for work, they were in competition about ideas and systems and not afraid to criticise each other's work in the hearing of third parties.

NCS was demolished in 1997 and responsibility for all computing in the BGS was handed to the BGS. The Survey had by then agreed to adopt the distributed model for computing and when it took over from NCS it was decided that only the provision of networks and the main element of the infrastructure should be done centrally. Anything that went on the desk top was to be the responsibility, both to purchase and maintain, of the group using it. Database management and applications had never been under central control and after NCS abandoned standards for commonly used software, such as word-processing packages, the BGS did not replace them. None of these issues were taken up until after the 1997 reorganisation.

The success story is UK Nirex Ltd. In one year Nirex was the largest single commission, bigger than any Government department except the Department of Education and Science, who provided the Science Budget. In that year over 200 individuals from all divisions and most groups were committed for all or part of their time to the contract. Radioactive waste was the market-sector responsibility of the Fluid Processes Group in the GGS Division, but the contract had made multidisciplinary demands on the Survey for many years and it was beyond the capability of any one group or division to handle it. The solution reached was to appoint a

contract manager who sat outside the management structure and followed his remit with the impartiality of a key account holder, whose first responsibility was to the customer. It worked well and if nothing else pointed to the inadequacy of the market-facing approach to the management structure, this did.

It is difficult to evaluate the impact of Price Waterhouse on the BGS. It was not all good, nor all bad. Some that was bad was nothing to do directly with either Price Waterhouse or BGS, but reflected on the determination to pursue market economy ideals within government bodies, which engaged many in Whitehall at the time. In positioning the Survey to face the market economy Price Waterhouse did expose the BGS to market populism, the worst aspects of which were in the management of staff. Flexibility in staffing is of central importance within market economics. Although the progress of change in the BGS was slow, long service and loyalty did become devalued as staff, particularly new recruits, were expected to move on out of the BGS to develop their careers. While unit costs influenced most decisions, the price of long experience, a high degree of specialisation and wisdom came to be seen to be too high to bear. Staff who were not aggressively commercial came to be valued less than those that were and the organisation lost its tolerance for the low achievers and the 'workhorses'. An 'unfunded' category of staff emerged, which stigmatised individuals. These were, often, highly skilled scientists for whose skills there was no immediate need in the Commissioned Research Programme and who were the victims of cost cutting in the Core Programme. Even leading-edge, sometimes recently promoted scientists fell into this category when the Nirex contract collapsed.

On the other hand, staff learned to exploit their skills in selling if not marketing and began to appreciate the value of a satisfied customer. The insularity of the BGS from the community that used the information it held or was capable of delivering was also broken down in the process. The importance of this should never be underestimated in any analysis of the effectiveness of the consultancy. Coming, as it did, at the same time as the Programme Board, which was set to improve the efficiency with which the Survey conducted the Core Programme, its effect on the BGS culture was considerable. Matters such as working to time and budget, fitting the quality of work to the customer's specification, and taking account of customer needs all became part of the new culture, even though there was not uniform success in applying them. This was particularly important now that the presence of a Programme Board ensured that there was a customer for all the work.

In terms of the specific remit given to Price Waterhouse, however, there is quite a different outcome. If there is one single criterion by which to judge their success it could be whether, as a result of them, the BGS achieved what the Secretary of State for Education and Science asked for. That is for the BGS to use its 1990 PES award to stimulate the generation of outside income for reinvestment in core surveying activities. Many indirect benefits came from the enhanced, not to say frenetic, commercial activity that came in the wake of Price Waterhouse, but there is no calculation that can be done that shows that surplus

income derived from commercial activity was used to expand the activities in the core surveying programme. It is evident, though, that through the 1990s the BGS expanded the breadth of its commercial and commissioned research activity sufficiently to remain economically viable and this prevented the attrition of the Core Programme. The annual gross income of between £17 and 18 million made a contribution to the overhead that was essential to the Survey's survival. So, although there was no cash transfer from the Commissioned Research Programme to the Core Programme, there was a financial benefit to the Core Programme.

This, though, is not the whole story. In the decade from 1990, income from commissioned research instigated by the major Government departments halved. During the same period, income from the private sector doubled, but it did not make up for the fall in income from Government. Cost cutting was also required. Apart from UK Nirex Ltd, the biggest contributor to the private-sector income was the oil industry, and that only happened because of a good deal of hard effort put in by many staff in chasing the work, cultivating the customers and then delivering a good product. The importance of exploiting all these skills, which are inherent in many BGS staff, was learned from Price Waterhouse. Interestingly, though, of the six high-priority business opportunities that Price Waterhouse helped BGS to develop, the only one to feature the oil industry involved the development of a series of products that did not flourish. Prospects within the industry as a whole were not thought to be good. It was argued that demand for geoscientific services would decline, as exploitation in UK waters diminished and there was an expectation that this would begin in the short term. None of this came to pass. Of the other five business opportunities one was spoiled by the separation of the Regional Geophysics Group into two parts. The others showed no short-term return at all, though now, ten years on, two of them are beginning to pay dividends and the potential that was forecast for them in 1990 now looks realistic. In the case of these, it was the lead time for the development of the new markets that was grossly underestimated by Price Waterhouse. Their two so-called 'generic' opportunities were to utilise the BGS multidisciplinary capability and exploit the skills, knowledge and databases to provide high-value services. Carrying out both became increasingly difficult in the organisation as it became progressively more fragmented into non-co-operating, business-fixated groups.

Even at the time, it was evident that Price Waterhouse was a mouthpiece, albeit indirectly, for the Government. Mr Beasley had maintained his contacts in high places and was in a good position to know the current Government thinking on all relevant issues. In 1990, privatisation of state-funded bodies of all kinds was well established and Prior Options was not many years away. It would have been no more a secret to him than it was to the BGS senior management that, only two years before, in 1988, the BGS had been threatened with privatisation. Such a threat was not going to go away as long as the current Government remained in power. It made good business sense for the consultants to act upon this knowledge and understanding. It prepared unwitting bodies like the BGS for their fate and ensured that

repeat contracts were a serious possibility if privatisation were to happen to them — and it made the consultants look good in Government's eyes.

Although in detail some of what was implemented after Price Waterhouse was not successful, the overall impact has to be regarded as having been beneficial. In 1990, the bottom line for the BGS senior management was the survival of the BGS. Only later did it become the survival of the BGS in the public sector. While it may, in retrospect, be tempting to be critical of this single-minded attitude, it worked. The proportion of the BGS work programme that was commissioned and commercial was on the point of reducing to around 55% because of the PES awards. This level, the lowest since 1973, was to be sustained within a few percent throughout the 1990s despite the enormous pressures under which the BGS operated. In other parts of the NERC there is a different picture. In the year 2000, two of the other major research centres, were in financial trouble. One, the Centre for Coastal and Marine Science, is to be demolished and distributed among universities. The financial viability of the other, the Centre for Ecology and Hydrology, is being questioned. Neither of them had been through the rigour of anything comparable to the Price Waterhouse review and neither of them has managed to get control of its Commissioned Research Programme in the way that the BGS has. The reason for the commercial self-assurance evident in the BGS must be traced back to Price Waterhouse.

Chapter 13

The R&D Programme

Butler recommended that there should be a Science Programme alongside the Core and Responsive programmes. His Study Group considered that it was essential for the BGS to undertake some basic research in order to contribute to the understanding of the systems that are studied in the Core and Responsive programmes. This followed on from their view that the BGS should be seen as the provider of an essential service, needing research to maintain its quality, rather than as a research institute providing a service as a side-line. They suggested that the programme should be funded in part from NERC research grants in competition with the academic sector and in part from the surplus generated in the Responsive Programme. They were strongly of the view that the Science Programme should not be funded out of the budget for the Core Programme.

The Programme Board did not endorse this funding mechanism and it was never implemented. Instead, the Programme Board instituted a Research and Development Programme as the third programme and allocated around £400 000 to it in its first year.

There was never a single view on what the R&D Programme was meant to achieve. There were those who saw it as a vehicle from which to carry out, pure, curiosity-driven research. Others, seeing the Core Programme become strictly strategic and driven by measurable output targets, saw the R&D Programme as the only place within which to carry out research to keep up-to-date the BGS research and laboratory capability. This second view was easy to justify. When the BGS Directorate came to restructure the existing Science Budget Programme and divide it among the six Core Programme elements in the Briden-Larminie paper, in anticipation of the announcement from the House of Commons in November 1988, it was by no means evident where all the projects approved by the Chief Scientists should go. The R&D Programme was established then, taking in a miscellaneous collection of projects, some of which would have been homeless without it. Among them were projects carrying out research in analytical methodology, for example. This sort of research, though essential to maintain capability, did not fit easily into the structure for a Core Programme that essentially contained surveying activities.

The Programme Board, itself, was never quite sure about the function of this programme. They vacillated about where capability research should be carried out: as an integral part of the Core Programme, or outside it. One year, they even challenged the use of the word capability to describe any part of the research

programme. Their indecision and lack of vision for the R&D Programme made it vulnerable.

The Butler funding model was not implemented, in part because the NERC did not allow its institutes to bid against universities for research funds (though the converse was not true). This meant that the Butler Science Programme could easily become a collection of research projects carried out entirely by universities. The only sensible way forward was to do the exact opposite to what Butler proposed. A portion of the BGS Science Budget was put to one side for the R&D Programme. Although it was meant for BGS staff to bid into there was nothing in NERC's rules to prevent the academic community bidding into it. The Director of Earth Sciences, himself, saw the R&D Programme as an additional funding source for academics and a struggle began between him and Peter Cook, the BGS Director, over who should control the R&D Programme — the BGS or a committee of the NERC Council, the Earth Sciences Committee.

In 1990/91, the first year under Programme Board control, there were 20 projects in the R&D Programme. The Directorate had agreed that the size of the programme should be equivalent to 10% of the Responsive Programme. Basing the calculation on the previous year's Responsive Programme, a limit was set of 23 staff years of effort for 1990/91. An invitation had gone out to staff in July 1989 to submit bids. Bids were required for new projects, as well as ones that had been put into the programme the year before, when there was no other home for them. They were advised that proposals should have a bearing on Core activities and be designed to pursue basic research ideas necessary to underpin future developments in the Core Programme. Alternatively, they could follow up ideas that may have originated in CR projects within which there had been no scope to develop them further. This last issue satisfied a sore point that had been with staff for years. A total of 104 proposals were submitted, an illustration of the fecundity of the imagination of BGS staff. A short list of 33 proposals was drawn up for full costing. The Chief Scientists, acting as a review committee, reduced it to 20 projects, which the Programme Board, eventually, approved. They fell into five categories:

- support for Individual Merit Promotees (IMPs)
- support for staff with the potential to become IMPs
- broadly-based projects which provided support for a range of Science Budget and commissioned research programmes
- projects derived from commissioned work which could not be pursued anywhere else
- development projects aimed at enhancing an existing BGS system as a basis for future commissioned research.

In addition, there were jointly funded CEC (European Union) projects to which BGS had an ongoing commitment. The programme was a rich mixture of speculative science, underpinning investigations and development of technical and scientific capability. It had good prospects, but politics killed it.

First, the Director of Earth Sciences insisted that it was externally peer reviewed. This was handled first by a committee of NERC Council, the Earth Sciences Committee, and later by its replacement, the Earth Sciences Technology Board (ESTB). As pressure mounted on the BGS Programme Board to make the programme available to open competition the decision was taken to close it down. The 1994/1995 financial year was its last. Next year, 1995/96, the components of the programme became integrated into the Core Programme and external peer review ceased. At first, the words R&D were retained to describe this part of each element of the Core Programme. Later, they were to go and whatever R&D was left was disguised as development of capability.

The loss of the R&D Programme was a severe blow to the BGS. There were few links between the six main elements of the Core Programme. The R&D Programme, while it lasted, was the only BGS-wide integrated scientific research programme and it did offer the opportunity for the development of the science and technology for the corporate benefit. Once it went, the proportion of funds devoted to R&D gradually reduced. At its highest it constituted, by definition, 10% of the value of the Responsive Programme, which translated into around 7% of the total scientific effort in the BGS. The conventional wisdom is that an organisation needs to devote around 10% of its scientific effort to R&D to maintain its long-term viability. Even counting Science-Budget-funded projects, particularly IT-oriented ones, within the Core Programme that were unashamedly R&D and not necessarily described under the capability heading, the total R&D effort in the BGS never reached 10%.

There were other losses. The idealistic approach taken by the Directorate in defining the first programme included one idea, whose importance exceeded all the others: that staff who have worked for prolonged periods on commissioned research should be given the opportunity to develop their science outside the Commissioned Programme, when they are inhibited from doing so within it. The opportunity to implement this was lost. The career development of staff with the potential to become IMPs was lost, as was a readily identifiable and accountable source of co-funding for CEC projects. All of these losses became irritations among staff and were to be raised time and again after 1994/95 eventually to become influential in thinking during the major overhaul of the organisation undertaken in 1999.

Chapter 14

Efficiency Scrutiny, Senior Management Review and Prior Options

There can few better examples of Government policy leading to a massive waste of time, money and emotional energy in an organisation for absolutely no benefit at all, than the Efficiency Scrutiny, the Senior Management Review and the Prior Options Review. This series of exercises, which had its origins in the White Paper *Realising our Potential: a Strategy for Science, Engineering and Technology* (Cmnd 2250), published in 1993, began in December 1993 and ended in January 1997 when the Government abandoned Prior Options to focus on the coming general election.

The 1993 White Paper was followed by what was called a review of the boundaries of the research councils, led by Sir David Phillips. This resulted in their being restructured. Out of it emerged six research councils, two of which were new. There were revised or new Royal Charters for them, new missions, the re-introduction of part-time chairmen, and a new post of chief executive. These were to take over the responsibilities of the previous full-time chairmen and secretaries to Council. For the NERC, there was also a new internal structure. A single Directorate of Science and Technology replaced the three science directorates, within which the NERC's in-house scientific capability and university research funding had been managed since 1985/86. There was a concomitant decrease in the number of Grade 3 officers at NERC HQ in Swindon. All the component institutes were reshuffled and some were merged to make up four research bodies that came to given the generic term Centre/Surveys. These new creations were roughly equal in size and their Directors were equal in rank. In all of this, both the BGS and the British Antarctic Survey remained essentially untouched.

This new structure gave greater freedom to the directors of the new Centre/Surveys, though it did not go so far as to include them within Council, which, as executive directors with multi-million pound budgets, they had long thought they should be. There was also a weakness in the way the NERC committee structure was reorganised. Discipline-based committees were replaced by discipline-based Science and Technology Boards, which were quite effective in serving to perpetuate the old separation by discipline that had been dominant under the three science directorates. The Earth Sciences Committee, which had been the parent of so much that had happened since 1980, was dissolved and the BGS came under a Science and Technology Board with responsibility for Earth Sciences. Even the name was clumsy. The Earth Sciences Science and Technology Board became contracted to ESTB.

The aim of the 1993 White Paper, it was claimed, was to set out a range of policies and initiatives designed to improve the nation's competitiveness and quality of life by maintaining the excellence of its science, engineering and technology. In keeping with the ideology of the day, it was axiomatic that this was thought to be better done within the private sector than the public service. It was believed that more could be done to extend and accelerate the operation of market forces in relation to the science and technology that Government departments commissioned in support of their policy, statutory, regulatory and procurement responsibilities. There was a clear statement that the Government believed that many of the services currently provided by its research establishments could be carried out in the private sector. Thus, it was announced that Government intended to undertake a scrutiny of over fifty Public Sector Research Establishments with the aim of looking in depth at privatisation, rationalisation, and different options for ownership. It was meant to be a light and speedy review, which is rather shocking when it is considered that the future of the whole of Government-funded civil science was at stake.

A team of five full-time members, seconded from various departments, and one part-timer, seconded from the private sector, was appointed to the Efficiency Unit of the Office of Public Services and Science (OPSS) attached to the Cabinet Office. They reported to Sir Peter Levine, the Prime Minister's Efficiency Adviser, who was answerable to William Waldegrave, the Chancellor of the Duchy of Lancaster. The full title of the exercise was the 'Multi-departmental Scrutiny of Public Sector Research Establishments'; usually it was called the 'Efficiency Scrutiny'. The terms of reference, announced in late January 1994, were:

1. To identify those Public Sector Research Establishments where early privatisation is feasible and desirable.
2. Where early privatisation is not feasible or desirable, to identify the potential for rationalisation of facilities or capabilities, and recommend means of implementing such rationalisation.
3. To consider whether changes to current ownership and financing arrangements for establishments would lead to more effective operation of the open market and better value for money; if so, to recommend one or more alternative models.

Although the scrutiny originated in the White Paper, it actually followed closely the 'Next Steps' prior options process (usually referred to as 'Prior Options'), which had already led to reviews of some of the research establishments that were now to be involved in the Efficiency Scrutiny. Others had been subjected to internal reviews initiated by their parent departments. The novel aspect to the Efficiency Scrutiny was that the White Paper ensured that institutes within research councils were to be scrutinised, whereas they had been excluded from Prior Option reviews. The thinking behind this may have been influenced by the fact that institutes of the Biotechnology and Biological Sciences Research

Council and the Scottish Agricultural Research Institutes were already functioning as companies limited by guarantee, something that was to loom large in BGS thinking in later years. This seemed to suggest that this private-sector style of operation for Government research laboratories was feasible.

There was considerable unease in the BGS when this exercise was announced. The Survey had been threatened with privatisation already in 1988 and the cynical view of many staff was that the Price Waterhouse affair was effectively preparation for privatisation. The BGS was the sixth biggest research establishment in the review and, compared with all other NERC institutes and many research establishments outside the NERC, it had a large commissioned research portfolio and could be said to look like an organisation that had the potential to survive privatisation. Many staff felt that the Survey was targeted for privatisation. This was not entirely unwelcome in some quarters. There was a significant and vocal minority that thought the BGS needed to be free of the shackles of the public sector in order to thrive in the future. Even the Director, Peter Cook, was ambivalent on the issue at the start. There was, therefore, quite a vigorous debate among staff in the six months before the findings of the scrutiny were published and put out to consultation.

It is interesting to look at the criteria for privatisation that were being used. The Government saw the distinction between the public and the private sector as hinging ultimately on the twin issues of control and liability. These were embedded in three main criteria against which the BGS and the others would be assessed. The scrutiny team decided that they would look first at the extent to which the activities undertaken by an establishment under scrutiny could be carried out within the private sector. Activities that were close to core interests of Departments, they thought, were better carried out in the public sector, while admitting that it might be difficult, within some research establishments, to disentangle such activities from those that were more distant from the Departmental core.

They would next look at the extent to which the resulting private-sector organisations could be permitted to have control of their own destiny, which might include their choosing to stop working for Government and diversifying. Their belief was that if Government should feel the need to stop a privatised organisation from going under or to intervene in its operations, then, perhaps, privatisation was not right for it. There were caveats to this one. Government might be able to seek advice from alternative sources, or even create a new source. Diversification was thought unlikely to lead to conflicts of interest. In any case, Government could bind organisations with the potential to diversify away from their original core activity to it with long-term contracts or even by retaining ownership of certain facilities and hiring them back to the newly privatised companies.

The third criterion was how far an organisation was already in shape to thrive in the private sector. This would have been a matter of relevance to the potential for a trade sale or flotation, when there would be a need to attract private-sector purchasers or investors. The salient points were a clear mission, proven revenue stream with the potential for growth, competent management,

commercial-type operating methods and accounting, and a favourable balance between assets and liabilities.

These were the criteria that were to be used in a speedy and light review that would determine whether or not the BGS should be privatised. Issues like Government's need for independent and impartial advice, the threat that privatisation may provide to the historical continuity of record, the ethics of putting into private ownership assets that had been acquired with the taxpayer's money over 160 years and reaction among geotechnical consultancies in the private sector to having a large, powerful new organisation dropped among the smaller companies as a competitor did not seem to feature. More importantly, though, there was no specific reference to Government having a need for the outputs from long-term, strategic, scientific research. These were some of the issues that the BGS would consider quite important in its defence against privatisation. If they were not to be taken into account, the organisation felt vulnerable.

In mid-January 1994 the scrutiny team's terms of reference were received by the BGS, accompanied by a questionnaire. Both were circulated among senior managers, and a senior staff meeting was called for 26 January to discuss their response to the questions. Written submissions were also requested from them to help draft a full response, which was to be dispatched to the scrutiny team before one of its members, Dr H K Wilson, seconded from the Health and Safety Executive, visited the BGS on 9 February.

This was the second of five reviews during the 1990s, more than in any previous decade. Except for the Charging Review, all of the reviews carried out in the 1980s had been conducted by scientists, if not specifically by geologists. In the Efficiency Scrutiny, no assumptions could be made that those being reviewed shared with the reviewers either the common language of science or even a common understanding of the remit of the public service. Having had the experience of the Charging Review, when lawyers, economists and classicist administrators had asked questions of BGS senior staff that astounded them in their seeming naivity, the Survey was slightly better prepared than some other organisations being reviewed. Nonetheless, some of the questions in the questionnaire were heavily loaded. For example, what is the correct tactical response to the question, 'If the organisation were to change its status which would you consider the most and which the least desirable and why?'

There were seven main questions, each of which was supported by several supplementary questions. Whereas most could be dealt with factually, the question about status required the BGS to make a statement about its preference: public sector or private sector. Despite the excitement about a lively and burgeoning commercial future that had been generated by the Price Waterhouse consultancy, the official position within the BGS was one of caution. In the submission that the BGS prepared, attention was drawn to the conclusion of the Charging Review, that it saw a continuing national need for the Core Programme of long-term, strategic, geoscience surveying and monitoring and that little opportunity existed to fund this programme entirely from levying charges.

It was a great surprise, accompanied by relief, that when the scrutiny team circulated its emerging findings among research establishments in April it appeared to contain no threat to the BGS. Though the paper still had to go to Ministers there were grounds to believe that the BGS had escaped privatisation once again.

The final report was released for consultation in June 1994. The only recommendation in it that specifically referred to a NERC institute was that the case for the transfer of the Institute of Virology and Environmental Microbiology to either Medical Research Council or Biotechnology and Biological Sciences Research Council should be investigated. Four other establishments were identified as candidates for early privatisation; another was to be given Government-owned-contractor-operated (GOCO) status and two more were to be subjected to further scrutiny. As these seven constituted about 50% of the cost of all the establishments in the scrutiny, it could be said that Government's major objective of reducing public spending had been achieved by the Efficiency Scrutiny team. These seven establishments contained the largest of those under review, AEA Technology, but five of them were smaller than the BGS.

The consultation period began with a request for Director to provide comments within a week of receiving the paper. Thereafter there was opportunity for the Chief Executive of the NERC and the Director General of Research Councils and many others to take up some of the many recommendations in the report that impacted on the way in which research councils operated. In July 1995 the status of the Science Minister was changed when the Office of Science and Technology was moved from the Office of Public Service and Science into the Department of Trade and Industry. Ministerial deliberations on the report were delayed by this change and it was not until the end of September 1995 that a statement on the Government's response to it was released by Ian Lang, the President of the Board of Trade. He stated that the Government accepted most of the recommendations of the report, but there were several, some involving the regrouping of research council and departmental institutes, which were not accepted. Other recommendations were about operational matters, and some of them were implemented, but the actual impact of any of this on the BGS was negligible. It might have been different had the BGS not been through the Price Waterhouse process. It was evident that, as so many of the changes that the Survey had been through matched elements of the recommendations of the scrutiny report, many Public Sector Research Establishments were far behind the BGS in developing their commercial capability.

Despite all this, there were no grounds for relaxation or complacency. The scrutiny team had recommended that, in the future, research council institutes should be included in a modified form of the Prior Options review. This was taken up and Mr Lang announced that a Prior Options review of the research councils was to be undertaken and completed by the end of 1996. It was felt, at the time, that Government, dissatisfied with the outcome of the Efficiency Scrutiny, was making another attempt to identify establishments for privatisation. There was

another sting in the tail. Mr Lang said: 'Nevertheless, the Government accepts the scrutiny's finding that there is scope for improving co-ordination and co-operation in managing research establishments across Departments and Research Councils. We want as much funding as possible to go to front-line science, rather than administration'.

Out of this statement, came the Senior Management Review of the summer of 1996, carried out, again, by staff seconded to the Office of Science and Technology.

If the Efficiency Scrutiny had been meant to be light and speedy, this one was 'ultra-lite'. The review team inspecting the NERC consisted of four people. A Grade 5 seconded to the Office of Science and Technology, Dr Derek Barker, headed it. With him were a Grade 7 and an HEO from OST and the Grade 7 head of the NERC's Audit and Assessment Unit. The procedure was quite simple. Some 39 of the NERC's senior staff were involved, from the Chief Executive down to all Grade 5s, with a few selected Grade 6 managers. Each was required to fill in a Job Evaluation of Senior Posts (JESP) form prior to an interview. The interviews took place in August and lasted about one hour each. Ample guidance was provided for senior managers before the interview. The final report was to be delivered first to Sir John Cadogan, the Director-General of Research Councils, then to Sir Peter Gregson, the Permanent Secretary to the Department of Trade and Industry, and, eventually, the Treasury. It all seemed to be a fair and well-structured affair.

In reality, it was anything but fair. The Senior Management Review was, in fact, incorporated into a bigger review that had been initiated by the Director-General of Research Councils in March 1995 and was now being undertaken simultaneously. The overall aims of the Director-General's review were to identify the optimum structures for each of the research councils, ensuring that the aims and requirements placed on them could be effectively discharged at minimum cost. A statement from the Office of Science and Technology about this review, contained in a letter received by Peter Cook in March 1995, indicated that the Director-General was looking for reductions in the administrative costs of science by 30%. His intention was to review all the Grade 5 posts in the research councils. The functions of each post were to be assessed and they were to be benchmarked. The overall management structure was to be scrutinised with the aim of generating a leaner and flatter structure in which a higher proportion of income flows through to the science. Thus, although the announcement from the Minister did not come until September 1995 it had been evident for some time what was in prospect.

In the set of criteria by which Grade 5 posts were to be assessed, the BGS Assistant Directors were judged to occupy operational, as opposed to policy, posts. A Grade 5 occupying a policy post in Whitehall may have as few staff as a secretary and half a dozen Grade 7 and junior staff. In the Department of Health, Grade 5 was entry level for staff with medical qualifications, regardless of their management responsibilities. An operational Grade 5, however, was expected to

manage 200 staff and administer a budget of several millions of pounds. The word 'command' seemed to dominate the thinking of the review team. It was clear before the interviews that the 'delayering' of management was to be a key feature in the review. During the interviews, various other aspects of the current political thinking were raised: outsourcing and market testing, for example, both of which were expected to yield cost savings. The interviews themselves reflected the conceit of Whitehall. It was only because the junior man was ill that the Grade 5s and the BGS Secretary were interviewed by Dr Barker, who was their peer. The Director of BGS, however, was interviewed by the Grade 7 from the Office and Science and Technology. That the OST should think that a Grade 7 from their ranks would have the understanding and experience to carry out a review of the Director's post says a lot about attitudes in Government to the management of British science.

The outcome, when it was announced in May 1996, carried few surprises. NERC HQ was to lose one Grade 5 post and the BGS two. The rest of the NERC escaped damage. In the BGS, it was recommended that the three corporate divisions should be reduced to two by 31 March 1997 with a saving of one Grade 5 post. Another recommendation was that the merits of restructuring the four programme divisions should be considered after the outcome of the Prior Options review was known, with a view to reducing them to three. These meant that either the head of CCID or BGS International would have to go for certain, but that a decision regarding the loss of the head of one of the four programme divisions was delayed.

The Government announcement of the commencement of the Prior Options review of 42 Public Sector Research Establishments came in late September 1995, shortly after the press release on the outcome of the Efficiency Scrutiny by Ian Lang and during the Senior Management Review. The number was reduced to 36 in a later announcement. The reviews were to take place in three tranches. The outcome of the first, consisting of 17 establishments, was due to be announced in May 1996. The review of the BGS was to take place in the second tranche, in which there were nine establishments, including the NERC's Centre for Ecology and Hydrology (CEH) and the Centre for Coastal and Marine Sciences (CCMS). The British Antarctic Survey (BAS) was not included. It was expected that reports would be put to Ministers in July that year. The third tranche was due to be completed by December. All three of the NERC reviews were co-ordinated by a NERC Prior Options Steering Committee chaired by Dr Ian Graham Bryce, a member of Council and Vice-Chancellor of the University of Dundee. The role of this committee was to gather evidence and produce a report, which would be submitted as advice to ministers. The report was not going to be published, and the ministers were not obliged to act on anything in it.

Of all the reviews to which the BGS had been subjected, this one was the most sensitive to external political events. It was regarded as a zero-based review (by Professor John Krebs, the NERC Chief Executive) and no one doubted that it was an attempt by Government to get what it wanted after the Efficiency Scrutiny had failed to deliver the required outcome. It was widely felt that, having failed

once, Government was not going to be seen to fail again, but timing was to be crucial. The Government had lost heavily in the May 1995 local elections and was consistently returning poor opinion-poll results. The next general election had to held before May 1997. If the Prime Minister decided to go to the last possible date, there was ample time to complete the Prior Options review, but experience elsewhere seemed to indicate that there may be insufficient time to complete a process of privatisation following the publication of the results of the review. This was particularly so in the case of a trade sale if there were difficult questions to deal with in relation to assets, liabilities and statutory obligations, for example. Some such privatisations had taken more than eighteen months to negotiate, though none had actually failed because of them. Finally, no one knew whether, if Labour won the election, their Government would continue with privatisations started before the election or abandon them. It was essential, therefore, that the BGS knew in some detail what the implications were of all the options likely to face the Survey in order to be prepared for any eventuality. A member of staff, Andy Howard, was drafted into the Central Directorate Support Group full time for six months to deal with Prior Options.

The Prior Options process was structured around five key questions. They were:

- Is the function needed?
- Must the public sector be responsible for the function?
- Must the public sector provide the function itself?
- What is the scope for rationalisation?
- How should the function be managed?

Dealing with the first three was not difficult for the BGS, now a veteran of reviews, but the fourth and fifth questions required deft handling. There were risks that, if not carefully crafted, the wording of any objective assessment of the options could convey the wrong message, especially to a reader who was looking at it with a certain aim in mind.

Director called staff meetings in January 1996 to discuss the options and there were several formal and informal Directorate meetings in the period during which the BGS submission to the NERC Prior Options Steering Committee was being prepared. At the start of the process, despite having had experience of the Efficiency Scrutiny, there was no clear view among the eight members of the Directorate of what position should be adopted. Two were unequivocally in favour of remaining in the public sector. Two favoured privatisation. Three vacillated between the two extremes and one abstained. The BGS submission was ready by March and Peter Cook, in a step designed to avoid misquotes and misunderstandings at a later date, published it in a technical report, *Future Options for the British Geological Survey* (Technical Report number WQ/96/2). The stance adopted in it was the in-between one, that the BGS should remain a public-sector body in the NERC, but that if a change were to be deemed necessary, the status of company limited by guarantee would be appropriate.

The idea that the BGS might successfully operate as a company limited by guarantee (CLG) was first raised during the Efficiency Scrutiny. The NERC was withdrawing from the Civil Service pay agreement on 1 April 1995, which would make it easier to operate as a CLG. The Biotechnology and Biological Sciences Research Council had already converted all its institutes to CLGs. NERC HQ carried out an investigation of it as an option in September 1995, after the BGS had first looked into it. The NERC review concluded that there were benefits and, superficially, this looked like an acceptable outcome, but they did not think the BBSRC model, in which the research council had retained ownership of the buildings and employed all the staff, was appropriate for the NERC.

Once the submission was prepared the action did not stop. A number of visits to organisations that had either experienced privatisation or had been involved with it in other ways were carried out and there were several informal Directorate meetings to discuss new developments as they happened. The object of all of this activity was threefold. Firstly it was to gather and assess evidence that would allow management to decide to what extent any of the options that were currently popular would harm or help the BGS. Secondly, it was to put the BGS in a position to modify its position quickly, should external conditions change. Thirdly, it was felt that if the wrong decision about the Survey's future were to be made, good evidence would be needed by management to organise a campaign against it.

There is no doubt that, once again, the BGS was under threat. The Prior Options Steering Committee collected evidence from external sources as well as from the Centre/Surveys under review. Not all academics consulted were wholly sympathetic to the BGS. One, who stated that he thought BGS was staffed, on the whole, by 'competent, journeyman scientists', believed that there were no good reasons for the Survey to remain in the public sector. Rumours abounded and not all were baseless. Ever since the early 1980s, when NERC HQ first heard of the privatisation of the so-called commercial part of the Swedish Geological Survey and asked Malcolm Brown to examine the feasibility of doing the same to the BGS, the threat of splitting up the Survey had been in the air. It was considered again by Butler and by Government when it was considering its response to Butler in 1988. It was inevitable that it should come up again, and it did. One strong rumour was that a major firm of civil engineering consultants had made an offer to buy outright the BGS data holdings and collections. There was also talk of universities being interested in acquiring the BGS laboratory facilities. As the universities were regarded by Government as being in the private sector, a transfer of laboratory assets, such as this, would count as much as a privatisation as the sale of the data holdings.

The options for privatisation that had to be taken into account were varied. There was the outright privatisation either by a trade sale or a management or management/employee buyout. There was partial privatisation, full or partial attachment to a university, contractorisation to form a government-owned contractor-operated body (GOCO) and company limited by guarantee (CLG). GOCOs were quite fashionable after the way in which Serco had been contracted

to run the National Physical Laboratory on behalf of the Department of Trade and Industry. The Laboratory of the Government Chemist had been fully privatised and had taken its statutory rights with it into the private sector. A consortium of the Royal Society of Chemistry, its own management and the venture capital firm 3i had bought it out. This raised the spectre of the BGS being bought out by a consortium that included the Geological Society. A third privatisation that seemed to offer itself as a model for the research-council institutes was the Natural Resources Institute, the research arm of the Overseas Development Administration. This had been broken up and each part taken over by either one university or a consortium of several.

Information was acquired about them all and it was quickly realised that there were almost as many individual models as there were privatised bodies. Each one seemed to have been tailored to suit its individual qualities and all were complex. A balance of the pros and cons for each option revealed that none of them was attractive, but of them all the least damaging was to become a CLG within the public sector. The consequences of outright privatisation were horrific, not least because then, as now, over 70% of the BGS income was derived from Government sources. As recently as 1988, Government had given its support to the BGS Core Programme, which, if it were to be continued, would require guaranteed funding at least until 2005. Any reduction in the level of Science Budget, as experience in the 1980s had shown, could make the BGS inoperable. In order to carry out both the Core and Commissioned programmes, the BGS required its current range of skills, which had implications on the viable size of the organisation. Studies done then and more recently indicate that there is not a great deal of scope for the Survey to reduce its numbers without changing its remit.

Matters, such as the BGS right of access to land that is enshrined in the Science and Technology Act 1965, which subsumed the original Geological Survey Act of 1845, did not appear to be an impediment to privatisation. Neither did the matters of the Survey's statutory rights to borehole information and the need to support a national geological library. Similar ones had been dealt with in the privatisation of the Laboratory of the Government Chemist. There was an argument about whether the BGS case could be dealt with by administrative action, which Government was increasingly doing, or whether legislation would be required. Whichever was felt necessary would have an impact on the length of time it took to complete a privatisation of the BGS.

The outcome for twelve of the seventeen establishments reviewed in the first tranche was announced late in May 1996, indicating that the review was proceeding on schedule. The principle that seemed to be emerging was that each organisation was being shuffled one step further along the route to full privatisation. Organisations that were integral research establishments within Departments or other non-departmental public bodies were recommended for agency status. Existing agencies and CLGs were recommended either to be privatised or to be subjected to a more detailed review to explore the potential for full privatisation. This might have been taken to indicate that the most likely

outcome for the BGS was to be made into either an agency or a CLG, but what worried the Directorate was that, compared even with some of the agencies and CLGs in the first tranche, the BGS already had much more commercial freedom.

Thus, this outcome did not dispel any of the fears that full privatisation must still be considered an option. Towards the end of June, Mr Anthony Beattie of the Cabinet Office made a surprise visit to BGS Keyworth, apparently to try to persuade the Directorate to jump before it was pushed. His visit was received with an unnerving sense of urgency. He sat on the NERC Prior Options Steering Committee and was the link between it and Sir Peter Levine's team. He was also the former chief executive of the privatised Natural Resources Institute and had first-hand experience of privatisation.

His visit was quite unsettling and forced the Directorate to look in even more depth at its options. It was agreed in the Directorate that, if the organisation had to jump, it would be best to establish the BGS as an independent foundation with company limited by guarantee status. This was the preferred option expressed in the BGS submission to the Steering Committee. Even the Treasury accepted that CLG status was appropriate when it was desired to maintain the independence and impartiality of the body in question, and to avoid giving it a purely commercial character. A draft proposal for the transfer of status, written as an expression of interest, was worked up and sent for comment to the chairman of the Programme Board and Anthony Beattie at his desk at the Cabinet Office. The draft was then modified and submitted as a proposal to the NERC Prior Options Steering Committee. The die had now been cast.

There then followed an unnervingly quiet month, during which the BGS continued to struggle with the options. Even though an offer to transfer to CLG had been made, the Director still considered that it was necessary to investigate further the 'university option' in case the bid for CLG status failed. It was also felt that in the event of full privatisation a management buyout would give the BGS the best chance of controlling its own destiny. Examples elsewhere showed that the Government was averse to single-tender action where management buyouts were concerned and in all the recent cases management buyouts were achieved in a competitive sale. There were many constraints imposed on organisations interested in a management buyout, mainly to reduce their advantage over the competitor bidders. Management were not allowed, for example, to build their case in office hours. They were expected to do the job they were paid for in office time and organise the buyout in their own time. There were constraints on the use of public funds to finance consultants, and most of the good consultants had been retained by Government to advise them, so they would not be available to advise the research establishments.

Nevertheless, the BGS did seek advice from a venture capital firm, a commercial bank and management consultants. It became clear that, in order to raise the funds for a purchase, the senior managers would have to find a partner and it was most likely to be a venture capital firm or a bank. Naturally, any partner would look very closely indeed at the long-term financial viability of the BGS as

well as the competence of its management. These were major concerns. The BGS's high dependence on Government funding made it necessary to obtain Government funding guarantees for at least ten years. In addition, the senior staff, who would comprise the executive, would be expected to make a major financial investment in the venture as a sign of their good faith in it. This could mean mortgaging houses to raise the capital. Finally, because returns might not be immediate, it was unlikely that a partner firm would be sympathetic to retaining on the executive anyone among the senior staff who was over 55. This dose of realism put an almost immediate stop to any further exploration of this option. From here on the CLG option was the only one that would be given any serious consideration by the BGS Directorate.

On 24 July there was an announcement that gave hope to those who were opposed to the idea of privatising Public Sector Research Establishments. It was that the Parliamentary Science and Technology Committee had expressed concerns about the course of the Prior Options reviews of the Public Sector Research Establishments to the Minister for Science and had decided to conduct an inquiry into them. The deadline for written evidence to it was 1 October. The BGS was quick to put in a paper and on the strength of it Peter Cook was invited to give oral evidence to the inquiry, all of which was to be collected in October. Effectively, this inquiry slowed the process down, but few were prepared to make any assumptions about its outcome.

By September the Director was confident enough about progress to put out an office notice to all staff summarising the position thus far. Although he had not been allowed to see the report of the Steering Committee he had reason to believe that contractorisation and transfer to university ownership had been rejected by it. Three options were left, not apparently ranked. They were given as the 'enhanced status quo', privatisation following a negotiated sale, and privatisation following a trade sale.

In the 'enhanced status quo' model the BGS would remain part of the NERC and staff would continue to be NERC employees, but the Survey would become a research contractor to NERC HQ. The logic in this model was that it was a continuation in development of the current NERC 'arm's length' policy. The fear among BGS management about this option was that either the whole of the core strategic programme or parts of it might be put out to competitive tender by the NERC. If external bodies were then successful, the BGS could be left to coordinate a programme over which it had no executive powers.

Privatisation by negotiated sale would involve the BGS management being invited to make a bid for ownership of the BGS through single-tender action. This had been done in the case of the Buildings Research Establishment, where the incumbent management had been given six months to negotiate an agreement for purchasing it from the Department of the Environment. This option would allow the BGS to form a company limited by guarantee. The guarantors would be representatives of the user community, who would appoint non-executive members to the BGS Board.

The third option was sale by competitive tender. There would be an opportunity for the BGS management to arrange a management or management/ employee buy-out, but its bid would be in competition with whoever else was interested.

In October, while the Parliamentary inquiry was still in progress, John Gummer announced the competitive sale of the Buildings Research Establishment, one of the Public Sector Research Establishments reviewed in the first tranche. It seemed that the attempt to arrange a negotiated sale had failed. This action immediately invalidated one of the options selected by the NERC Prior Options Steering Committee.

One problem for the Government regarding privatisation of Public Sector Research Establishments emerged as early as June, and was known to the BGS management to be serious in September. This was the not insignificant matter of what was called the 'crystallisation' of pensions, and it had the potential to stop the process completely.

Government does not make any separate provision for public-sector pensions. They are paid out of the general fund, as are salaries and other outgoings. In the case of a sale by competitive tender, Government would expect, because the law required it, that a bid would include provision for the pensions. Opinion was tending towards the view that, because the sums were so large, Government was going to have to take pensions out of the equation. To do so it was estimated that if all the Public Sector Research Establishments under review were to transfer to the private sector, Government would have to find £1.2 billion in cash to secure the pensions. The figure for the NERC alone was £89 million.

There were other problems for Government. As a result of the criticism that they had not been achieving the best price for some recent privatisations, they now seemed to be in favour of 'clean breaks' with the privatised organisations they were creating. That is, their preference was to make sales by competitive tender with no half measures. This meant that negotiated sales, which took longer to arrange and may involve a potential management buyout, had lost their appeal. They were also now running out of time. Only a trade sale could now be completed before an election in May 1997.

On 2 December the Parliamentary Science and Technology Committee published its report. It was hard hitting and critical of Government, saying that the scale and conduct of the reviews was profoundly unsatisfactory and that the wholesale disruption caused by it in the last few years should never be repeated. They recommended that the research councils should be left to organise themselves in a way that they considered most appropriate to carry out the science needed to fulfil their missions. They were also of the view that the Office of Science and Technology should work with Departments and the research councils to produce a system of regular reviews, say once every five years, which would command the confidence of all concerned.

It took until 29 January 1997 for the Government to admit defeat. In a written response to a Parliamentary Question from Nigel Evans, MP, Ian Taylor, the Minister for Science and Technology, said:

> We are satisfied that the functions of the NERC establishments — the British Geological Survey, Centre for Coastal and Marine Sciences and Centre for Ecology and Hydrology — covered by the second tranche of prior options reviews are needed. We have concluded that they should remain in the public sector and retain their separate identities. I shall expect NERC to build on its 'arm's length' relationship with the establishments and to improve their financial management systems.

To what extent this was a political defeat for the Government by one of its own committees and the electoral system may never be known. Whether or not the whole exercise had been necessary, however, is known. In supporting the decision, the NERC Prior Options Steering Committee announced that it accepted that environmental science is long term and multifaceted, involving research, survey and monitoring over decades, that environmental issues transcend boundaries and increasingly require an integrated and multidisciplinary approach. The benefits are pervasive and serve many users. This was new phraseology to describe very old ideas. Only ten years ago something similar had been written in the Butler report and accepted by Government.

The Steering Committee agreed that funding for such activities had to come from the public purse, but it also concluded that private-sector ownership of the NERC establishments was both appropriate and feasible provided certain conditions were met, including the provision of necessary funding. The list of factors the Committee said needed to be taken into account in any future examination of the potential for privatisation went right to the heart of the matter. They said that the core functions of the establishments do not make a profit and that there is uncertainty over the long-term funding levels and volume of work required by the NERC and other key customers. The market opportunity was small; fragmentation of the organisations is not appropriate; and there was little commercial interest shown during the review. The Committee pointed out that in the event of a privatisation of the three Centre/Surveys, rationalisation costs were likely to be in the order of £22 million, the cost of pensions crystallisation, £89 million and start-up cost estimated at £4.6 million. Despite these, the Steering Committee considered that it was appropriate for the Centre/Surveys to be privatised in the form of profit-retaining CLGs with charitable status. As an example of Orwellian doublespeak, this has few parallels.

Having escaped privatisation, the Centre/Surveys were not entirely free from any consequences of the review. The Steering Committee had recommended that in preparation for privatisation, but also in the interests of improving the delivery of the NERC's science, there was scope for restructuring and rationalisation of the Centre/Surveys. The ministerial statement endorsed this. The NERC was required to develop an implementation plan, which it completed and released in May 1997. There were three strands to it. The three Centre/Surveys that had been subjected to Prior Options were to be 'rationalised and restructured', the arm's length relationship that was developing between NERC HQ and the Centre/

Surveys was to be enhanced and there was to be improvement in the financial management system for the NERC.

For the BGS this meant losing two of the Assistant Director posts, several Group Manager posts and eighty other staff, and undergoing another review of the efficacy of keeping offices in Edinburgh, Exeter and Wallingford.

The review of the offices produced no change, but there was no way to avoid the staff reductions. No one, even Peter Cook, was quite sure how the Steering Committee came up with a figure of eighty staff to be lost. The best guess is that it represented around 10% of the total staff complement. It was to be made up of natural retirements, resignations and early retirements and would include staff that had already gone in the previous year. At the same time as staff were to be lost, recruitment of 37 new staff was to be allowed. The purpose behind this was to change the balance of the grades rather than to contract the organisation. Outgoing staff were to be Grade 7 and SSOs; incoming staff would all be junior grades.

Because the BGS had been allowed by the NERC to take into account staff movements, retirements and resignations that had already happened in the year before the announcements were made the figures that were finally agreed were 74 staff to be lost and 46 new appointments. Nevertheless, a year later, in May 1998, the new Director, David Falvey, had to put out an office notice renewing the offer of early retirement and raising the possibility of compulsory redundancy if the numbers could not be made up by other methods.

It is ironic that by the time the first office notice was issued on 20 May 1997 advising staff that the NERC was making a large sum of money available for an early retirement scheme to help achieve this staff reduction, the Government that had forced it upon the BGS had lost a general election.

Chapter 15

Another reorganisation, 1996–1997

Senior managers had expressed dissatisfaction with some aspects of the 1991 reorganisation, privately, from its earliest days, but it was not for anything to do with this that in 1995 the Directorate began to look critically at the management structure. The stimulus for this was the announcement by the Director-General of Research Councils, in March that year, that he was going to initiate a review of the management function of all the Grade 5s in the research councils, with the aim of reducing their number. He had set a target of a 30% reduction in the cost of administering British science. In order to prepare for this, Peter Cook set up a meeting of the Directorate for 27 April 1995 to identify the important strategic elements that ought to be considered in any new management structure that the Survey might have to implement after the review. He insisted that the meeting went ahead even though he was going to be away at the time on a three-month sabbatical and would not take part in it.

The meeting looked at the requirements for a future management structure and, in doing so, tackled some of the complaints that had been raised within the divisions by Group Managers. Among them was inter-group rivalry, which had been viewed in prospect by the Price Waterhouse consultants as being potentially good, adding a new dynamic to the BGS. In reality, it had become an irritant and was viewed by some Group Managers as symptomatic of much deeper failures within the management system.

The conclusions of the meeting were somewhat contradictory. For example, it concluded that the basic operational unit within the BGS should remain the group, but that there was a need to make adjustments to some groups in order to reduce the amount of overlap between them. It was noted that co-operation between groups was best when they were complementary to each other and had no overlapping interests. The Directorate also saw some merit in introducing a matrix approach to the management of certain activities, most notably the commissioned research programme. Action taken along these two lines would have done a lot to reduce the level of inter-group rivalry, but they then agreed that some of the activities carried out in so-called corporate groups might be better devolved to operational groups. This would have strengthened those groups whose recent activities showed that they had begun to opt out of the corporate BGS. By contrast, they did agree that more BGS-wide coordination was needed for marketing and business planning, identifying the sharing of earnings targets between groups as an objective of any new system.

No action immediately followed this meeting and inter-group competition was again raised in the Directorate at its July meeting, when Peter Cook was back from sabbatical leave. Discussion was deferred for a month, when it was planned to hold another strategy meeting for the Directorate, but this time it was to be facilitated by staff of the Centre for Exploitation of Science and Technology (CEST). Held in the Quorn Hotel, Quorn on 30–31 August 1995, this meeting was billed as a self-assessment workshop the purpose of which was to focus on two aspects of strategic thinking, namely future direction and opportunities. This was a good sequel to the April strategy meeting.

Beforehand, the CEST facilitators interviewed individually the Director and all the divisional heads and prepared a briefing pack for the meeting, summarising the issues that were raised at the interviews. There were no surprises among them. One of the realities of the market economy was that price was king and the BGS, having to carry a lot of unavoidable overheads, was struggling to compete. Competitive tendering by Government departments was particularly harsh. It was not at all uncommon for the BGS, having lost at tender because of price, to find itself being invited to carry out a rescue operation near the end of the contract. It had also become evident that high staff costs in the BGS had driven some established customers to stop buying its services, settling for the cheaper option of buying a geological map and doing the interpretation themselves. Sadly, in some such circumstances they would not even pay £75 plus VAT for a 1:10 000 map, but bought a generalised compilation at 1:50 000 for £8.50. While business and sales were being lost this way, there was ample evidence of inadequacies in the processes the Survey was supposed to have developed after Price Waterhouse to enhance business development. There was still a tendency among BGS staff to complete a contract to the highest specification rather than do it fit for purpose. ADs complained about the lack of coordination of marketing effort and that there was no clear definition of marketing roles and responsibilities. There was no system of reward for those groups that were successful and no facility for investment to be focused in areas of greatest opportunity, and the system of setting targets for groups was not working. There were some more basic concerns. The conflict between the long-term objectives of the Core Programme and the prevailing short-termism in the commercial sphere came up, and with it the prospect that the BGS might succeed in neither its commercial nor its non-commercial role if this conflict was not resolved. The conflict of interests in being both the advisor to the geoscience community at large and contractor had in no way been diminished.

The workshop was divided into five modules, covering scenario planning, price-versus-quality considerations, products and services, the role of Technology Foresight, which was beginning to dominate Government thinking on science, and, finally, the way forward. In many ways, this was a five-year review of Price Waterhouse, though it was structured to look forward, not critically backwards. In a sense, that had been done at the April meeting and there was no need to repeat it.

Quite a lot came out of the workshop. Most surprising was the recognition that it was in the Survey's best interest to develop a closer relationship with the

NERC. The NERC had already embarked on its arm's length policy, which the BGS had welcomed despite finding that many of the new responsibilities being loaded on the Centre/Surveys came without any additional funding. A consequence of this had been that much of the strain in the relationship between the BGS and the NERC had gone. The BGS Directorate, for the first time in the memory of any of its members, found itself in a position where it was relaxed about agreeing to strengthen the relationship between them and NERC HQ.

There were three other crucial conclusions. First among them was the recognition that contingency planning was needed to cover the possibility of the loss of a major contract. The decline in value of contracts from Government departments had continued, so that the only large one remaining was with the Overseas Development Administration — and they had now moved to competitive tendering. Almost as large was the contract with UK Nirex Ltd. It was felt that the BGS was vulnerable on both of them. The loss of very large contracts had occurred in the past and the Survey had recovered, but not without difficulty and some help from the NERC. The absence of a strategy to deal with a repeat occurrence was, in the new 'arm's length' environment, therefore, cause for concern.

The next issue was what was called 'IT into everything'. This became something of a catch phrase after the meeting. The BGS already had developed its IT/IS (Information Technology and Information Systems) policy based on two lead elements. One was to become 'first follower' in all fields of IT and IS development except those that related to digital mapping. This meant that, rather than become involved in software and systems development, the Survey would wait for a commercially developed substitute, not only to come on the market, but to be tested in other organisations first. The second strand to the policy was to move from a centralised computer management system to a distributed one. It was this second one that was thought not to be working as well as it should. Few were prepared to abandon it, because there were undoubted benefits from it. It was thought that the weaknesses, though significant, could be addressed within the framework of the distributed system, given the will. There was no coordination of applications development between groups and divisions; there were no corporate software standards, and there was no centrally defined policy about where investment at any level should be made to improve the Survey's IT/IS capability. The recognition that IT was into everything did not mean that everything that anyone could think of should be developed, because there were resource limitations that had to be recognised. Targeting of resources was essential. While this was being done within some of the divisions, it was difficult to do for the BGS as a whole because of its distributed, group-centred management system and the insularity of the divisions. The conclusion was that the BGS had to find the half-way point between fully distributed and fully centralised.

Lastly, there was a whole raft of issues that recognised the Survey's poor record in business development. Marketing effort was not coordinated, and there was no recognition of premium customers, while product development, customer research and across-BGS rationalisation of products was almost non-existent.

Much effort was expended at the workshop in an attempt to understand where the BGS sat in the product chain. Should the Survey concentrate on becoming the provider of basic information to be used by the private sector to generate their own value-added products, or should the BGS go all the way and develop its own value-added products in competition with the private sector? There was, here, a major difficulty in defining the remit of a body that tried to balance its public service role with a commercial one. Inevitably, with the prospect of privatisation still on the horizon, attitudes favoured the commercial option, if for no other reason than it offered better survival prospects.

It was not the objective of the workshop to go beyond problem identification. A set of key actions did emerge from it, but they were an ad hoc collection, not a coherent set that could inform a reorganisation. Rather it was to inform strategic thinking, not yet started. The announcement on the final outcome of the Efficiency Scrutiny was still a month away, and though the Director-General of Research Councils had made known his intention to downsize or de-layer the management of research councils, the Senior Management Review had also not yet been announced.

Matters came to a head at the senior staff meeting that was held at the beginning of November 1995, only two months after the Quorn workshop. Present were Group Managers from both the science and administration divisions, the divisional heads, the Director and the Individual Merit Promotees. This was the first such meeting at which discontent with aspects of the BGS management system was aired openly by Group Managers. Not all of them were in agreement with the critics, though it was the critics who were the most vocal. At first, Peter Cook was reluctant to accept that the structure he had created was failing in any way. The Quorn meeting had not overtly attributed the weaknesses that were identified at it to a failure in the management system, though this was the line taken by some of the critics among the Group Managers. By the end of the meeting, however, he was prepared to accept that there were issues that needed addressing. In a message to all senior managers after the meeting he stated his agreement that there should be adjustments made to the current Divisional/Group structure because of them. Aware of the intent behind the Director-General's review, he did warn that the adjustments may lead to the reduction in the number of Group Managers and that some of them should be prepared to lose their jobs.

The announcements about the Efficiency Scrutiny and the Senior Management Review had come in September and Peter Cook, therefore, took the precaution of deferring any action on restructuring until the outcome of the latter was known, though he began discussions with the Assistant Directors almost straight away. His problem was to devise a new structure that accommodated both the reduced levels of senior management he was having to contemplate and provided a solution to the problems that had been raised in the April Strategy meeting, at the Quorn in August and by the Group Managers independently.

There were several matters about which managers had complained and attributed to internal competition, which fitted the conclusions of both the April

meeting and the Quorn workshop. They all stemmed from one core issue. This was that the management system itself encouraged internal competition. If any one knew the true levels of internal competition it was these managers and at the meeting in November some of them had admitted to practices that could not be described as in the best interest of corporate BGS. Their view was that it was the internal competition that had led to a fragmentation of effort and lack of coordination in areas where it was thought essential to have coordination. Essentially, the critics were looking for a change in the nature of the management system that would re-establish the primacy of the interests of corporate BGS over the interests of the individual groups and divisions. They did not subscribe to the view that the corporate interest was the sum of the interests of the groups and divisions.

In his *History of the British Geological Survey 1990–1997*, Peter Cook identified four critical issues that needed to be addressed. These were poor coordination of databasing, the tendency for divisions to compete in unhelpful ways, for walls to be built between divisions and groups and a failure of marketing to bring together the complete spectrum of BGS skills rather than just those residing in one group or division. He decided to tackle these by a restructuring within an unchanged management framework, rather than to carry out the more radical review that the most vocal of the critics thought was needed.

The March announcement by the Director-General of Research Councils had provided more than a broad hint that a reduction of about a third in the number of Assistant Directors was in the offing. The Senior Management Review was directed only at Grade 5 managers, but there was continual pressure from NERC to reduce management costs. Taking into account these and the criticisms being made of the current management system the restructuring had to include a re-examination of all levels of management.

When it came, the Senior Management Review recommended that only one Assistant Director should go, but a decision on a second would be made after the outcome of the Prior Options review was known. Ideally, this meant that the new management structure should not even be revealed to staff until after the Prior Options announcement. There were obvious difficulties with this. The optimum time for introducing a new structure was the beginning of the financial year on 1 April 1997. Because several new posts were to be advertised and filled, the new structure had to be ready and announced well before Christmas. When nothing but silence came from Whitehall about Prior Options in the final weeks of 1996, a decision whether or not to anticipate it had to be made. In November, at a meeting of the informal network of directors of Public Sector Research Establishments (PSREs) that had been set up to develop linkages in the light of Prior Options, the view was expressed by some usually well-informed members that it was unlikely that there would be any privatisations other than of ADAS and the Buildings Research Establishment before the general election. Director took the decision to announce the new structure in an Office Notice issued on 1 December 1996 (Figure 9). A target date of 1 April 1997 was set for it to be fully operational.

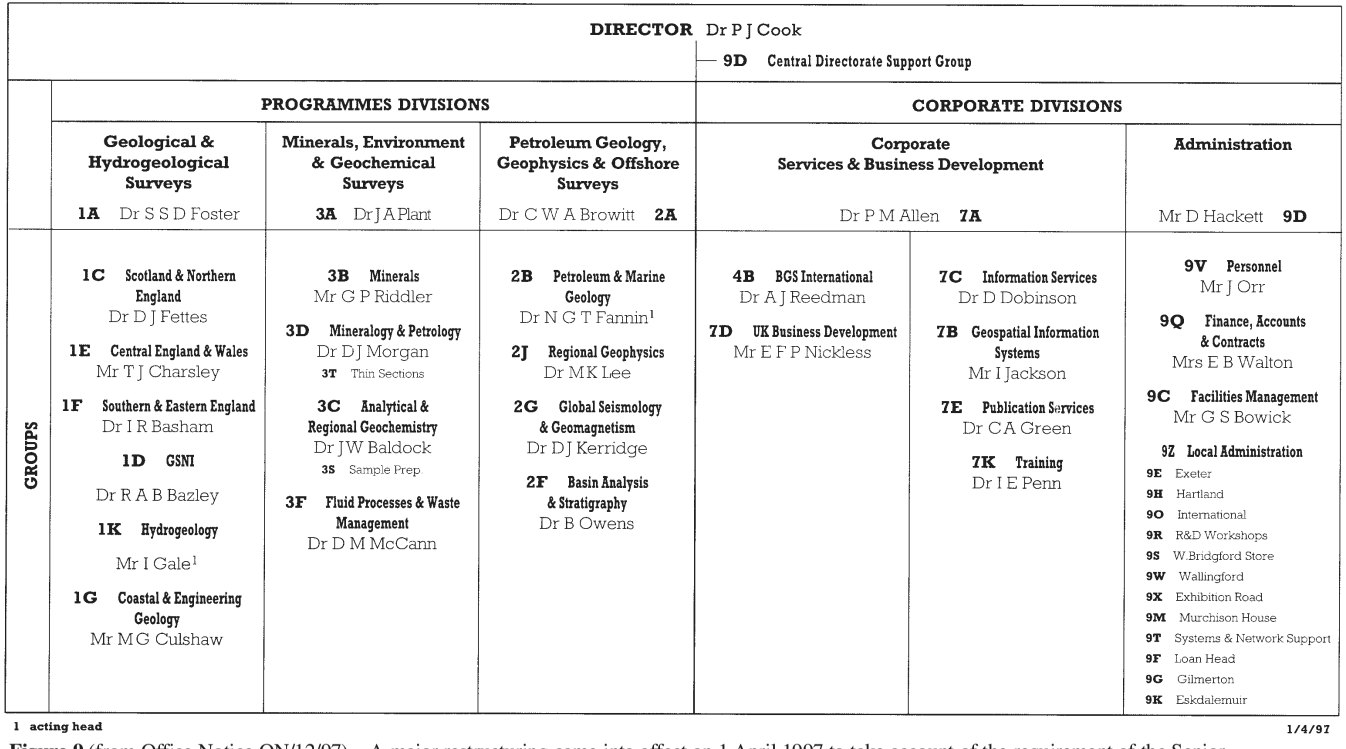

Figure 9 (from Office Notice ON/12/97) A major restructuring came into affect on 1 April 1997 to take account of the requirement of the Senior Management Review and Prior Options to reduce the number of management posts. International and Marketing Division became two groups in the Corporate Services and Business Development Division. The Land Survey, once with three Assistant Directors and twelve units, was reduced to four groups.

In 1998 P J Strange became head of Southern and Eastern England, J W Arthurs of Northern Ireland, D W Peach of Hydrogeology, D C Holmes of Fluid Processes and Waste Management, D C Ovadia of UK Business Development, and W Hatton of Minerals. The NERC Isotope Geoscience Laboratory rejoined BGS. In 1999 N J Riley became head of Basin Analysis and Stratigraphy Group.

This was the most drastic restructuring that the Survey had ever undertaken. Two Assistant Director posts were to be lost. There was a reduction in the number of groups, and therefore Group Managers, from 26 to 19. The number of Grade 6 staff, not all of whom were Group Managers, was reduced from 23 to 19.

Being forced by the external pressure to downsize the management and having also to address problems that had been recognised in the current management system did not present the difficulties that might have been expected when it came to finding a coherent theme for a new structure. In contrast, however, a recurrent problem that was faced in the months of planning was how to create three programme divisions that were more or less equal in size and whose heads had responsibilities that were equitable and comparable with those of the heads of the two corporate divisions

No division was left untouched. The centralised NERC Computer Services was disbanded at the end of 1996 and the specialist teams that maintained the network and systems were disbursed to the Centre/Surveys. The decision was taken to put the twelve staff who were allocated to the BGS into Facilities Management, which was part of the Administration Division. This was the only change to that division.

International & Marketing Division was merged with the Corporate Coordination and Information Division (CCID) to form the Corporate Services and Business Development Division (CSBD), the second corporate division. The Senior Management Review did not specify which of these two divisions should lose its Assistant Director, but there was little doubt that it was more likely that International would be the victim. In the previous ten years there had been a dramatic change in the nature of work done overseas. Whereas it had once been dominated by big residential contracts overseas, by the mid-1990s Government policy changes had impacted on the BGS such that there were few residential contracts on offer in the fields that the BGS specialised in. Nearly all staff who went overseas did so on short-term contracts. The core of permanent overseas specialists had reduced to a handful and the remit of the division had changed. International marketing and contract management had become dominant over project and programme management, which had once been the mainstay of the division. In recognition of this, the post of head of International was regraded to Grade 6 and the responsibility for UK Marketing and Remote Sensing was removed from it.

Three of the groups within CCID remained unchanged. These were Training, Information Services and Publication Services. The fourth group, Information Systems, was merged with Remote Sensing (from International and Marketing Division) and Data and Digital Systems taken from TMOS Division, to make one large and powerful IT/IS unit called the Geospatial Information Systems Group. The aim of this move was to bring under single management most of the IT staff so that the problems identified in the CEST workshop and the senior staff meeting could be addressed.

The UK Business Development Group was created, under a Grade 6 manager, to coordinate the BGS marketing effort, again a point of criticism raised

many times in the past two years. The Press Officer and PR staff moved into this group, which was kept small. The concept of key account managers had being raised at the CEST workshop and had been acted upon. It was agreed that earnings of around £500 000 a year from a single client should define the threshold above which a key account holder was justified for that client. Two were recognised and made responsible to the head of UK Business Development Group, but most of his staff were the sector managers.

The four programmes divisions were reduced to three, by disbanding the Groundwater and Geotechnical Surveys Division and sharing out its groups among the other divisions. The biggest of the new divisions was the Geological and Hydrogeological Surveys Division (GHS). The five Land Survey groups within Thematic Maps and Onshore Surveys Division (TMOS) were reduced to four. Hydrogeology was brought over from the disbanded GGS Division, as was the engineering geology half of the Engineering Geology and Geophysics Group. This was merged with Coastal Geology, taken from Petroleum Geology, Geophysics and Offshore Surveys Division (PGGOS).

Regional Geophysics Group acquired the geophysicists from the Engineering Geology and Geophysics Group, effectively reconstructing the Regional Geophysics Group as it was prior to 1991. The new, enlarged group was moved into PGGOS. Also in this division, Global Seismology and Geomagnetism were merged into one group. The petroleum geologists were taken out of Petroleum Geology and Basin Analysis Group and put with the marine geologists to form Petroleum and Marine Geology. The basin analysis specialists were joined with Biostratigraphy and Sedimentology Group to form Basin Analysis and Stratigraphy Group.

The third division, Minerals, Environment and Geochemical Surveys Division was formed by adding the Fluid Processes Group to the Minerals and Geochemical Surveys Division. Two groups from the old division, Geochemistry and Analytical Geochemistry, were merged to form one in the new. Lastly, the NERC Isotope Geoscience Laboratory was put into this division when it returned to BGS management in July 1997.

What emerged was a more clearly defined market-facing structure at divisional and group level than the one it replaced. But it was also a strongly discipline-based organisation. The three programme divisions very closely reflected the classic distinction between geophysics, geochemistry and geology which had characterised the structure of the Survey under Kingsley Dunham and Malcolm Brown. Most groups were predominantly single discipline, with only three specifically meant to be interdisciplinary groups. These were the Coastal and Engineering Geology, the Fluid Processes and Waste Management, and the Basin Analysis and Stratigraphy groups. The reasoning behind this was that it would increase their commercial capability.

The most important step taken to reduce conflict in one market sector was to move Regional Geophysics into PGGOS. By doing this, all the expertise in oil and gas exploration, which had been the principal source of revenue from that

industry, was now concentrated in one division, but so, now, were all the geophysicists, except a small number, who were attached to the Fluid Processes and Waste Management Group. PGGOS was now, effectively, the geophysics division.

The Minerals, Environment and Geochemical Surveys Division, now that Fluid Processes and Waste Management Group and, later, the NERC Isotope Geoscience Laboratories (NIGL) had been moved into it, contained nearly all the expertise in geochemistry and became a geochemistry division. Only those geochemists specialising in water chemistry and attached to Hydrogeology Group remained outside it.

The Geological and Hydrogeological Surveys Division, with the addition of engineering geology and hydrogeology, was now in a better position to deal with land-use issues than ever TMOS was. The merger of coastal with engineering geology recognised the importance of engineering geology issues in the coastal environment.

There were anomalies. Strong arguments in favour of moving the Minerals Group into GHS and, thereby putting the capability to deal with resource issues alongside the others that related to land use, floundered partly as a result of numbers. There were similar reasons for leaving the biostratigraphers and sedimentologists in PGGOS rather than moving them into GHS Division. Despite these, however, areas of overlap had been significantly reduced at both divisional and group management levels. Whether interdivisional co-operation would increase as a result would be seen in due course.

Two other steps were taken to deal with weaknesses in the old structure. One was the creation of three high-level subcommittees of the Directorate. These were the Scientific Programmes Subcommittee, the Business Development Subcommittee and the Management Subcommittee. All three were meant to provide BGS-wide overviews of various important operations, which hitherto had become fragmented. Of the three, the Business Development Subcommittee came into action first because it was tasked to draw up the remit of the new, UK Business Development Group. The other two never met.

An external consultant was drafted in to help the Business Development Subcommittee. The two key issues that were addressed by the subcommittee were the terms of reference for the sector managers and the way that earnings targets should be handled in the new structure. Both issues were hotly argued before a conclusion was reached and it was agreed to stop the arrangement by which individual groups were set earnings targets. In its place, came staff utilisation targets, with each Group Manager being set the target of achieving 100% utilisation for all of his staff. The earnings target for the BGS was to be apportioned among the business or client sectors and the responsibility for meeting it shared by the sector managers and the Group Managers.

The most revolutionary step taken in this reorganisation was to create a matrix of IT/IS staff. The new head of Geospatial Information Systems was to be the head of the matrix. All staff whose main work was in IT/IS, regardless of their

original discipline, were to become incorporated into the matrix. They would look to the head of the matrix for their career development. He was responsible for allocating them to groups and coordinating their work, particularly in fields such as database design and development and applications development which had been completely uncoordinated hitherto. Of all the new arrangements that emerged from this reorganisation, this was the most resented.

There were, in 1997, only eight members of the BGS management who had open-ended appointments. That is, their substantive grade was their current management grade. Most of the others were temporary appointments on three or five-year contracts and their substantive grades were one lower than their management grade. One manager was on contract from the outside. When temporary appointment to management grades was introduced in the late 1980s it was meant to give the Director flexibility during times of change, but also the freedom to move managers who had shown that they were not up to the job. Up to 1997 only one repeat contract had been refused. This reorganisation was the first opportunity there had been to take full advantage of the flexibility the arrangement offered. The decision was taken, therefore, with a few exceptions, to make managers compete for the new jobs. In the case of mergers, all the previous heads of groups would be expected to compete with each other for the one post that survived. With regard to the other posts, it was expected that young, ambitious Grade 7 staff would apply and compete against the current incumbents.

The reality was quite different from the theory. This device was well known to have been used in management reorganisations throughout the public service for many years and it was a feature of the private sector. There have been few occasions in recent decades when an action initiated by the Directorate caused so much resentment and bad feeling as this one. The theory patently did not work. In some cases there was no competition for an advertised post because the suitable potential applicants in the group decided, with no coercion, that they would not put themselves forward against their Group Manager. In others, where there was competition from young staff, it was not strong enough to dislodge the incumbent. The worst bad feeling was caused where two or more experienced Group Managers had to compete for merged posts. Though it is difficult to see how else the reduction in the number of posts could have been achieved, this was not an experience that anyone who took part in it wanted to have again.

Chapter 16

Image

For most of the 1980s the senior management of the BGS had been preoccupied with dealing with continuously falling funding from Government and policy initiatives from NERC HQ that were perceived not to be in the best interests of the BGS. The two directors who followed Malcolm Brown were short-term appointments, but their time was taken up almost entirely in dealing with big issues including the fall-out from the 1982–84 Visiting Group, the NERC Corporate Plan of 1985, and Butler. Matters relating to the everyday management of the Survey effectively stagnated. By the end of the decade these crises were over. The PES awards of 1988 and 1989, the establishment of the Programme Board and the Price Waterhouse report all ensured that the 1990s were not going to be a re-run of the previous decade.

When Peter Cook took over from Geoff Larminie as Director in March 1990, there was a prospect of financial stability, at least for a few years, but the need for change identified by the Charging Review ensured that little else was to be stable. The whole of the 1990s was to be characterised by a continuous process of change.

It actually began as soon as the pressure on funding was removed with the announcement of the first PES award in 1988, but Peter Cook accelerated it once he had settled down in the post. Directorate meetings that had been held every two months during Malcolm Brown's time, slipping to quarterly during the period that Geoff Larminie was in the chair, were racked up to monthly in 1990 and they were invariably whole-day affairs. During the crises precipitated by the Efficiency Scrutiny and Prior Options the Keyworth-based Assistant Directors often met for short meetings between the scheduled ones. An enormous number of issues were taken up, debated and acted upon. Those that relate to the Survey's commercial development and to the Core Programme have been dealt with elsewhere, but there were many that had an impact on the public profile of the Survey.

The question was asked by the Price Waterhouse consultants, why it was that the United States Geological Survey was well known in the USA and the British Geological Survey had almost no place in the public consciousness within the United Kingdom? There is no simple answer to this question. The USGS has a high profile from its work on earthquakes and volcanoes and it is funded to disseminate its research findings either free or at minimal cost. None of these apply to the UK. But these are not the only factors that have a bearing on public awareness and Peter Cook was determined to find which were. At his first Directorate

meeting after taking office he declared that he wished to see the BGS adopt a more positive and up-front stance in the area of public relations and soon afterwards asked for a job description to be drawn up for an information or press officer. The post was advertised and filled in April 1991.

The first serious attempt to open the BGS to the public was the series of open days arranged in October 1985 to celebrate the sesquicentennial anniversary. Another open day was arranged in 1986, at which it is reputed that 12 000 visitors came to Keyworth. The cost of these events was considerable, but the benefits are particularly difficult to quantify. They were not continued at Keyworth, but the Edinburgh office has regularly arranged open days since then. Nowadays they tend to be in association with organisations, such as Scottish National Heritage, which organises a Scottish Science Week, usually in September each year.

Alternative ways of presenting the BGS to the general public have been sought and many tried. Each year staff at the Keyworth office take part in the British Association for the Advancement of Science, Science and Technology week, setting up stalls for school parties. Independently of this, since 1985, there have been regular organised tours of the site for visiting parties from all sorts of organisations including some with no direct geological association. Mostly, these tours are organised on request. However, in the early 1990s the BGS took stands at various national events, such as the Agricultural Show at Stoneleigh and the Green Show as part of the campaign to heighten public awareness of geology. The conference facilities at Keyworth are from time to time hired out or loaned to external organisations, such as the Geological Society, and site tours are often arranged in association with these events. In 1994 and 1995 the BGS, acting on behalf of the NERC, became one of three UK sites to receive telepresence broadcasts from JASON projects. They were organised by the American oceanographer Dr Robert Ballard to raise scientific awareness among children, particularly in relation to the potential that science offers for careers. Live satellite TV broadcasts were arranged from Belize in 1994 and Hawaii the next year. The images were projected onto a giant screen in the De la Beche lecture theatre and were seen by over 2500 children in 1994 and 5300 in 1995.

On appointment, the Press Officer, Hilary Heason, was tasked to heighten the BGS profile in all branches of the media. Steps were taken independently by the Global Seismology Group in Edinburgh to make it the first point of reference for the media in the event of a newsworthy earthquake happening anywhere in the world. They were highly successful in this, but there is a cost: staff have to be on standby twenty-four hours a day, seven days a week in order to be consulted and they require very efficient technical backup.

One highly successful early initiative of the press officer was the launch of *Earthwise*, the official BGS magazine. It is aimed at the lay reader, but is about research carried out by the BGS. The first issue was in September 1991 and it is published twice a year. The print run is normally 5000, of which around 4000 are distributed externally. Recent issues have covered themes such as new perspectives on the past, geohazards, sustainability, minerals and the BGS in

Europe. The magazine is highly popular. Additional printings of some issues have been ordered by educational establishments to support their course work. A similar magazine, *Earthworks*, produced by the BGS originally for the Overseas Development Administration and now for its successor, the Department for International Development, covers geoscientific research carried out for them overseas.

A significant development in January 1992 was the start of the BGS Lecture Series. This was to be an annual event, held in both Keyworth and Edinburgh, at which a distinguished speaker would talk on a subject that was of broad interest, but not necessarily on geology. The speaker at the first lecture was Professor Brian Hoskins from Reading University, talking on 'Climate change — lessons from the past'. Audiences have consistently filled the De la Beche lecture theatre in Keyworth. Among the speakers have been Sir Crispin Tickell, Sir John Cadogan and Sir Robert May.

A sequence of promotional events began with the Minerals Industry Forum in 1992 at which the BGS presented its research to invited members of relevant industries and sought comment from them on how appropriate it was to their needs. Others followed, targeting the petroleum industries, the local authorities, the water industry and the sector concerned with contaminated land. These were multipurpose events, partly marketing, partly consultation and partly publicity, and they were difficult to balance. Accusations from attendees that they had been brought to the BGS only to be subjected to marketing hype were heard, despite strenuous efforts to minimise this aspect. Also in 1992, a list of major international and national conferences was drawn up at which it was thought that a BGS presence would bring benefit to the organisation.

The university link scheme was started in 1991. In it one member of staff was identified for each university to act as the channel of communication with it. There were several reasons for doing this. The financial pressures on the BGS during the 1980s had led to a much reduced level of recruitment, compared with previous decades, and in many geology departments the BGS was no longer viewed as a potential employer for their graduates. The scheme was expected to provide a two-way flow of information about potential recruits and recruitment opportunities, but, like many of the other initiatives taken at this time, the university link scheme was, as much as anything else, about raising awareness about the BGS and developing an image.

In September 1995 EuroGeoSurveys was founded, managed by a Director-General in Brussels, the first of whom, Richard Annells, was on secondment from the BGS. This organisation was formed, largely as a result of initiatives taken by Peter Cook, to represent the interests of geoscience and the Geological Surveys of the European Union. Membership was deliberately exclusive to EU member states and Norway. It was meant to be both a lobby group and functional. Several working groups were set up within it and they put in bids for EU funding to carry out multinational research projects. One of these, the Geoscience Electronic Information Exchange System (GEIXS), managed by the BGS, established a

Europe-wide metadata service for geoscientific information, which has acted as a model for such services within member states but has also been adopted for other types of metadata and used outside the EU. In 2000, years after completion of this project, the BGS manager of GEIXS was still receiving requests from overseas to give talks on it. At the same time as the founding of EuroGeoSurveys, the Western European Geological Surveys (WEGS) was re-formed into the Forum for European Geological Surveys (FOREGS) representing all European Geological Surveys.

Perhaps the biggest venture in raising public awareness came in the summer of 1993, when Peter Cook expressed his interest in the BGS launching a series of popular publications. The Core Programme Task Force, set up by the first Programme Board, and Price Waterhouse had rejected any idea that the BGS should enter the high-volume, low-price market. Both recognised that the BGS was not equipped to initiate and sustain a mass sales campaign, nor was this close to the Survey's core business. Both groups, however, added a caveat that there may be overriding reasons that justify doing it. Peter Cook did believe that a popular publications series was potentially a money-spinner. He also considered that the presentation of geology to the general public through a series of popular publications fitted the new NERC attitude to public understanding of science that had emerged after the publication of the White Paper *Realising our Potential* in 1993. This, effectively, fitted the caveat and justified starting the programme. The Programme Board agreed.

In all, 42 books, leaflets, posters, maps and information cards were published in the *Earthwise Publications* series up to March 2000. Although total sales in the period up to the end of the 1999/2000 financial year had reached 26 000 for these publications this fell short of expectation and hardly justified the description 'popular publications'. Policy was changed in 1999. Instead of publishing hard-copy outputs, it was considered potentially more fruitful to use the World Wide Web to pursue the BGS policy on public understanding of science.

A step in this direction had already been taken with the establishment of free downloads of various BGS books on the BGS website after its relaunch in October 1997. The purpose of this policy initiative was to put into the public domain, at minimal cost to the BGS, information that the geoscience community could freely use. In the main, the publications were concerned with the establishment of standards which the national and international geoscience community can follow. Among these is the BGS Lexicon, which is a database of all the stratigraphical terms used on BGS maps. About 1500 were fully defined following the criteria laid down by the North American Code on Stratigraphic Classification and Nomenclature. This can be interrogated online. The most popular of all the titles that are downloaded as PDF (Portable Document Format) files is the scheme for symbols and ornaments used on BGS maps. Other publications include four volumes on rock classification. These were developed from the dictionaries that were drawn up for the digital-map-production system. They were based on

international standards where they were available. For some rocks, metamorphics, for example, the international committees responsible for setting standards had not finished their work when the BGS needed the standards. The Survey had to set its own. This should be salutary to them. Worldwide, technology is making a demand for standards in geoscience and the researchers developing computer applications cannot wait years for the committees to finish their ponderous deliberations. The BGS scheme for metamorphic rocks is almost certainly one of many that have been developed to fill the vacuum and could, because of its availability on the Web, become a de facto world standard. Other reports available on the website are a series endorsed by the Stratigraphy Commission of the Geological Society on regional standard stratigraphical classification schemes, and Holostrat, a discussion centre for British chronostratigraphy. This last is the only item available that has been devised with the Internet in mind. Two other publications have been produced in collaboration with others. *Environmental geology in land use planning* was devised in collaboration with the Department of Environment, Transport and the Regions. *Dealing with radon emissions in respect to new development* was drawn up in collaboration with the Buildings Research Establishment, Land Use Consultants and the National Radiological Protection Board. *Earthwise* and *Earthworks* magazines and the BGS Annual Report are also available from the website. Downloads of all titles in the three years up to September 2000 exceeded 10 000, running at about 125 a week and rising.

Chapter 17

Belt tightening in the 1990s

Despite the PES awards of 1988 and 1989, the promised financial stability was short lived. The Treasury had already abandoned the practice of annually adjusting the Science Budget allocation to the research councils in line with inflation. Any increases in the Science Budget to the research councils usually came with precise instructions about its use. Within the national economy, inflation, which had an effect on all costs, did not stop and in 1990, after being quite low, was back at 10%. Salary inflation, which affected over 60% of the cost base, was a serious matter in the BGS because of the relatively high proportion of senior staff who were at the top of their pay scales. In the first year after each of the two PES awards, therefore, the amount of staff time that was affordable within a fixed budget diminished by an amount equivalent in percentage terms to a little more than the rate of inflation. In addition, several times, the NERC announced, unilaterally, small but painful cuts in baseline funding as it struggled with its own budgetary difficulties. On occasion, this happened during the financial year. Despite all of this, the expected annual outputs from the Core Programme remained constant, which meant that new ways had constantly to be sought to deliver them, with a little less money each year.

This downward pressure on income was a pervasive feature of the whole of the 1990s. One of the ways chosen to deal with it was to try to reduce overheads, which had to be done in the face of strong external pressures that were driving them up. These pressures were many, including Government and EU policy. Prior to 1979, BGS spent very little or nothing on marketing, health and safety, quality assurance, training, promotion and advertising, copyright protection and PR.

The Health and Safety at Work Act dated from 1974 and the BGS management were always aware of its requirements, but a full-time Health and Safety Officer had to be appointed in the early 1990s to cope with the flood of new regulations. Those introduced for the use of equipment in 1992 had major implications for the BGS, leading to the generation of a training strategy in 1995 in which health and safety training was elevated in priority. In 1990, the BGS completed the questionnaire required by the Control of Substances Hazardous to Health Regulations (COSSH) in order to gain accreditation. This was something that was increasingly required by customers and was used as a discriminant at the tendering stage. In August 1999, after several years of planning and the development of new analytical systems, United Kingdom Accreditation Service (UKAS) accreditation was gained for a set of tests carried out in the chemical analytical laboratories.

A Quality Assurance Working Party was set up in 1991, originally to debate its relevance. Although accreditation under either British Standards or ISO has not been sought, a full-time QA Manager has been appointed, auditors trained and audits carried out throughout the BGS as though in compliance with ISO standards.

The part-time training coordinator, who had been appointed in 1989, became a full-time Training Officer in April 1991. The amount and quality of training offered increased considerably and, in recognition of this, in October 1996 the BGS became the first component of the NERC to acquire Investors in People accreditation. It was renewed in 1999.

In January 2000 the BGS carried out a self-assessment exercise in benchmarking following the procedure defined by the European Foundation for Quality Model (EFQM). The next stage is to carry out a full, externally monitored assessment in one or two year's time. Again, the BGS is the first component of the NERC to do this. While there are undoubted benefits from Investors in People and EFQM, and all Government organisations are under pressure from the Cabinet Office to achieve accreditation under them, there are also commercial advantages in having their logos at the foot of headed notepaper. But not everyone in the BGS is convinced that the cost of gaining accreditation translates into savings in running the organisation.

The Copyright Designs and Patents Act of 1988, in association with Government policy to treat its own information as a tradable commodity, had a severe impact on the BGS. Rules had to be developed for the licensing of data in 1990, and a pricing policy for all sale products followed in 1991. Ultimately a full-time Copyright Manager had to be appointed to manage them. Income from royalties, data licensing and copyright charges soon began to make an essential contribution to the budget, and copyright has to be enforced in order to protect it. In this case, the increase in overhead has been compensated by an increase in income.

Action in this area took place against the background of an internal reorganisation of the enquiry service in 1990 to take better account of it as a potential centre of income generation. However, further changes came in response to the Citizen's Charter, one of the initiatives of John Major's Government. A Customer Charter for the BGS was written and issued in March 1994. It incorporated a draft Quality Policy Statement and covered such matters as response time for enquiries, turn-around time for mail-order sales, time for dealing with telephone enquiries and for handling the post. Thus, in 1997, when the Intra-Governmental Group on Geographic Information (IGGI) introduced its Standard Charter Statement, BGS was among the first six Government bodies that were able to sign up to it.

The Programme Board, itself, came at a cost. It required a secretary, as did the now very active Directorate. These two posts formed the nucleus of the Central Directorate Support Group. Its work was enhanced by the need to deal with a seemingly exponential growth in the amount of paperwork generated by

NERC Council and its committees and the EU. Within the International Division changes in the work profile, largely reflecting changes in Government policy, meant that senior staff, who had been mainly concerned with programme management before 1979, became preoccupied with a marketing and sales function. Externally stimulated reviews of various kinds that stained the 1990s made demands on staff time that were covered by overheads. When market testing was fashionable it took staff time to go through the process, even when the end result was negative. This, like all of the reviews, led to a drain in resources for no benefit. There was also an impact on the size of the budget required to cover management. In the early 1980s, Dr John Bowman, the NERC Secretary, had set a minimum number of staff that was allowed to justify a Grade 6 management appointment within the institutes. Thereafter, NERC HQ periodically complained about the apparent management overload in the BGS, but no BGS manager has ever found himself or herself underworked.

Lastly, the cost of computing has steadily grown. The BGS is now entirely dependent on computers. It is they that have enabled most of the operational efficiency gains, but they also generate the capability to do more and different types of work. For this reason it is not usual for the efficiency gains to translate into cost savings.

As a consequence of this progressive increase in the cost of the overhead, efficiencies and cost reductions had to be found elsewhere to pay for them. Throughout the organisation better project management, awareness of costs and a touch of parsimony brought benefits. The efficiency of book and map production increased considerably as costs reduced with the introduction of new technology. In 1993 the acquisition of a new wavelength-dispersive X-ray fluorescence machine and the introduction of a laboratory information management system (LIMS) improved analytical precision and sensitivity considerably and increased the potential throughput of samples. The unit cost of chemical analyses also decreased. The cost of making thin sections also went down after attention was paid to the detail of the processes used to make them. The automation of geomagnetic monitoring brought savings. Reviews of various services, such as vehicle maintenance, running the staff restaurant, security and cleaning were periodically carried out and in some cases led to the service being contracted out.

There were, however, some serious casualties of cost cutting. One of these has been the BGS drilling capability. From being a major part of the Core Programme in the 1960s,1970s and 1980s it was reduced to one team operating a single rig with a capability of reaching around 200 m onshore towards the end of the 1980s. The rig was finally mothballed in 1999.

The second major loss has been the offshore operational capability. The formal Continental Shelf Mapping Programme, funded by the Department of Trade and Industry finally came to an end in 1992 when the last 1:250 000 map was completed. The occasion was marked by a ceremony held in the Geological Museum at which a number of medals, cast in copper, were presented to participants in the long campaign. The inscription on the reverse side said,

'Presented in recognition of your contribution to the BGS regional mapping programme 1966–1992'. This programme was a remarkable achievement, making the UK the first country in the world to map its continental shelf. Sadly, the end of this, effectively the primary survey stage, has not been followed with a programme of systematic revision. Surveying offshore is a very expensive business and funds have never been found to do other than opportunistic revision, except in the north-western waters, where oil-industry consortia have funded primary exploration. As a consequence, the highly innovative operations team that sustained the Continental Shelf Mapping Programme has been run down to a minimum viable level and may not survive the end of the consortia mapping projects.

Another casualty of cost cutting was the closure of the district offices at Aberystwyth and Newcastle in 1994. One member of staff was left behind in accommodation provided by the university at Aberystwyth[1], but all other staff were transferred to Edinburgh or Keyworth. In 2000, as part of a second cost-cutting exercise, the Exeter office was sold and the staff level reduced to four, who were placed in rented accommodation on an industrial estate on the outskirts of the town. There was also a rationalisation of the geomagnetic monitoring stations, with some staff reductions as a consequence of the introduction of an automated system.

The single most important impact on staff morale that took place in the 1990s was the introduction of delegated pay arrangements. As part of the Government's quest to reduce public expenditure, civil-service pay arrangements were replaced in 1995 by a series of separate agreements between the Treasury and individual departments, research councils and agencies. The NERC took over responsibility for devising and running its own pay scheme, negotiating directly with the unions. A Management Steering Group, made up of scientists and administrators from the NERC component bodies, acting as an advisory committee, was set up to work with the HQ team, who were tasked to develop the new arrangements in 1994. The advisory committee's recommendations were frequently in conflict with Treasury instructions and the ambitions of HQ, which were to reduce the pay bill. The scheme that emerged was far from adequate. Pay bands were introduced to replace grades. This move was the final step in the process, started in the 1960s to unify the grading scheme in the civil service. It meant that there would, henceforward, be no terminological distinction between, say, scientists, administrators and cartographers who fell within the same pay band. This was an antidiscriminatory benefit that was much appreciated, but the way the pay bands were structured was far from beneficial to staff. Annual pay increments disappeared. In their place came performance-related pay. The NERC was allowed to determine for itself the percentage increase in pay it was going to implement for the forthcoming year, but it had to be within limits set by the Treasury. The total pay increase was divided into two parts; one was a cost-of-

1 This staff member is now located in Cardiff.

living adjustment, the other was performance related. The knock-on effects of the latter on staff reporting were troublesome, to say the least, but the most serious deficiency was the lack of annual increments. The pay structure was such that newly promoted staff could never expect to reach the top of the pay band they had been promoted into, even if they remained in the same band for the rest of their careers. Fairly quickly staff became polarised between those newly promoted into a pay band and those who were at the top of the scale. In the case of the Grade 7 staff (now Band 4), there was a £14 000 pay differential between the highest and the lowest paid and no prospects for newly appointed staff into the pay band ever closing the gap. After the first year, steps had to be taken to improve the pay scheme, but after five years it was still inadequate and the source of more staff discontent than any other matter.

Other initiatives taken by the NERC at this time, partly to reduce its own overhead, were welcomed. For most of the 1990s NERC HQ behaved like a body that was about to be disbanded. The instruction that came with the abandonment of Prior Options, to develop its arm's length relationships with its institutes, followed several important initiatives already taken. An early decision was to decentralise the computer services. The first step, taken in 1993, was for BGS to migrate from centralised VAX computers, maintained by NERC Computer Services (NCS), to a distributed, UNIX-based system managed within the BGS. This arrangement, which came as a recommendation from NCS, fitted well with the group-centred, post-Price-Waterhouse management structure within the BGS, even though it left a vacuum at the centre that had adverse long-term consequences. In 1995, NCS was market tested. Although it was decided that the provision of computer services by an in-house capability should continue, NCS was disbanded towards the end of the 1996/97 financial year and most of its staff were transferred into the NERC Centre/Surveys. A substantial transfer of funds accompanied this move and allowed the BGS, for the first time, to concentrate its resources on building a computer system that suited its own needs. This is not to say that NCS was unsuccessful, but its time had passed and it was a brave decision of the NERC to recognise this and act accordingly.

Another major decision was to return the NERC Isotope Geosciences Laboratory (NIGL) to BGS management in July 1997, over a decade after its removal from the Survey. The NIGL had been based in purpose-built laboratories in Keyworth since 1989, when the Gray's Inn Road office was closed. The transfer of these staff to Keyworth, along with the analytical chemistry staff from the Mineral Resources and Applied Geochemistry Group, in December 1989, marked the end of the process of centralisation in Keyworth, which had begun in 1976 (see Dennis Hackett's *Our corporate history. Key events affecting the British Geological Survey, 1967–1998* for full details). In 1999 the budget that the NERC had held for building work in the Centre/Surveys was also transferred into their financial management.

There were several other important NERC initiatives taken in this 'arm's length' period, which were perceived as giving the BGS a greater degree of

autonomy and, by extension, better control of its finances. They covered recruitment, promotion, delegated spending limits (i.e. the level up to which the BGS Director was allowed to make a decision on spending without seeking approval from NERC HQ), the introduction of facilities to bank underspend at the end of the year, and a new financial management system. Only the last is of questionable benefit. Plans for a new NERC accounting system were laid in 1995. The BGS's requirements were defined by an internal working group and conveyed to the NERC. After one false start a new financial management system was installed in 1999, which appeared not to take account of the BGS requirement. The NERC had been encouraged to improve its financial management by the Prior Options Steering Committee in 1997 at the same time as it was advised to develop its 'arm's length' policy. In the light of this, it was disappointing that they chose, with their new system, to centralise financial management and deprive Centre/Surveys of their freedom to manage important aspects of their own finances.

The BGS was given the delegated responsibility to organise its own promotion panels for grades up to SSO (Band 5) in 1995 and for promotions from SSO to Grade 7 (Band 4) in 1996. Hitherto all promotion panels had been organised by the NERC. It was believed that this would lead to fewer promotions, as BGS management, being conscious of cost, would apply the promotion criteria more strictly than the NERC panels. This was followed by the delegation to the BGS of the NERC's responsibility for managing the Career Management Panel for BGS staff. Finally, the carriage of all stages in the recruitment process up to Grade 7 (Band 4) was put into BGS hands; previously, approval to appoint had rested with NERC HQ.

By the end of the decade the BGS had more freedom to operate within NERC than ever before and felt that there were efficiency gains and cost benefits accompanying these new freedoms. The Survey also has a better ability to manage its cost base with direct control over more parts of it than in the past. But most of this is marginal. Salaries consume over 60% of the total costs and there is little that either the BGS or the NERC can do to keep them in check. The recently completed redundancy programme has reduced the salary bill, but at such a cost that repeating it cannot be contemplated again in the near future. With half of the BGS income earned commercially, the key to long-term financial stability and an end to belt tightening has to lie in NERC's management of the Science Budget allocation. Some fresh thinking is clearly required here.

The glaring exception to the loosening of the reins was the new financial management system. This was followed, early in 2000 by a surprise letter from the NERC Chief Executive instructing the Survey to conform to new NERC-wide standards in the production of the Annual Report. This is the third such attempt since the late 1970s. The others succeeded only in antagonising BGS staff. Whether or not this signifies the end of the arm's length policy and a stop to the drift of the BGS towards autonomy within the NERC has yet to be seen.

Chapter 18

IT into everything

The phrase 'IT into everything' was introduced into the senior management's vocabulary at a strategic planning workshop in 1995 organised and facilitated by CEST, the Centre for the Exploitation of Science and Technology. It was a statement of the obvious in the sense that IT had been in nearly everything for some considerable time and the BGS had a very high proportion of computer-literate staff, more so than in many other geological surveys. But in the interviews with senior staff it conducted before the workshop, CEST found that this was not fully recognised in the organisation's strategic thinking.

It was recognised by members of the NERC Experimental Cartography Unit back in the 1960s that computers would, in due course, fundamentally change the way geological surveys worked, but it was the geophysicists in the BGS who spearheaded the change process. Geochemists followed. The geologists were a slow, somewhat reluctant last, but by the mid-1990s all BGS scientists were exploiting computer technology together. When a new technology is introduced in any work area it is first used to do more efficiently and more quickly the sorts of things that were previously done with the old technology. The next stage begins when the new technology is applied to tasks that only it can do. The BGS is now sitting on the cusp between these two stages.

It is no surprise that geophysicists and geochemists did lead the way in the use of computer technology. Theirs are dominantly numerate sciences, within which it is relatively easy to find a use for computers. Geomagnetists and seismologists were amongst the early computer users. As early as 1964 the Atlas System, housed near Didcot, was used for processing geomagnetic data. Both the program and the data were input on paper tape. The next year Glasgow University obtained an English Electric Leo Marconi KDF9 computer which used the same language as the Atlas and operated the same way. This computer was then used by preference by the geomagnetism staff, who were based in Edinburgh, but in 1970 Edinburgh University set up its own computer centre and the BGS migrated to this. The global seismologists found a need for computing power in the 1980s to work in real-time. First, they took advantage of the DEC PDP15 in Edinburgh University, but later the BGS purchased the same range of computers and installed machines in the Edinburgh office to be used by the geomagnetists and seismologists. Both then kept pace closely with the emerging technology.

Also amongst the earliest users of computers were geophysicists dealing with gravity data. The data had been assembled and organised on 80-column

library cards in the 1960s. These remained in use until 1974, when the data were transferred onto the IBM360/195 computer at the Rutherford Laboratory. The aeromagnetic data, collected on airborne surveys during the 1950s and 1960s were initially held in analogue form, but these data were digitised, starting in 1982. By 1989, when this data conversion exercise was completed, the two main geophysical databases were held, and the data processed, entirely on computers.

Data transmission using computers was pioneered in the BGS by the Geomagnetism Unit. Working in partnership with the United States Geological Survey, they established a pilot system, called INTERMAGNET, for exchanging geomagnetic data in real time between the UK and Denver, USA, in 1987. The system went fully operational the next year. Originally, they took advantage of satellite links for data transfer, but when the Internet became available this was used. INTERMAGNET is now a world-wide service using both the Internet and satellite links.

The World Wide Web was used by the Geomagnetism Group for the purposes of running an enquiry service in 1994. A little before the BGS set up its corporate website, the group developed its own to allow enquirers access to non-sensitive magnetic data, such as mean value magnetic declinations in specific geographical areas. The website was also used to give information about recent earthquakes, usually within hours of their happening.

In the Regional Geochemical Survey Programme, analytical data had been held on punch cards since 1969–70 and were easily migrated onto computer databases. Computers were used for running instruments and data processing from 1968 when the first computer was attached to the Jarrel Ash spectrometer. Computers are now an integral part of all analytical equipment.

There are several reasons for the slow start in the use of computers made by geologists. The innate conservatism of the Land Survey is a factor, but it is rather less important than the large size of the task they faced and the lack of appropriate computing technology to deal with complex, essentially graphic features in the early years. The attempt made by the Experimental Cartography Unit in the late 1960s to produce a geological map by digital methods led to the publication of the Abingdon 1:50 000 geological sheet in 1971. Unlike the geophysicists, whose pioneering work at this time led directly to successful operational systems using computers, the Abingdon experiment demonstrated that the technology was insufficiently mature and too expensive for this method to be given serious consideration for a production process at that time. Further research on it effectively stopped until the mid 1980s. In the meantime, however, computers were being used to generate relatively simple graphics on sand-and-gravel resource maps produced in the Industrial Mineral Assessment Programme in the late 1970s and a dedicated computerised word processor was purchased to produce mineral assessment reports in the early 1980s.

The use of computers for storing geological data also has a long history, but a faltering start. Bill Read, at that time based in Edinburgh, is credited with proposing to the then Director, Kingsley Dunham, in 1967 that a system for storing

geological data on computers, similar to that being used in the oil industry, should be introduced into the BGS. Some work on this was started and David Gray was appointed to chair the Computer Committee, which was meant to coordinate computing across the Survey. It does not appear to have been successful. Conflict with NERC Computer Services, which was trying to implement pan-NERC solutions may have played its part, but throughout the 1970s computers were being tried in a wide variety of tasks in all parts of the Survey. Many of them were funded, after Rothschild, from commissioned-research budgets and lay outside corporate control, but this was an era of experimentation and it was probably unreasonable to expect much success in coordination during this experimental phase of activity. An independent Computer Unit was set up in the BGS in 1974, again to try to bring some control to this expanding and exciting field, but this also was not successful.

Meanwhile, the attempt to begin to computerise the BGS data holdings, which was started in the late 1960s, languished. It was not until 1981 when a two-man group, the Geological Databank Scotland, was established in the Edinburgh Office that serious experimentation on computer databases for geological information began again, largely in the Edinburgh and Newcastle offices but also in Exeter. There was pressure from the Edinburgh group to adopt the database management system called MIMER, developed by the Swedish Geological Survey, which had been loaned to the BGS on trial. It failed to make an impact on the decision-makers, who decided to standardise on the ORACLE relational database management system for the whole of the NERC.

The domination of the BGS computer policy by the demands of geophysicists, though challenged periodically, remained for nearly twenty years. The first significant shift in policy came in 1988, when NERC Computer Services (NCS) expressed the view to the NERC Scientific Computing Strategy Committee that a future strategy should address the total configuration for advanced research computing and not just the part supporting 'number crunching'. The NCS produced 'A plan for the 1990s' in 1989 and initiated the second round of reviews of computing needs within the NERC institutes. The user requirements that emerged from this indicated that in the BGS the explosion in the volume of scientific data, fuelled in part by increasingly automated means of data capture, had created a demand for computer data management. This was no surprise to many staff, coming, as it did, over twenty years after Bill Read's paper. It was recognised that there was also a strong and growing need for a modelling capability using computers and to support computerised cartographic and other graphical representation, in particular where it was interactive with computer databases. The development of an implementation plan from these decisively led computing in the BGS into new areas and away from the dominance of the mathematically based science disciplines, but the tensions remained. The BGS has a need for computing to support all areas of its work activity. With a limited budget for computing there is inevitably a struggle for priority in funding between those whose main need is for computers to support their research and those

concerned with information management and computer databases. This conflict raises its head every year when spend on the capital budget is decided.

Although these new areas were pushing the limits of the current technological capability, the major manufacturers had become firmly established and many of the tools that are currently required within BGS were available then, though some in primitive forms. The complexities of dealing with geological map data with computers were no longer insurmountable. Strong pressures were brought to bear on the Director to force a change in the BGS computer policy and give priority to computer developments that supported geology as opposed to geophysics.

The money that came with the PES award for the enhancement of the NGIS Programme in 1990 was the key that opened the door to the future. Suddenly, the BGS was able to acquire appropriate kit in all areas where computers could make a contribution. Computers became increasingly used for word processing, databasing and cartography. In the case of the last, the invention and widespread availability of GIS (geographical information systems) was revolutionary. By the middle of the 1990s every scientist had access to a PC or Apple Mac computer. By the end of the decade every scientist had one or more computers on his or her desk and access to a lap-top for out-of-office use.

It is easy now to forget just how recent and how dramatic this change in computer use is and how, as recently as 1990, much of what is now taken for granted by geologists, as opposed to geophysicists and geochemists, could not be done. There is, perhaps no better example of this than in the development of digital cartography. The Digital Map Production System (DMPS) for 1:50 000 maps, which was being developed from 1988 into the 1990s, stored data in an ORACLE relational database management system. The cartographic system and GIS in use was Intergraph, and the maps being produced were plotted using a Versatec electrostatic plotter through which vectorised linework and polygons depicting the geology were overlain on raster images of the topography. In 1990, the DMPS had been developed to meet the cartographic requirement for efficient production of the printed map via a GIS. Cartographic attributes were held digitally within the graphics file and within the ORACLE database, and were used to generate a finished digital map ready for proof checking using electrostatic plots and then reprographic processing. The success of the 1:50 000 production system contributed to the development of a comprehensive database/map production system based on the geological attribution of map data at a scale of 1:10 000, which was also being developed in the early 1990s.

The complexities of the 1:10 000 DMPS tested the application software beyond its limits in a number of areas — particularly in relation to the 'doughnut' effect. This is where one polygon (or many) is completely enclosed within another, like the hole in the middle of a doughnut. This disposition of polygons is commonplace on geological maps, but the software could not deal with it effectively. The DMPS could not be made into a practical, operating system until this and other problems were solved. Compared with 1971, when the Abingdon sheet was published, they were trivial problems and work-arounds were devised, but it

took pressure from BGS and visits to the Intergraph headquarters in the United States to force them to recognise the seriousness of this problem, in particular, and improve their software. In 1991, the fully operational 1:10 000 DMPS, free of clever work-arounds that BGS cartographers and programmers had had to devise to make the prototype system work, was set for the last stages of its development. It was possible to think ambitiously about developing the sort of systems to handle geological data that were comparable to those already in existence for geophysical and geochemical data.

The principle of the 1:10 000 DMPS was to put all the geological information that was on an approved 1:10 000 geological map into databases. This included descriptions (attributes) for every line, polygon and point feature on the map. A line depicting a fault was described in the database as a fault, with information on the fault as well as the names of the formations and rock types on either side of it. This same line, however, was also given cartographic attributes, such as the thickness it had to be drawn, the length of the dashes if it were a dashed line and the colour ink to be used. This approach meant that the databases could be interrogated for their geological information and a map drawn to illustrate it. A map showing only sandstones could be derived from the database, or one that showed only faults or only coal seams.

The implications of this approach were many. The DMPS required comprehensive dictionaries to support the databases. Corporate rock classification schemes had to be drawn up. Surprisingly, in a Geological Survey with a 150-year history, none of these already existed. Classifications had to be fixed for all other data that were to be taken off the map and put in the databases. A Lexicon of names of stratigraphical units used on BGS maps was made and, eventually, mounted on the BGS website. The concept of 'seamlessness' was introduced for geological maps. In its simplest sense this meant that any two adjacent map sheets had to fit together seamlessly, such that an internally consistent map, straddling the boundary between two map sheets, could be generated from the computer databases. In the broader sense it meant that the geology of the whole of the UK should be depicted as a single entity to nationwide, common standards. To achieve this meant not only that there should not be any boundaries between map tiles, but that there should be a single, internally consistent stratigraphical classification scheme for all rocks in the country. Old practices, such as stopping solid geological boundary lines at the edge of drift deposits, had to end because the computer did not like dealing with gaps in information.

The impact of the introduction of digital map-making processes on thinking among everyone who was involved with the production of geological maps, from the field surveyor to the cartographer, was profound and led to many changes in practice. Outstanding among these were those related to map production. Prior to 1988, map production was carried out partly in house, partly externally. In house, the generation of vector linework was done digitally, while colour-polygon encoding was done manually. External bureaux were used for reprographic processing to produce plate-ready films for the printer. There were cost disadvantages in this

arrangement. By 1990 a fully digital system was in place, which allowed the whole process, apart from plate-ready film production (until 1993) and printing, to be done in house cost effectively. Quality control became tighter and more effective and improvements in efficiency could be freely introduced. The effect on output was considerable. Between 1990 and 1994, output of printed maps per year more than doubled to over thirty and it has remained steady at this level since then.

The biggest demand that the introduction of digital map production made was that the BGS should operate to corporate standards in all things related to data storage. This was not required for map-production purposes, but full advantage of the DMPS could only be taken if all geological information for the whole of the UK could be integrated with it. To do this required a single set of hardware, software and database standards. If geochemical, geophysical and hydrogeological information were to be used in conjunction with the geological data within the DMPS, then they also had to conform to the same standards. Similarly, geotechnical, mineral-resource-potential and other derived information should also be kept within the same database framework to the same standards. Lastly, there is no reason why the coastline should act as a boundary between storage systems, when the geology crosses it.

The battle to introduce conformity in software and database standards had begun to be addressed by the Computer Management Group, an outcome of the 1997 reorganisation. The CMG consisted of the head of Geospatial Information Group in the chair, the head of Facilities Management and the chairs of the two Computer Users' Groups. It was a small, innovative group not afraid to take on the big issues that had been highlighted in 1995. It championed the IT matrix, which, though it became operational, did not contain everyone who should have been in it. Group Managers and ADs, it transpired, had kept some key staff out of it so that they would remain totally in their control. The biggest achievement of the CMG, however, was the introduction of corporate software standards. Despite knowing that all the successful firms in the private sector and many government bodies had introduced them, this was regarded as an infringement of the individual rights of managers in some quarters of the BGS and was vigorously resisted. The small community of Apple-Mac users at first resisted the change, as did those in the three main GIS camps. Even though the BGS had standardised on the WordPerfect word-processing package some years ago, Word was becoming the de facto standard and there were several other packages in use in corners of the Survey. After several months of discussion, this action was still not fully resolved when David Falvey took office as Director in January 1998. The matter of database standards was taken up by a special project (called BGS-geoIDS), which was approved to run for three years by the BGS Board in March 1998. This was designed to ensure that at the end of it there should be a coherent set of database standards for the whole of the Survey.

At that same meeting the Board approved another project, named DigMapGB, the purpose of which was to digitise all 1:50 000 maps for the whole of the country and selected areas at 1:10 000. The 1:250 000 maps for the

whole offshore and onshore area had already been digitised. This project was meant to provide a first version of a seamless digital map of the whole country. To function effectively it would require a unified map data standard incorporating the geological attribution from the 1:10 000 database, the cartographic enhancements to the 1:50 000 database and all data to be upgraded to it. It had once been rejected by the Programme Board, but was now being revived. Some members of the Directorate rejected it because there was nothing in it for them. It is easy to see why. One division, PGGOS, had only a marginal interest in UK onshore geology. Within the Minerals, Environment and Geochemistry Division, the practice of digitising whatever geological maps they needed for themselves was well established. Only the Geological and Hydrogeological Surveys and Corporate Services and Business Development divisions had a majority interest in the outcome of this proposal. The argument that the Directorate itself had developed in April 1995, that co-operation between groups was best exemplified when there were no overlapping interests, did not appear to apply to divisions.

The completion of these two projects paved the way for the implementation of the Digital Geoscientific Spatial Model (the DGSM UK). It is this that defines the threshold to the next logical stage in the development of the Geological Survey. The origin of the idea for the DGSM can be traced to an internal paper by Vic Loudon, 'The data library, the database, and the computable model in geology', dated June 1976. This paper presented the idea of the computable model as 'an explicit statement of a hypothetical construct which represents a system or some aspect of it, implemented on the computer as a set of procedures and parameters …'. In 1979 a committee was set up under the chairmanship of Innes Lumsden to look into digital cartography within BGS and ended up recommending going beyond the digital map to construct the model behind it. Thus, a second committee was tasked to examine small-scale spatial modelling. It reported in 1982 and several small R&D projects were carried out as a consequence of its recommendations, but neither the computer power nor the software was then available for the task envisaged in the report.

Despite this, a small group of specialists in the BGS, under the guidance of Vic Loudon, continued to carry out research that contributed eventually to the implementation of his ideal. Some of the research was carried out within projects funded by the Department of the Environment. There were three of these towards the end of the 1980s. Each was a contract to carry out research into the delivery of thematic maps derived from geoscientific information for the use of town planners. Two were based on Southampton, the third on Wrexham. Out of these came the basic knowledge that led to the development of the DMPS, which delivers an essentially 'flat' model from a set of inter-linked databases. This went into production in 1993/94.

The logical next step was to extend the DMPS into the third and fourth dimensions. There had been several attempts to run projects to devise a 3-D modelling capability for geological information in the 1990s. Largely because of

lack of resources and low priority, none had been successful beyond a certain point. The technical problems to be overcome were also very complex, and commercially available software was not adequate. Because the BGS had adopted a 'first follower' policy the Survey was not going to be tempted to put any resources to writing its own software for 3-D geological modelling. In different parts of the Survey expertise was building up in the use of the existing commercial 3-D modelling software packages such as EarthVision and Vulcan. The geophysicists, also, were expert at devising 2.5-D and 3-D models that simulated gravity and magnetic fields, relating them to low-resolution 3-D geological models. Thus, with the know-how gained through the development of the DMPS, it became timely in the mid-1990s to reconsider Vic Loudon's original concept of a computable spatial model. It is now generally referred to as the DGSM and defined as the totality of the spatially referenced, validated and tested geoscientific information of the UK landmass and continental shelf within a single system.

There are two important strands to the DGSM concept. One is that it is fully four-dimensional. The standard, printed geological map is a representation of a three-dimensional model in two dimensions, which itself is a clever and enduring concept, quite different from the depiction of, say, a perspective drawing like a block diagram, on a two-dimensional surface. To progress beyond this and hold all the geoscientific information that is on a map, and which has been used to construct the map, within a properly spatially referenced three-dimensional model that may vary with time can only be done with computers. In the ideal model each piece of information is given xyzT coordinates and held in either a system of inter-linked databases or, ultimately, a single xyzT database. The total model itself will be too big and data-rich ever to be viewed, except as low-resolution versions, but parts of it could be illustrated at high resolution. The core of the DGSM, therefore, is the database, or set of databases, which have to be designed and maintained to exceptionally high standards of conformity and integrity.

This leads, naturally, to the second key strand. Nowadays, the central reference sources for geoscientific information are the standard publications of the BGS. These are the 1:10 000 and smaller-scale geological and other maps, the published memoirs, reports and various books, and the databases of interpreted and validated geochemical and geophysical data. Volumetrically, most of this is in analogue form and with few exceptions it is an ad hoc collection of sources that have not been validated to a common date stamp. The DGSM UK will replace these as the standard reference source for geoscience. All the data in it will be integrated, validated and updated each time new data are added. Thus, it will never lose its currency.

This is a big concept, to hold most, if not all, of the BGS geoscientific data in a single set of three-dimensional databases, which have conduits to systems that allow the data to be processed or transferred elsewhere for representation on maps, diagrams or whatever. A scoping study to develop a plan for developing the DGSM UK was carried out in 1999/00 and the NERC agreed £4.4 million additional funding for a programme to develop it over five years from 2000/01.

In some respects the building of the DGSM is little more than a massive housekeeping exercise to put the Survey's data in good, modern order, but in parallel with this will be research into ways of making the data accessible. Here, the technology is still maturing. The growth in the use of Internet and e-mail has been phenomenal in the last ten years. There is now a general assumption among BGS scientists that communications between each other and with other researchers, customers and the general public will be by electronic means. The BGS established its corporate website in 1994, and in 1999/2000 it developed a commercial website in partnership with Compaq. Both exercises were accompanied by research into various ways of making data accessible via the web, culminating in 2000 with the launch of the Geoscientific Data Index on the web. This gives users access, at index or metadata level, to most of the BGS data holdings and will be one of the conduits that will be developed to allow access to the DGSM. The development of user-friendly and fast methods of transmitting large and complex packages of data via the web has now been taken up by industry. The BGS is poised to take advantage of anything new that comes along in this field.

Many complex problems need to be addressed before the DGSM can be made functional. Some are technical and can be handled internally or with manufacturers, but others, such as the management of copyright on the World Wide Web, are not and depend on national and international legal agreements. The use of the World Wide Web to distribute BGS data, until it is replaced by a better system, is now a reality, but the problems of policing usage of data so distributed makes a nonsense of some of the pressures brought to bear on the BGS by Government to exploit its data holdings for profit. This is a conundrum, far from solved.

Chapter 19

Matrix — mark three

After the trauma of the 1997 reorganisation, the last thing that BGS staff wanted in 1998 was another one. On the 5 January 1998, however, David Falvey replaced Peter Cook as the Director (Plate 6) and it seemed unlikely that he would break the mould used by his predecessors and not initiate one. However, he was not to be given a free hand to do it how and when he wished. The Science and Management Audit, which took place just before his appointment in 1997, responded to pleas from the staff that they interviewed and advised that a period of stability, free of review and reorganisation was needed for the BGS. In reaction to this, David Falvey announced that he would leave the current structure in place for two years. This meant that April 2000 became the target date in all minds for another upheaval.

That it would be an upheaval was in no doubt as soon as it was realised what process he was going to use to prepare for it. Knowing that the BGS, Price Waterhouse apart, had not revised its Strategic Plan since 1988, David Falvey determined that the time was ripe for another strategic planning exercise. He announced that he was going to do it at a series of open meetings he held immediately he took office in January at Keyworth, Edinburgh and Wallingford

Plate 6 D A Falvey, Director from January 1998.

David Falvey was born in 1945 in Sydney, Australia, and graduated from the University of Sydney in 1967 with a BSc in Geology & Geophysics and Applied Mathematics. He gained a PhD in Marine Geophysics at the University of New South Wales in 1972. He worked in exploration geophysics for Shell from 1972 to 1974. He lectured in geophysics at the University of Sydney from 1974 to 1982. From 1982 to 1994 he worked for the Bureau of Mineral Resources, later to be renamed the Australian Geological Survey Organisation now Geoscience Australia, in Canberra and became Associate Director and the head of the Petroleum and Marine Geosciences Group. He was Director of the Ocean Drilling Program in Washington from 1994 to 1997.

when he introduced himself to the staff. Full details were released in an office notice at the end of that month.

The aim of the new Strategic Plan was to define the shape of the BGS beyond 2005, when the 15-year Geological Mapping Programme was due to finish. The plan was to set out key strategic issues facing the BGS, the Survey's customers, the geoscience community and society as a whole over the next decade. It was to identify the steps that had to be taken within the BGS in order for it to position itself as the premier provider of 'geoscience solutions' in the UK. It was intended that the Strategic Plan would provide a long-term framework within which detailed business and programme planning could take place. The process was to be completed in a year, during which there were to be wide-ranging consultations within the BGS and outside among the user community.

The plan was to be drafted by a small team of junior staff without any input from management. Stuart Marsh, who was the Board Secretary from the Central Directorate Support Group, was nominated to be the secretary to the drafting team. An invitation was put out to all staff to apply to join it. Applicants were asked to submit a 300-word statement on the importance of this exercise to the future of the BGS, giving the skills they would bring to the team. The six successful applicants were John Bloomfield from Hydrogeology Group, Wallingford, Paul Egerton from the Petroleum and Marine Geology Group, Edinburgh, and four from Keyworth. These were Andy Howard of the Central England and Wales Group, David Talbot of Analytical and Regional Geochemistry Group, Jenny Walsby of Geospatial Information Systems Group and Sandra Williams, head of Finance. Only one of the team was over forty.

There were several reasons for doing it this way. One was that in by-passing the management David Falvey was going to obtain unfiltered comment from staff on the perceived state of the Survey. As an Australian, who had never worked in the UK before this appointment and had had practically no contact with the BGS, he was severely disadvantaged in comparison with his senior managers, the majority of whom were BGS careerists. At that stage in his tenure he would have had difficulty even in detecting the filters, let alone assessing their mesh size. Perhaps more importantly, he was looking for the views of staff who were going to be working in the survey for at least the next twenty years and therefore had a long-term stake in its future. As junior staff, they were likely to be unabashed at the idea of consulting staff, and it was expected that staff would be open and honest with them. The risk in this process was with regard to the quality of the end product. Many senior managers were resentful at being excluded from the process and doubted whether a team of quite junior staff, some with very little or no experience of the BGS outside their own projects, could deliver a sound Strategic Plan. In the view of the managers, as they were going to have to implement and manage the strategy, they should have a hand in developing it.

The strategic planning process began in early March 1998 with a two-day retreat at Rothley Court, Rothley, in Leicestershire. It was attended by the Directorate, selected staff from NERC HQ and the strategic planning team and was

run by an external facilitator. At this meeting the Director took the opportunity to tell the Directorate the content of the Science and Management Audit report and about his private briefing with the SMA Chairman and the NERC Chief Executive. One matter stood out. The SMA had interviewed forty members of staff in its data gathering exercise and had gained the impression that inter-group competition was still rife, despite the attempts to deal with it made in the 1997 reorganisation, and that there was little cross-divisional co-operation. The NERC Chief Executive told David Falvey that this was something he had to deal with. There were, in this, shades of the early 1980s, when Malcolm Brown also had to deal with the problems of having a strong-minded set of individualists on the Directorate. A matrix management system had emerged that time. Would one emerge again?

The Strategic Planning team, when it began, was concerned at first with the broad canvas. Through March and April they consulted with staff by putting key questions on the BGS Intranet and asking for answers by e-mail. They met with stakeholders — a new word made popular by a new Government — and attended group meetings. By May, they had devised what they called the 'Agenda for Strategic Geoscience'. This was circulated among staff for comment, and revised. They then put together a 'Mission and Goals' paper, which was also circulated, and in July were able to write the first draft of the Strategic Plan. At every stage up to and beyond this point the team reported to the BGS Board.

The draft Plan was revised during August. It was renamed 'the Prototype Plan' and presented to the Director. On 16–17 September, the team presented the Prototype Plan to the Directorate at a retreat at the Hannover International Hotel, Hinckley, where it was hotly debated. A summary was then prepared for the Group Managers to see.

While it had been evident to most staff that the Strategic Plan would lead to a new work programme and, possibly, a new management structure, it took on an unpredicted function in September. The second call for volunteers for early retirement had still not produced a total that fully met the restructuring and rationalisation requirements of the NERC Prior Options Steering Committee. The Director decided, therefore, that there should be a review of the skills of all Grade 7 and SSO staff (Bands 4 and 5). His aim was to match the skills profile obtained this way with the one required to carry out the programme that would emerge from the Strategic Plan. His expectation was that the skills evaluation exercise would reveal staff who were not suited to the programme without retraining, as well as gaps in the skills profile that could be filled by retrained staff or new recruits. He did declare, however, that some staff might find themselves facing compulsory redundancy as a result of it. Later in the year the skills evaluation exercise was extended downwards to include HSOs (Band 6). Thus, when he put key elements of the emerging Strategic Plan to staff during October they were met with considerable interest. Suddenly, it was realised that the employment prospects of individuals could be dependent on the Strategic Plan.

The whole document went up on the BGS Intranet later in October for staff to comment on through November. At about the same time, when the business

planning cycle began, it became evident that the financial year 1999/2000 offered the bleakest prospects for commercial income that had ever been experienced. The gap between planned expenditure and predicted income was much too large to be dealt with by the usual range of devices that had been deployed by the Directorate since the early 1980s. An action plan was developed by a subgroup of the Directorate to reduce this gap and enable the BGS to finish the financial year with a balanced budget. It became clear, while drawing up the plan, that, though it was possible to reduce the gap to a manageable level for 1999/2000 by making draconian cuts, there were knock-on effects in succeeding years. An inescapable conclusion was that the BGS could not continue to support its current staff size without changing the top-heavy age and grade structure. Work on the action plan occupied the early months of 1999. A final version was put to the Directorate and then to the Board. It was scrutinised by NERC HQ and on 22 April the Director announced that he was declaring a state of redundancy. Twenty-five senior staff were to be made redundant by 31 March 2000. Seven of these were to meet the Prior Options total; eighteen were new. A last call for volunteers to take early retirement was made that same day. The skills evaluation exercise, tied as it was to the emerging Strategic Plan, assumed considerably more importance now.

The second stage in the development of the Strategic Plan began in November, when 'Team Plus' was established. Team Plus consisted of the original strategic planning team with the addition of two Assistant Directors and eight Group Managers. The decision to introduce this unplanned stage in the process was in reaction to the continued resentment among senior managers about their exclusion. In addition, the Prototype Plan, though a wordy document, was light on detail in some important areas, reflecting the limited experience of the team. The new, enlarged team divided into two groups, one to define in more detail a science strategy and the other to look into core assets. They worked, as had the original team, by consulting externally and internally. In January 1999 consultation with customers was carried out and the last big question was put to staff on the Intranet. This was for them to consider what type of organisation was needed beyond 2000. The final version of the Strategic Plan was then prepared and went to the Board in March 1999 for their endorsement.

Stage three in the development of the Strategic Plan had already begun in February with the establishment of eight task forces to look into aspects of implementation of the Strategic Plan that was about to go to the Board. This was the key stage in the whole process. The original strategic planning team had chosen not to consider implementation for the very good reason that they regarded themselves as too inexperienced to deal with it. Each task force was chaired by a Group Manager, the Director or an Assistant Director. Members were drawn from the strategic planning team, management, the Board and staff. The topics that were considered were:

- ongoing strategic planning
- customer involvement

- the BGS work programme
- Digital Geoscientific Spatial Model
- organisational structure
- operations
- human resource management
- communications systems.

The three key ones were on the work programme, organisational structure and human resource management. The task force on organisational structure was small and chaired by the Director. All the task forces had to complete their work and report to the Board by May.

The penultimate stage commenced after Board endorsement of the eight individual implementation plans. This was to prepare a single plan from them, which presented a new management structure and work programme for the Survey. By July, the outline of a new programme fitting within a matrix management system had been drawn up and was ready for discussion.

The Strategic Plan itself, which did not contain any of the details of the programme or structure, was printed and issued to staff in September1999, though it was not formally launched until early November. On 8–9 September the new work programme and new management structure were presented to a meeting of the senior staff. Only cosmetic changes were permitted at this stage. By 23 September the new programme and structure had been endorsed by both Sir John Krebs, the outgoing Chief Executive of NERC and Professor John Lawton, who was to replace him at the end of the month. The final stage was to put the implementation plan into action.

This, in outline, was the process that was followed. As an exercise in staff consultation the drafting of the Strategic Plan was exemplary. There was no reason for any member of staff to feel that he or she had not been given a chance to share in its development. Consultation diminished as the later stages progressed, particularly when the task forces were in operation and, after that, at the implementation stage, which began at the end of September, when it was virtually non-existent except at Directorate level. There is an inevitability about this, as implementation is a complex matter sometimes requiring an autocratic approach.

The Strategic Plan that emerged from this process was built on the understanding that the BGS had to adapt to a number of changes that had emerged progressively during the last thirty years, but had accelerated in the last ten. Included were the changes in the uses to which geoscientific information was put. Scientific understanding of processes within the natural environment had improved immeasurably and the growth worldwide in the use of information and communications technology now enabled rapid and wide dissemination of new scientific information. After 165 years during which the work of the Survey had been dominated by the need to complete systematic geoscientific surveys, the BGS was facing a future beyond 2005 when these would play a much less important part. To prosper in the future, the BGS had to understand how to position

itself so as to continue to serve the community in these changed circumstances. The vision presented is unequivocally that of a public service body.

Finding a way to adapt to the knowledge-driven economy, heralded in the Government's White Paper *Our Competitive Future* published in December 1998, was crucial. Understanding that the creation, application and dissemination of knowledge would, together, be a powerful driving force in the future, the BGS itself would have to accentuate its role as a knowledge-based geoscientific research organisation. In the plan, the BGS was defined as the gateway to the nation's geoscience knowledge. This recognises that, with 165 years of experience researching the geoscientific make-up of the UK, the Survey not only possessed a huge resource of data, information, skill and knowledge, but had an obligation to the community to exploit it fully for their benefit. The challenge ahead, therefore, was for the Survey to evolve into a knowledge-based scientific service provider that carried out user-focused strategic geoscientific research. This realisation, that in the future the BGS would have to concentrate heavily on the exploitation of knowledge, is in marked contrast to the current understanding that the BGS is primarily concerned with research and surveying.

The knowledge-based economy is technology driven and the Strategic Plan identified the Internet as the main vehicle to disseminate information. The development of systems for data management was essential to allow the BGS to take full advantage of modern communications technology. Foremost among these is the Digital Geoscientific Spatial Model (DGSM) of the UK. Ultimately, this will hold in digital form all the validated geoscientific data that reflect the current state of knowledge of the subsurface structure and composition of the UK and its offshore areas. The DGSM will replace, as the central reference source, all the maps and books that at present describe the geoscientific character of the UK and will be open to direct interrogation by the user community.

For most of its history the Geological Survey has contributed to the national economy primarily in relation to mineral resources. This began to change with the introduction of new planning legislation in the 1950s in association with the development of new towns and major civil engineering projects, such as new airport schemes. In the last thirty years the inclusion of geoscientific factors into planning controls has expanded considerably. In 1993, the White Paper *Realising our Potential* put enhancement of the quality of life and economic prosperity on equal footing within the agenda for the research councils. Now, while the management of natural resources, including hydrocarbons and water, is still important, the application of geoscience to understanding environmental change, preserving biodiversity, the mitigation of hazards and risks and the reduction of waste and pollution are on the ascent and this is recognised in the Strategic Plan.

Another important strand in the plan is the development of dialogue with clients and other users of geoscientific information. As long as the main remit of the Survey was to complete systematic surveys, dialogue with the user community was of minor importance. Systematic surveys are very long-term commitments and, once started, it is not advisable to tamper with the specifications.

The Programme Board, appointed in 1989, largely from the user community, provided guidance on the systematic surveys and monitoring programmes. For a work programme consisting predominantly of systematic surveys this was deemed adequate. The way in which the knowledge gained during the systematic surveys is exploited, however, is subject to continual variability because the exploitation is always targeted to meet specific and well-defined needs. Thus, in the era that follows the completion of the systematic surveys, consultation with the user community becomes paramount, whether it is about how existing data are exploited or how new resurveys are to be planned and conducted to fill knowledge gaps.

These were the main ingredients of the Strategic Plan, and they were to inform the shaping of a new programme. However, the needs for the future had to be reconciled with the need to complete the existing systematic surveys. This is something that the Strategic Plan did not actually address, but it was taken up by the BGS Work Programme Task Force. The new programme also had to permit developments that allowed the BGS to evolve into a knowledge-base organisation. The resulting programme would inevitably be transitional in nature, but it had to be set within a framework that was flexible to adapt to change year on year. The key to success was believed by the Organisational Structure Task Force to be in a new management structure. It would have to contain the flexibility to deal with the transition and permit the Survey to move on to the next stage. It was recognised early on that such a management system was probably better organised around a matrix than a hierarchical structure. At the same time, the introduction of matrix management was thought, as it had been in the early 1980s, to be necessary to deal with many of the issues that had arisen out of intergroup and interdivisional competition. Thus, the Organisational Structure Task Force recommended a new structure based on the matrix management model.

The matrix adopted (Figure 10) was based on the classic model. Research programmes comprised columns in the matrix diagram; human and physical assets comprised the rows. The terms ‘Group’ and ‘Division’ were abandoned. In their stead came Programmes and Directorates, respectively. Group Managers disappeared; Programme Managers appeared. Assistant Directors went out; Directors came in. The BGS Director became the Executive Director. The BGS Directorate became the Executive Committee.

The research programme was divided among three programmes directorates. They were the Lands and Resources, the Environment and Hazards, and the Information Services and Management directorates. The Lands and Resources Directorate was concerned mainly with strategic science; Environment and Hazards was predominantly applied research.

There were three corporate directorates, two of which had overriding responsibilities. These were the Administration and Finance Directorate and the Marketing, International and Corporate Directorate. Both were to provide services for and on behalf of the whole of the rest of BGS. The third corporate directorate was Geoscience Resources and Facilities, the head of which was the Chief Scientist. The main responsibility of this directorate was to manage the

science staff, laboratories and other physical assets on behalf of the programmes directorates, which owned none of these. The Geoscience Resources and Facilities Directorate also was to run a relatively small R&D programme, which was to be determined by the directors of the programmes directorates.

Within the Geoscience Resources and Facilities Directorate were the head of the NERC Isotope Geosciences Laboratory (NIGL) and four Heads of Discipline. These four were responsible for the career development, deployment, staff assessment (reporting) and training of all science staff. Prior to the establishment of the matrix, all staff had been invited to nominate themselves to a discipline, of which there were nine major ones. These were allocated to the four Heads of Discipline as follows:

- Geochemistry, Mineralogy and Hydrogeology
- Geophysics and Marine Geoscience
- Geology, Geotechnics and Palaeontology
- Information Systems.

The fifth Head of Discipline was the head of the Administration and Finance Directorate.

The Heads of Discipline, or HoDs, also were to manage all the laboratories and other physical assets and be responsible for purchasing new equipment. Each had a small R&D programme. This meant that the Programme Managers had no assets at all, nor the power to spend except on consumables, thus enabling them to devote all their energies to managing and enhancing their programmes. In recognition of one of the principal reasons for the failure of Malcolm Brown's matrix management system, it was a primary objective in this reorganisation that there should be no overlap of interest between the managers on the two axes of the matrix.

The Strategic Plan attempted to minimise the difference between the Core and Commissioned programmes, in effect by defining all the research carried out within the BGS as Core or relevant to the Core. This was translated by the BGS Work Programme Task Force into a threefold division of the programme. The Core Geoscience Programme, largely funded by NERC as the proxy customer on behalf of the national interest, remained central, but built onto it was a programme of core enhancement. There were two parts to this. In one, were strategic commissions and partnerships with Government departments, agencies, the EU, NERC thematic programmes, LINK and so on. In the other, were the purely commercial partnerships and contracts, all of which, to be acceptable, had to be aligned to the BGS role and mission.

The project was the fundamental unit. Programmes were clusters of projects, both wholly Science-Budget-funded and commissioned. It was the responsibility of the Programme Managers to enhance their Core Programme. Unlike in the previous structure, where there were groups that depended almost entirely on commissioned or commercial income, with little or no Science Budget, every programme in the new structure had some core funding, which was set to allow each

BGS Programme & Management Structure

(Executive Director; Dr D A Falvey) +

Director Special Projects—Dr P M Allen (Until June 2000)

Marketing, International & Corporate Development Directorate (Dr C W A Browitt) +

• **BGS International™ & Corporate Development** (Mr D C Ovadia)

• **UK Business Sector Managers** • **Central Directorate Support** • **Press Office**

Geoscience Resources & Facilities Directorate	**Lands & Resources Directorate**	**Environment & Hazards Directorate**	**Information Services & Management Directorate**
Prof J A Plant* +	Dr M K Lee +	Mr D C Holmes +	Mr I Jackson +
Geochemistry, Mineralogy & Hydrogeology Dr D J Morgan	**Integrated Geoscience Surveys (Northern Britain)** Dr D J Fettes	**Groundwater Systems & Water Quality** Dr D W Peach	**Information Management** Mr J R A Giles
NERC Isotope Geosciences Laboratory Prof. R R Parrish	**Integrated Geoscience Surveys (Southern Britain)** Mr P J Strange	**Earthquake and Forensic Seismology & Geomagnetism** Dr D J Kerridge	**National Geoscience Information Service** Dr C A Green
Geophysics & Marine Geoscience Dr J R Evans	**Continental Shelf & Margins** Dr N G T Fannin	**Urban Geoscience & Geological Hazards** Prof M G Culshaw	**Publications Production** Mr K Becken
Geology, Geotechnics & Palaeontology Mr T J Charsley	**Onshore Minerals & Energy Resources** Dr M G Petterson	**Pollution and Waste Management & Extraction Industry Impacts** Dr B Smith	
Information Systems Dr W Hatton	**Geological Survey of Northern Ireland** Mr J W Arthurs	**Coastal Geoscience & Global Change Impacts** Dr J G Rees	
Training & Career Management Dr I E Penn (Band 4)	**Reservoir Geoscience** Dr N J Riley		
* Assisted by Dr J W Baldock Until April 2000			

Administration & Finance Directorate (Mr F G Curry)+

• **Finance, Accounts & Contracts** Mrs S J Williams • **Personnel Administration** (Mr J Orr) • **Facilities & Infrastructure** (Mr G S Bowick)

+ members of the BGS Executive Committee

Figure 10 (from Office Notice ON/3/00) The structure on the reintroduction of matrix management in April 2000.

programme to operate above a minimum viable level. In total, there were ten research programmes and three information programmes in three programmes directorates. Four capability programmes, and the NIGL programme, were managed within the Geoscience Resources and Facilities Directorate.

Implementation was organised and carried out in the six months September 1999 to April 2000, finishing off with a tour of all offices by the Director and myself (I had been the Implementation Manager) to explain the matrix to all staff. Because the structure was completely new, there was no carry over into it from the old one. There were in total the same number of management posts, but as several managers were retiring on or near 31 March 2000, there were several vacancies. Posts were filled by a combination of interview by the Director and open competition.

During the six months to the end of March, the Implementation Manager and the Heads of Discipline progressively worked out the details of the way in which the matrix should operate. As they were completed, they were put up on the Intranet. At the end of the process, full details of the way in which the matrix was planned to operate stood on the Intranet for the guidance of all staff. By April Fool's Day, in the year 2000, matrix mark three, most procedures for operating it and a new work programme were in place.

Chapter 20

A geological survey in transition

Viewed from the end of the twentieth century, the period back to 1980 looks very much like one of transition, in which the BGS moved from being a traditional geological survey towards something quite different. The generally accepted mission of a national geological survey is to acquire, interpret, manage and disseminate geoscience information and knowledge on a nationwide basis for the benefit of all in society. What has changed significantly for the BGS over the last twenty years is the balance between these four different functions. The 1999 BGS Strategic Plan suggested that, in the future, less effort would be spent on the acquisition of new data and more put to the management, utilisation and dissemination of existing data and knowledge among the user community. It is the passage of the BGS from being a geological survey, whose primary concern was the traditional one of carrying out geoscience surveys to one more concerned with knowledge management and dissemination that defines this period as one of transition.

The remit of a geological survey was something that was taken up at a meeting of the directors of many of the world's geological surveys organised in 1992 by the Geological Survey of Canada to celebrate its 150th anniversary. In a talk given at the meeting, entitled *National Geological Surveys: Their Present and Future Role*, Professor Raymond Price stated that, 'To govern, governments require information'. Essentially, he saw geological surveys as being agencies that operate for and on behalf of Government. He described their purpose as to provide geoscience information for the development of sound public policies on mineral and energy resources, the management and mitigation of risk from natural hazards and the protection of the environment, both nationally and globally. In his analysis geological surveys do this by carrying out systematic geological, geochemical and geophysical mapping and appropriate research and by combining their findings with information taken from industrial and academic sources to create a national geoscience knowledge base. Geoscience information and expertise are provided to the public at low added cost. This is a description of the function of a geological survey that would apply in most parts of the world now, but has applied decreasingly in Great Britain since 1967.

The work programme in geological surveys has always been driven by national economic imperatives and in most countries these are most commonly allied to mineral-resource exploration and exploitation. Until the 1960s, Great Britain was no exception. The geological mapping programme was actually

started by De la Beche in 1832 in Devon to provide maps for this purpose, most notably, in that area, for the copper and tin miners. Subsequently, the coalfields were subjected to more detailed surveys and resurveys than any other part of the country. The gradual decline through the nineteenth century and eventual disappearance in the late twentieth century from the UK of metalliferous mining, followed by the replacement of coal by oil and gas as the main sources of energy, are two contributors to the change in the emphasis in the UK mining economy during the twentieth century. Another was the rapid development of the service industry at the expense of manufacturing, especially in the last quarter of the twentieth century. This created a large demand for industrial and construction minerals.

In response to these changes in the external economy, the balance within the BGS research programme has changed. Research carried out on metallogenesis is now minimal, and mostly in support of overseas projects. Expertise in coalfield geology has dwindled, while support for the industrial and construction minerals extraction industry is almost entirely provided through the published 1:10 000 geological maps. The majority of the work done by the BGS in support of mineral exploration now is in relation to offshore oil and gas. Although this is significant in volume, the total research related to mineral resources is much reduced compared with previous times.

Coincident with the reduction in the demand for the Geological Survey to provide information in support of mineral-resource supply there has been an increase in the requirement to supply geoscience data for town planning, new development and environmental purposes. The beginnings of this change became evident in the 1960s, when the Survey was requested to carry out surveys of several areas that had been designated for new town development. Among them, the sites for such as Milton Keynes, Peterborough New Town and Telford were geologically surveyed on contract to the new town development agencies. Another major investigation carried out in that period was for a potential new airport for London at Maplin Sands. By the early 1980s the BGS was involved in a major, long-running programme commissioned by the Department of the Environment to produce environmental geology maps of urban Britain to be used by town planners. Geoscience information about mineral resources in this programme was then, and remains, more likely to be required for planning purposes and to control exploitation than to be used to encourage mining.

This change in emphasis within the work programme of the Survey away from support for resource exploration and exploitation took place fairly rapidly. The fact that there was significant work for the Survey to replace it in support of environmental research is due to reasons associated with the way in which urbanisation and industrialisation had taken place in Great Britain. Because the country is small and compact, most major towns grew up on or adjacent to exploitable and exploited mineral deposits, the principal ones being on the coalfields. The legacy of environmental damage in these areas is immense and provides a wide range of hazards to health and physical wellbeing of the towns' inhabitants. If these towns are to be

further developed or redeveloped now that mining is almost finished and the smokestack industries are dead, the environmental damage has to be tackled to make them safe. The alternative, of re-siting the towns in pristine sites is inconceivable.

The environmental impacts on British towns, both of the growth of industrialisation and its decline, are many and diverse. There has been a change in the utilisation of water, for example. Whereas, in the past, many industrial companies used water from their own wells, the present-day, reduced demand for industrial water is more commonly met from the mains supply. Thus, the water table is rising in many ex-industrial areas. This, added to the rise in water table due to the cessation of pumping in abandoned coalfields and the increased demand for domestic water supply in areas of the country where groundwater is the main source, has changed the national groundwater regime in ways that are not yet understood. Many of the redundant industrial sites in British towns, such as gasworks and chemical plant, are contaminated with elements and organic substances known to present a health hazard to humans if ingested. Many towns are seriously undermined, having extensive networks of shallow underground cavities, many of which are unmapped. Opencast mines and quarries have been filled with unspecified types of waste, and then built over. Mine tips, which sometimes contain potentially harmful substances, have been flattened and the debris spread about during redevelopment. In many towns, urban and suburban expansion in recent decades has lead to properties being erected on ground that is liable to flooding and subsidence. Inevitably, therefore, these combine to create a powerful, new economic driver for the BGS and promise to have a major impact on the way the work programme will be structured in the future.

The Geological Survey itself, however, with a history spanning more than one hundred and sixty years, has also matured. Professor Price pointed out, in his address to survey directors in Ottawa, that systematic mapping is at the core of a geological survey's work programme. The question he did not address was what happens when the systematic surveys are complete? Experience in Great Britain suggests that there are four stages through which geological (geochemical and geophysical) mapping pass. They are not necessarily sequential in the sense that one must finish before the next can start, but their start dates will normally be sequential.

The first is a reconnaissance stage. During it, rapid surveys are carried out in all parts of the country, essentially just to see what is there. In Great Britain, this was mostly done by gentlemen amateurs and engineers, such as William Smith, before the Geological Survey was founded. The Geological Survey itself was established to carry out stage two: to do a systematic survey of the whole country at a single scale to common standards. The maps so produced become the primary reference source for geological information in that country. The scale chosen in Great Britain was one inch to one mile, or, nowadays, 1:50 000. In larger countries the scale may be much smaller, because it is important that the whole country is completed at the one scale. Called the Primary Survey by the BGS, this only finished when the last area in the Scottish Highlands was completed in the 1990s.

Stage three is to carry out detailed mapping at a larger scale than the primary survey, on a systematic basis. Again, the objective is to map at a common scale and standard, but this activity tends to be demand driven and it is unlikely that the whole of any country would be covered in this stage. In Britain the scale of six inches to the mile, or 1:10 000, was chosen for the geological survey, and it is probably justifiable economically to map no more than about 80% of the country at this scale. Again, it is a systematic survey, providing information with many potential uses and no specific clients.

The fact that stage-three surveys are usually demand driven means that in the absence of demand they may never take place, no matter how desirable geoscientists think it is to do them. Usually it is the outside community of users which determines demand. For example, it was the Government, acting on behalf of the coal industry, which instructed the Geological Survey to carry out the detailed surveys of the coalfields in 1871 and 1919. In the post-nationalisation period, after the second world war, the National Coal Board asked for improved maps. Resources were made available and the surveys were carried out. In some cases, the Survey staff themselves may have sufficient experience to know that certain systematic surveys, if carried out, will provide great benefits. Demonstrating the case, however, may be very difficult and where there are financial constraints such surveys may never acquire sufficiently high priority to be funded.

The fourth stage is one in which the main purpose is to revise, improve, update and enrich the databases created during the systematic surveys of stages one to three. There are two parts to this stage. In one, the existing databases are improved by collecting data at the same level of resolution as the systematic survey. Programmes of systematic map revision or opportunistic data collection may do this. For example, in the fifteen-year geological mapping programme that began in 1990 many areas previously mapped at the scale of six inches to the mile or 1:10 000 during stage three were resurveyed in order to modernise and improve the map. Independently of this type of revision exercise, geological field staff have, in the past, opportunistically visited new road cuttings and excavations for the foundations for new buildings to collect information that will improve an existing, good-quality map. Both types of activity are necessary if the geological map database is not to devalue and degrade with time. Opinion in the 1980s was that major map revision should be conducted at least every fifty years or, in urban areas and coalfields, every twenty-five years. It is now possible, if the geological map information for the whole country is held in digital form, to do this differently. New information, whether it is acquired from a systematic revision resurvey or opportunistically, will be used to improve the digital database. Instead of reprinting published geological maps that have been revised, which has been the practice until now, updated versions of them can be generated from the improved digital database and plotted electrostatically on demand. For geochemical and geophysical surveys revision has been done digitally for some time.

The other part to stage four is client-centred surveying, targeted for specific purposes. This means that the mapping parameters chosen, including scale, may vary

from area to area. Examples of this sort of activity include the preparation of thematic maps for land-use planners, where engineering geology properties, man-made ground and geological hazards are represented on maps. Another example is fracture mapping such as that done for UK Nirex Ltd in the Lake District. This was done in great detail at a very large scale in selected surface outcrops in order to contribute to a project designed to gain understanding of the fracture systems in the rocks and their impact on the hydrogeological regime in a repository for radioactive waste at depth. Generally, there must already exist good, large-scale geological maps for the targeted area. Additional fieldwork is usually required, but for the purpose of collecting the data specifically required for the defined end purpose. This sort of activity enriches rather than improves the databases created during the systematic surveys.

The nature of the research carried out in association with each of the four stages is also different. During the first three stages, research is mostly required to enhance the quality of the systematic surveys by, for example, improving the understanding of the stratigraphy or the geochemical and geophysical parameters being measured. Research of this type is also required in stage four to accompany the revision of the databases, but most of the research in stage four will be driven primarily by client needs and may not necessarily make any contribution to the improvement of existing maps or databases.

The BGS is close to completing systematic surveys in all disciplines. The gravity and low-resolution, aeromagnetic primary (stage two) surveys are both complete. A high-resolution, effectively stage-three, aeromagnetic and radiometric survey has begun, with flights over the East Midlands, but the extent to which this stage should be continued is still being debated. Three major, strategic mapping programmes are nearly complete. One is the Geological Mapping Programme, which as structured at present is a combination of: completion of the primary survey (stage two); completion of stage three and a revision of some earlier stage-three surveys; and stage-four activity. The second is the Regional Geochemical Survey, a primary survey. Both of these systematic surveys should be completed by 2010. In the third, the Primary Offshore Survey is complete except for western waters and the near-shore zone. The former is progressing with the help of co-funding from the oil-exploration industry. Completion of the near-shore zone is not in prospect — a case of a primary survey that has never been able to climb high enough in any list of priorities to be funded.

There are few examples of any kind of systematic survey that can be considered as essential, other than those either still in hand or completed. One for which an argument can be made is a national systematic survey of physical properties of all rock types, which is needed to make best use of the national gravity and aeromagnetic databases and to support geotechnical, geohazard and resource studies. Even if the case for this is accepted and funding could be found to carry it out, it would not affect the general statement that the BGS is very close to the end of the era in which nationwide, systematic surveys are of central importance in its work programme, and it stands on the threshold of a future in which stage-four types of activity will predominate.

The diminution of the importance of mineral-resource-related research and the ending of the dominance of the systematic surveys are evolutionary changes that all geological surveys are likely to experience as the society and national economy within which they exist also change. There are two other important factors that have driven change within the BGS during this transitional period, however, which have combined, possibly in a unique way, because of the national political setting within Great Britain after 1979. These are in the way in which the Survey interacts with the community that uses geoscientific information and the impact of computing technology on the way the Survey works.

Consider first the interaction with the users of geoscientific information. This began to change as a result of Rothschild. Before Rothschild, the corporate mindset within the BGS was dictated by the primacy of the systematic survey within the work programme. Being multipurpose and having no single customer, even though there was a single funding agency for the systematic surveys, there was no obvious need for dialogue with any outside agency or customer about how it should be conducted. If changes were to be made as a result of outside influence, they would usually be in relation to the order in which areas were mapped, not how or whether they should be done.

After Rothschild, Government departments to which funds had been transferred, found that either they had become customers who required the research and survey results to support their own policy initiatives or they were acting as surrogates for a huge range of beneficiaries among the general public. They began to specify their own sectorial, geoscientific needs, the effect of which on the BGS was to make the organisation conscious first that customers existed and next that they had needs. As the Commissioned Research Programme grew, reducing the dominance of the systematic surveys, this consciousness spread. The creation of the Programme Board, which acted as a surrogate customer for the Core Programme, brought awareness of customer needs even for the strategic, systematic surveys.

Initiatives taken by Government after 1979 forced other changes in the BGS culture. One was the pressure on them to adjust to requirements of the market economy and change many of their practices. When the Rayner review in the early 1980s led eventually to all departments putting their research contracts to competitive tender, the BGS had to respond by espousing some of the culture of the private sector to give it the flexibility needed to win contracts in this new environment.

Interaction between the BGS and the user community has always been on two levels. At the highest level it was with surrogate customers, largely through the strategic survey programmes. At the level below, there was the direct link between the BGS and the eventual end user of the information. This may have been via a commissioned research project or the sale of a map or the answer provided to an enquiry. This lower level originally took up a smaller portion of the work effort than the other, but from the early 1980s the relative proportion and nature of work done in it was set to change. At this time, the BGS began to

acquire more and more commissioned research contracts that directly met tightly specified customer needs. Initially they were with Government departments, but later the amount of contract work with the private sector, such as for UK Nirex Ltd, grew. Competition for these contracts could be fierce, and the BGS often found it was expedient either to form a partnership with private-sector consultancies or to become a subcontractor to them. It also became necessary for the BGS to hire specialists from the private sector to cover skill shortages when competing for some contracts. Gradually, Survey staff became adept at tendering and not afraid to use some of the devices which were commonly practiced in the private sector to win contracts but which were not strictly within what was still perceived to be the spirit of a public service. The end result was to establish the BGS as a hybrid organisation: a public-service body that does commercial work: not a business, but businesslike in its behaviour.

The provision of information directly to a customer, by means of a published product or a written answer to an enquiry, has always been an essential, though minor, aspect of the Survey's interaction with the general public. There has never been any question that the BGS should not publish and sell the maps, memoirs and other books that had always been its standard outputs, but once the Survey began to be commercialised, ideas for new products to publish and computer systems to deliver information to enquirers began to be generated. The question was posed: how far down the production chain should the BGS go as a public-service body? Should it confine itself to providing data for third parties to add value to and sell on, or should it develop value-added products itself and sell them directly. The option of providing the data free for everyone, which is the practice in some countries that are barred by law or Government regulation from undertaking the sort of activities common in the BGS, disappeared from consideration after the 1979 general election. A second, but equally important question was whether or not the BGS should serve the mass market.

When posed as questions for debate among senior managers there was never a unanimous answer. When looked at in relation to the sort of response the Survey should make to changes in its circumstances being forced on it from the outside the answers were quite clear.

Income from almost all commissioned research projects only covered costs. The pressure from Government for the BGS to make a contribution to its core funding from commissioned earnings, especially after the report of the Charging Review, meant that ways had to be found to generate a surplus over average operational costs. The most obvious way was to sell products or services on which it was legitimate to add a mark-up. In other words, the Survey should go as far down the value chain as possible and the larger the market that could be addressed, the bigger the potential return. This was despite the fact that the skills needed to do this, such as in product design and development, conversion of a prototype to a production model, systems management, marketing and selling, lay outside the Survey's core competence. Price Waterhouse had dealt with the question about the mass market when it recommended that the BGS should

concentrate on the high-quality, high-price end of the market spectrum. This might have been the correct decision at the time. It took into account the emphasis on systematic surveys in the work programme, the Survey's core competences and aspirations for itself and the known technological limits in 1990, but it was a decision that technology was going quickly to make redundant.

Even before Price Waterhouse, attempts had been made to develop value-added products to meet the needs of niche markets and generate an operational surplus. In the late 1980s the so-called Enterprise projects were funded with this purpose in mind. Extremely successful in the mid-1990s were the geophysical atlases developed for the offshore oil-exploration industry. The most successful of the early attempts, though, was the development of the Geohazard Susceptibility Package (GHASP) for sale to insurance companies. Using data taken from geological maps, an algorithm was devised that produced a score to give an indication of the potential for damage to property from subsidence in any post-code district. The development of GHASP was a major breakthrough for the BGS. It was the first time the Survey had tried to address the needs of a part of the community that did not traditionally regard geoscience as relevant. With the success of GHASP, staff began to devise ideas for tackling other markets. Examples included information on ground conditions for conveyancers, property owners and estate agents; radon information for the general public; geological synopses for civil engineers, mini-maps for big landowners and the provision of site-specific geochemical data to deal with contaminated land problems. In parallel, a system had been developed by the Global Seismology Group to provide information on the potential for earthquakes in large industrial sites.

In all of these, the BGS would deal directly with the customer. None of the products could be devised without consultation with end users. This was quite different from being aware of customer needs and being able to react to them. It was something about which the Survey had to be proactive. Potential customers had to be sought and their needs taken into account in the process of devising and designing the new products to suit market needs. In this respect there was little difference between the way in which the BGS had now to operate and the average private-sector firm.

The revolution in computing that has taken place during this period of transition has been pervasive in its impact on the way that the Survey worked, but it has had a very special impact in relation to the Survey's ambitions for the development of value-added products. This is well exemplified by GHASP. GHASP was a value-added product, the operation of which depended entirely on IT and the availability of digital data to feed the system. Writing the software was relatively easy, but the general absence of appropriate geological data in digital form created a serious problem. All the other ideas staff had for similar types of value-added products for the general public were also IT based and required basic geological information to be in digital form.

GHASP was delivered to customers on a floppy disk or CD-ROM, but later ideas required the generation of large numbers of individually customised

products determined by variable parameters on demand. To do this required a fairly complicated computer system to interrogate databases, analyse the data and deliver a simple, readable report. The development of the ALGI system (Address-linked Geological Inventory), which provided site-specific geological information suitable for house purchasers and conveyancers to use, was salutary in demonstrating the problems associated with the development of such IT systems and the size of the data-conversion task (analogue to digital) to support it. It provided the momentum behind moves to organise and digitise the Survey's data holdings, including all the 1:50 000-scale geological maps, and establish cross-BGS standards in database management.

With regard to the method of transmitting the information contained in these value-added products to customers directly, the Geomagnetism Group had demonstrated as early as 1994 how to do it using the Internet. When the Government changed in 1997 and New Labour showed enthusiasm for developing the 'knowledge economy' and exploiting the Internet to achieve mass communication, the BGS found another justification for the moving in this direction for delivering data and value-added products to its customers.

Once the potential of the Internet came to be appreciated, the traditional methods of disseminating information, such as selling maps, answering enquiries from the general public and carrying out minor project work and research on repayment, which the BGS had always done, had to be reappraised. As they stood, these services, including the way that access to the Survey's databases was gained, were available only to the knowledgeable and, in some cases, the rich. Modern communications technology now potentially gave everyone that same opportunity. The general public now knows that the Internet allows anyone, anywhere in the world, to have direct access to centres of knowledge and expertise wherever they are, and expects those centres to have their data, information and knowledge available to them. Geological surveys are unique within their nations in their holdings of geoscientific data and have to face up to the reality of organising themselves to meet the public's expectations of them as very specialised centres of expertise. In other words, it is now unavoidable for geological surveys to consider finding ways to communicate with a mass market using the Internet or its successors. This includes developing value-added products that are suitable for delivery via the Internet and understandable by people with no specialist knowledge in geoscience.

The effect of this and all the other changes that have taken place in BGS during the last twenty years on the definition of what a geological survey is expected to do are quite considerable. In his address to the geological survey directors at the meeting in Canada in 1992 (page 195), Professor Price stressed that a geological survey worked primarily for Government and that its main function was to carry out systematic surveys. This was the way, in his view, that they fulfilled their requirement to meet the geoscientific information needs of the nation. He said that the shift away from service to government and the general public towards the sale of information and professional services in the open

market would inevitably lead to the demise of the geological survey. I believe that the experience of the BGS shows and will continue to show that this is completely wrong.

The position that the BGS found itself in towards the end of the 1990s, while quite different from the one to be expected for a traditional geological survey, does not mean that the BGS is no longer a geological survey. The BGS is on the verge of becoming a mature geological survey: one in which stage-four-type activities predominate and the main national, systematic surveys will have been completed. In the future, the UK Government will not lose its need for geoscience information for policy formulation, and the Survey will have to continue with programmes of revision of its maps and databases in order to remain fit to serve Government, the general public and its commercial clients. However, the results of the UK Government policy, as well as other evolutionary changes in the Survey and society outside, are likely to lead to a large and continuing demand for geoscience information to be delivered directly to the consumer, whether it is a geoscience specialist or the general public. There is no resistance in the community within Great Britain for this to be done for a fee, which may have a small element of profit in it.

What this means is that the part of the remit for a geological survey that Professor Price describes as providing information to the general public at low added cost may become a major activity and one that is indistinguishable from the sale of information and provision of professional services. In other words, the needs of geoscience specialists and the general public for geoscience information can be met in the short term, at least, primarily by commercial means. In a mature geological survey, such as the BGS, this will come increasingly to dominate the work profile. The proportion of the total amount of information delivered this way rather than at no added cost, however, is likely to change in the future. The BGS has learned already that it is cheaper to give some types of information away on the Internet than formally to print, publish and sell it. It is conceivable that even the map-face data on the 1:50 000 geological maps, which are currently sold, could be made available for no charge over the Internet when the DigMapGB project is finished. The boundary between what can be given away and what should be sold is, at present, therefore, not fixed.

There is another gradually emerging truth. The Internet has made the debate about how far a geological survey should proceed down the value chain irrelevant. Not only does it appear to be more cost effective for a geological survey to devise its own systems to deliver information to the general public directly over the Internet, rather than via a private-sector intermediary, but such information also tends to be trusted more by the recipients when they know it comes from source. There is also growing evidence that the users feel that there is less chance of profiteering when a public-service body engages directly with customers this way.

The BGS, in common with other geological surveys of the future, will continue to build up the national geoscientific database, for which it is the natural

custodian, by carrying out field studies and research, in some cases following traditional practices. It will be the requirement to continue to maintain a high-quality national database, in the era following the completion of the systematic surveys, that will determine the content and shape of the programmes of primary data acquisition. Increasingly, however, the Survey will become more concerned with basic issues of data management and communication, and it is the latter that is likely to become king. Essentially, everything that will go on in the BGS will have to be planned in order to maximise the Survey's capability to communicate directly with the user community to meet all sorts of needs within it. Increasingly, this will be done using the Internet or its successors. The impact of all of this on the skills profile for the Survey is profound and will require it to make considerable changes. There will be a need for fewer geoscientists, more specialists in ICT (information and communications technology) and data management; fewer senior scientists and more junior staff concerned with housekeeping tasks. The sort of geological survey that the BGS will become will be quite different from the traditional model. Rather than being primarily concerned with data collection it will be firmly placed within the knowledge economy at the hub of a communication network for the dissemination of geoscience information and data. The next history to written about the Survey will show whether or not this actually happened.

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Appendix 1

The British Geological Survey Programme Board, 1989–1997, and the BGS Board, 1998 onwards

Chairmen

D G M Roberts	Acer	1989–1993
E Hassall	Wardell Armstrong	1993–2000
J Mortimer	Hanson Quarry Products	2001–

Official members

F G Larminie	Director	1989–1990
P J Cook	Director	1990–1997
D A Falvey	Director	1998–
D Hackett	BGS Secretary	1989–1999
F G Curry	BGS Secretary	1999–
J C Briden	Director of Earth Sciences NERC	1989–1994
D J Drewry	Director Science and Technology NERC	1994–1997
C M Read	Finance Director NERC	1998–

Members

M F Ridd	Consultant	1989–1992
L P Thomas	Consultant	1989–1992
W L Barratt	Tarmac Roadstone Ltd	1989–1991
M Hamlin	University of Dundee	1989–1993
R Chaplow	Sir Alexander Gibb and Partners	1989–1993
I A Thomas	National Stone Centre	1989–1991
E H Francis	University of Leeds	1989–1992
M J Cahalan	Retired, previously RTZ	1989–1991
E R Hassall	Wardell Armstrong	1992–1993
C J Morrisey	RTZ	1992–1999
C Nicholas	CAMAS Aggregates Ltd	1992–1994
M Brooks	University of Wales	1993–1995
R F P Hardman	Amerada Hess	1993–1995
G Walton	Geoffrey Walton Practice	1993–2000
A C Skinner	National Rivers Authority	1994–1999
D R Norbury	Soil Mechanics Ltd	1994–1997
J S Ornsby	RMC(UK) Ltd	1994–1996
J V Bramley	Retired, previously Laporte Minerals	1995–1998
J P B Lovell	BP	1996–2000
J Mortimer	Hanson Quarry Products	1997–2000
D J Blundell	Royal Holloway	1997–1998

A L Harris	Liverpool University	1998–
M J Carter	Marion Carter Associates	1999–
R A Scrutton	Edinburgh University	1999–
O A Bavinton	Anglo American	1999–
G Robinson	Retired, previously Ordnance Survey	2001–
A J Smith	Wardell Armstrong	2001–

Assessors

C Robson	Department of the Environment	1989–1990
R Mabey	Department of Environment	1989
B R Marker	Department of the Environment, later the Department of Environment, Transport and the Regions	1990–2000
J R V Brooks	Department of Energy	1989–1992
R Ritzema	Department of Education and Science	1989
K D J Root	Department of Education and Science	1989–1992
J Stephenson	Department of Trade and Industry	1989–1991
R Gamble	Department of Economic Development (NI)	1989
M Smith	Ministry of Defence	1989
J Aitken	Department of Energy	1990
E R Oxburgh	Ministry of Defence	1990–1993
G King	Department of Economic Development (NI)	1990–1991
D Bouch	Department of Trade and Industry	1991–1992
B Harding	Department of Trade and Industry	1992–1994
H Cherry	Department of Economic Development (NI)	1990–1992
M McBride	Office of Science and Technology	1992–1996
W C S Wilson	Department of Economic Development (NI)	1990–1994
A Murphy	Department of Trade and Industry	1992
B Sheridan	Department of Trade and Industry	1993
D E N Davies	Ministry of Defence	1993
G K McGeown	Department of Economic Development (NI)	1994–1997
A Redrup	Department of Trade and Industry	1994–1995
N French	Department of Trade and Industry	1996–1997
K Tregonning	Office of Science and Technology	1996–1997
K Hodgkinson	Department of Trade and Industry	1997

The Programme Board met forty times. It was replaced by the BGS Board in January 1998. Under the new arrangements there were no assessors, some of whom, though they had received the papers, had never attended a meeting. Instead, Observers were invited to attend meetings. B R Marker of the Department of Environment, Transport and the Regions, whose attendance record as an assessor was nearly complete, was the only one of these. In July 1999 four BGS Assistant Directors were invited to attend Board meetings on an informal basis as the Executive Members. In March 2000 this arrangement became formal.

Appendix 2

British Geological Survey Directorate 1979–2000

Directors

G M Brown	1979–1985
G I Lumsden	1985–1987
F G Larminie	1987–1990
P J Cook	1990–1997
D A Falvey	1998–

Deputy Directors

P A Sabine	1977–1984 (Acting Director for periods in 1979 and 1982/83)
G I Lumsden	1982–1985

Heads of Administration

E J Brown	1973–1983
D Hackett	1983–1999
F G Curry	1999–

ASSISTANT DIRECTORS

R A Eden Land Survey, Scotland and Northern Ireland	1975–1979
D Bleackley Overseas	1975–1980
H E Wilson Special Surveys	1977–1982
J E Wright Continental Shelf	1977–1983
W B Evans Land Survey, Southern England and South Wales Western England and Wales Programmes Directorate B	1977–1986
D A Gray Geophysics and Hydrogeology Programmes Directorate C	1977–1985
A A Archer Minerals Strategy and Museum	1977–1983

P J Moore Geochemistry and Petrology Geochemistry Directorate	1978–1987
M A Calver Land Survey, Northern England and North Wales	1980–1982
G I Lumsden Land Survey, Scotland and Northern Ireland	1980–1982
I G Hughes Overseas	1980–1983
E G Smith Land Survey Eastern England Geology Directorate Land Survey South	1982–1987
J H Hull Programmes Directorate A Hydrocarbons and Marine Surveys Land and Marine Surveys North Petroleum Geology, Geophysics and Offshore Surveys	1983–1994
K Bloomfield Programmes Directorate D Overseas Surveys	1983–1989
R T Haworth Geophysics Directorate Geophysics and Hydrocarbons	1983–1990
B Kelk Information and Central Services Information and Marketing	1984–1990
R W Gallois Land Survey North	1985–1989
P M Allen Land Survey South Land and Marine Surveys South Thematic Maps and Onshore Surveys Central Services and Business Development	1987–2000
J D Mather Geochemistry Directorate Geochemistry and Hydrogeology	1987–1990
C R Jones Overseas	1988–1989
J A Plant Minerals and Geochemical Surveys Minerals, Environment and Geochemical Surveys Geoscience Resources & Facilities Directorate	1990–

A J Reedman	1990–2000
International	
International and Marketing	
D Slater	1990–1991
Corporate Coordination and Information	
S S D Foster	1991–2000
Groundwater and Geotechnical Surveys	
Geological and Hydrogeological Surveys	
B Stephenson	1991–1994
Marketing	
E F P Nickless	1991–1997
Corporate Coordination and Information	
C W A Browitt	1993–
Petroleum Geology, Geophysics and Offshore Surveys	
Marketing, International and Corporate Development	
M K Lee	2000–
Lands and Resources	
D Holmes	2000–
Environment and Hazards	
I Jackson	2000–
Information Services and Management	

Appendix 3

Sources of information

Much of the information in this book has been gleaned from official BGS files. In addition, I have used other sources, including files kept by officers of the trades union and my own private files. These have been lodged with the BGS archivist. Other important sources include official BGS and NERC reports and diverse other publications. Full references to some of these are given in the text and in the list of References. A list of other main sources is given below.

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BGS Board. Minutes of meetings 1998 to 2000.

BGS Office Notices, 1970 to 1999.

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Directorate of the Institute of Geological Sciences. Minutes of meetings 1981 to 1983.

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Divisional files for the Corporate Coordination and Information Division (CCID) 1991 to 1997, especially ID/SCR/P on the Multi-departmental Scrutiny of the Public Sector Research Establishments.

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British Geological Survey

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