PETER BURKE
A SOCIAL HISTORY OF KNOWLEDGE
VOLUME II
From the ENCYCLOPEDIA to WIKIPEDIA
A Social History of Knowledge II
To Emmanuel College
in gratitude for supporting my research for more than thirty years
A Social History of Knowledge II

From the *Encyclopédie* to Wikipedia

Peter Burke

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Introduction

‘There is no history of knowledge’, declared the management theorist and futurologist Peter Drucker in 1993, predicting that it would become an important area of study ‘within the next decades’. For once he was a little slow, for the rise of interest in the history of knowledge was already under way – witness books by historians with titles such as *Knowledge is Power* (1989), *Fields of Knowledge* (1992) or *Colonialism and its Forms of Knowledge* (1996).

When I wrote *A Social History of Knowledge from Gutenberg to Diderot* (2000) I still thought of myself as taking an individual initiative that drew upon a long-standing interest in the Hungarian Karl Mannheim, a pioneer in the ‘sociology of knowledge’. However, it is retrospectively obvious that I was one among a number of scholars stimulated, consciously or unconsciously, by the current debates about the ‘knowledge society’ which had provoked Drucker’s prediction (below, p. 218). In 1998, two writers on the subject already referred to a ‘knowledge boom’. Since the year 2000, the trend has become still stronger, reflected not only in publications but also in research programmes, especially though not exclusively in the German-speaking world.

This book can be read either by itself or as a continuation of *Knowledge from Gutenberg to Diderot* (I hope before long to produce a revised version of both volumes under the title *From Gutenberg to Google*). Its origins were in personal curiosity, in an attempt to answer the question, ‘by what paths did we reach our present state of collective knowledge?’ At a time when retirement liberated me from professional ‘periods’ and ‘fields’, it was easier than before to indulge this curiosity.
Introduction

Continuing *Gutenberg to Diderot*, this volume offers a general view of changes in the world of learning from the *Encyclopédie* (1751–66) to Wikipedia (2001). Its main themes are processes, among them quantification, secularization, professionalization, specialization, democratization, globalization and technologization.

However, countervailing trends should not be forgotten. Indeed, if this essay has a single thesis, it is the importance of the coexistence and interaction of trends in opposite directions, an equilibrium of antagonisms that tips over into disequilibrium from time to time (below, pp. 176, 211, 250). The nationalization of knowledge coexists with its internationalization, secularization with counter-secularization, professionalization with amateurization, standardization with custom-made products, specialization with interdisciplinary projects and democratization with moves to counter or restrict it. Even the accumulation of knowledge is offset to some degree by its loss (below, ch. 5). Only technologization seems to march onwards without encountering serious opposition.

Histories of aspects of knowledge, like histories of much else, are generally written within a national framework that often gives readers an exaggerated impression of the achievements of citizens of that country. Take the case of polar exploration: in this context, the British think of Robert Scott and Ernest Shackleton, the Americans of Robert Peary, the Russians of Otto Shmidt, the Norwegians of Fridtjof Nansen and Roald Amundsen, the Swedes of Alfred Nathorst, the Finns of Adolf Nordensköld and the Danes and Greenlanders of Knud Rasmussen. In an attempt to compensate for national biases, this study adopts an explicitly comparative approach.

The book focuses on the West, trying not to confine itself to the ‘Big Five’ – Britain, France, Germany, Russia and the USA – but to bring the rest of Europe and also Latin America into the story, at least from time to time. For example, a small country such as the Netherlands has produced a considerable number of studies about the history of its own knowledges – colonial knowledge, the history of science, the history of museums, and so on.

Many excellent monographs have been published on aspects of the vast topic surveyed here, especially in the case of the history of science. Most of these monographs are confined to the history of a single academic discipline. Here, however, I adopt a comparative approach in order to escape disciplinary biases as well as the national biases mentioned above. What follows is an attempt at a general synthesis, a work of distillation or, more exactly, of what a historian of science called ‘raiding, rearranging and sometimes revising the
works of my fellow historians’. Plugging holes is another aspect of the task, since some topics have received much less scholarly attention than others. So is making connections between developments in different places or in different fields.

The point is to present a big picture of a kind that is often invisible to specialists, a picture that includes a general description of specialization itself. This big picture of the period c.1750–2000 will be defined by contrast to the early modern period, c.1450–1750, on which I have worked for most of my academic life. However, continuities between early and late modern will not be forgotten, among them contemporary awareness of the problem of what is now known as ‘information overload’. My hope is to encourage dialogue between two kinds of scholar who do not often speak to each other: historians of the early modern and late modern periods.

The book’s title raises two questions that require a preliminary discussion. What is social history? What is knowledge?

Social Histories

In the first place, the term ‘social’ is obviously a problematic one. It is employed here primarily to distinguish what follows from a general intellectual history of the period 1750–2000.

The individual thinkers that loom large in intellectual histories will not be left out – they did indeed make a difference, and nearly eight hundred of them will be mentioned in the following pages – possibly too many for some readers, but a counterpoise to the faceless abstraction of general trends. All the same, the protagonists of this study are what sociologists call ‘knowledge-bearing groups’, especially but not exclusively small, face-to-face groups, and ‘knowledge-generating institutions’, understood as groups of people who meet regularly in pursuit of common aims, following rules that produce different social roles, from bishop to professor and from prime minister to CEO.

Where the Polish sociologist Florian Znaniecki wrote of ‘the social role of the man of knowledge’, this essay will be concerned with the many social roles of knowledgeable people, roles produced by such knowledge organizations as universities, archives, libraries, museums, think tanks, learned societies and scientific journals. The processes by which knowledge is institutionalized will also be discussed.

Ideas will not be omitted from this study – institutions cannot be understood without them – but their external rather than their
Introduction

internal history will be privileged, intellectual environments rather than intellectual problems. The emphasis will fall on the Institute of Advanced Study at Princeton, for example, of which Albert Einstein was once a member, rather than on his theories of relativity, and on Edward Thompson’s critique of the University of Warwick rather than on his study of the making of the English working class.

Attention will also be paid to small face-to-face groups, whether as teams or as competitors, since these groups often do the work for which a single individual receives the credit. Despite the myth of the heroic explorer, for instance, by the late nineteenth century, if not before, ‘the agents of exploration were groups, not individuals’. Again, in the course of the period, laboratory research was increasingly carried out by teams.

In short, what follows is a social history in the manner of earlier social histories of archaeology, for instance, of anthropology, cartography or medicine. Alternatively, the book may be described as a historical sociology of knowledge. Like the sociologists, it emphasizes the fact that knowledge is situated, in contrast to the traditional view of scholars as remote from the world, in laboratories, observatories, libraries and other ivory towers. Scholars do need ‘a space of their own’ in order to work without distraction, but this remoteness is only relative. They take the world, including politics, into the lab with them, while their results are often used, as chapter 4 describes, for worldly purposes.

The book might therefore have been entitled, like one of its sections, ‘a political history of knowledge’, were it not for the fact that its aim is wider, with the term ‘social’ acting as an umbrella covering economic and political history as well as social history in a narrower sense. Another possibility was to call the book ‘a historical ecology of knowledge’, given its concern with competition for resources, with differentiation and with favourable environments or niches for particular institutions, disciplines, or kinds of scholar such as the polymath (below, pp. 161ff.).

A third possible title was ‘a cultural history of knowledge’. The phrase ‘cultures of knowledge’ (or ‘epistemic cultures’, in German Wissenskulturen) is increasingly current and it is surely useful, reinforcing as it does the idea of knowledges in the plural. What follows is often concerned with practices such as observing, mapping or taking notes, practices that may equally well be described as cultural or social. All the same, the emphasis on institutions seems to require the term ‘social’, which has the additional advantage of evoking the tradition of the sociology of knowledge, now nearly a century old.
Knowledges

The second question, ‘what is knowledge?’ sounds uncomfortably close to the question asked by ‘jesting Pilate’, who, according to Francis Bacon, ‘would not stay for an answer’: what is truth? A first step might be to distinguish knowledge from what the Polish anthropologist Bronislaw Malinowski called ‘the brute material of information’. ‘We are drowning in information’, we are told, but ‘starved of knowledge’. We may become ‘information giants’, but risk becoming ‘knowledge dwarfs’.

Borrowing a famous metaphor from another anthropologist, Claude Lévi-Strauss, it may be useful to think of information as raw, while knowledge has been cooked. Of course, information is only relatively raw, since the ‘data’ are not objectively ‘given’ at all, but perceived by human minds that are full of assumptions and prejudices. However, knowledge is ‘cooked’ in the sense of being processed. The processes, discussed at length in chapter 2, include verification, criticism, measurement, comparison and systematization.

Knowledges or knowledge traditions should be imagined in the plural, as they already were by the philosopher Michel Foucault in the 1970s, although they are still often regarded as singular, a familiar part being taken for the whole. To quote Drucker again, ‘We have moved from knowledge to knowledges’. London taxi-drivers who speak of ‘the knowledge’ when they mean the topography of the capital are far from the only people to share the assumption maliciously attributed to Benjamin Jowett (Master of Balliol College Oxford) that ‘what I don’t know isn’t knowledge’. Knowledges may be divided into explicit and implicit (or tacit), pure and applied, local and universal. Although histories of skills are rarely written, ‘Knowing how’ clearly deserves a place alongside ‘knowing that’. In similar fashion, dominated or subjugated knowledges (savoirs assujettis) deserve a place alongside rather than underneath dominant ones. There is a political aspect to the question, ‘what is knowledge?’ Who has the authority to decide what is knowledge?

This book is concerned mainly with academic knowledge, as it is with knowledge in the West. A more exact title would therefore be ‘a social history of western academic knowledge’. The problem is that, besides being rather cumbrous, such a title gives the false impression that this kind of knowledge will be treated in isolation.

In fact, interaction between different knowledges is a central theme of this study. Hence the recurrent references to detectives and
spies, for instance, or to governments and corporations, as well as the
discussion of the links between new academic disciplines such as
chemistry, economics or geology and the practical knowledge of
apothecaries, merchants, miners, and so on. For example, Adam Smith
was a member of the Political Economy Club in Glasgow, and his
famous *Wealth of Nations* (1776) benefited from the author’s conversa-
tions with its merchant members. Indeed, it has been argued that
the development of economics in Britain happened ‘largely without
benefit of academic or other forms of official recognition’.22

Again, the frontier between academic and intelligence work was
often crossed, especially though not exclusively in wartime. In the
USA, the wartime Office of Strategic Services recruited a number of
professors (below, p. 119). In Britain, Peter Russell, best known for
his distinguished contribution to Spanish studies, joined the secret
services in the 1930s, while the art historian Anthony Blunt worked
for both MI5 and its Soviet equivalent, the NKVD.

Turning to geography, despite its focus on Europe and the
Americas, the book discusses other parts of the world, such as
nineteenth-century Egypt, China and Japan. Such a discussion is
necessary because western knowledge spread outside the West in this
period – although the term ‘spread’, implying that what moves does
not change, is not the most appropriate one. It is more realistic to
think in terms of an active reception in which individuals and groups
beyond the West appropriated and adapted western knowledge for
their own purposes. In the second place, the world beyond the West
needs to be discussed because there was traffic in the opposite direc-
tion, the importance of which has been recognized – in the West –
only relatively recently. Explorers, for example, in this period as in
early modern times, depended on indigenous guides and maps. So did
botanists, linguists and other scholars, even if they presented the
resulting ‘discoveries’ as their own.23

It is obvious that the subject is a vast one, difficult to confine in a
volume of some hundred thousand words, and I can only hope that
readers will not feel that I have contributed to information overload
as well as discussing it. A brief outline of a vast topic, it privileges
relatively sudden discoveries at the expense of the slow and patient
accumulation of knowledge that leads gradually to major shifts of
interpretation. It is equally clear that this book is written from a
personal point of view. My own knowledge of knowledge is, to say
the least, uneven, and I have often been torn between a desire to do
justice to the natural sciences and an attraction to case studies in
fields that I know better, from art history to anthropology. The
approach is all the more personal because I have lived through and
been involved in changes in knowledge regimes over the last half century, 20 per cent of the period covered by the book, viewing these changes from the perspective of one discipline – history – and three sites: the universities of Oxford, Sussex and Cambridge.

In other words, what follows, despite its length, should be regarded as an essay, impressionistic in its methods and provisional in its conclusions, making no pretence to cover the ground of its vast subject but rather to offer a bird’s-eye view. In a sense it is a sequence of essays. The first four chapters focus on the processes of gathering, analysing, disseminating and employing knowledges, emphasizing the historicity of activities that are often assumed to be unchanging. Chapters 5 and 6 attempt to counter the common assumption of the continuous progress of knowledge, or ‘advancement of learning’, recognizing the problematic aspect of accumulation. Chapters 7 and 8 examine the history of knowledge from geographical, economic, political and sociological points of view, while the final chapter makes more explicit the book’s essential concern with change over time.

Specialization has affected the historiography of knowledge as well as its history. The history of science, for instance, is an autonomous department in many universities. Again, an International Intelligence History Association has been founded (1993), together with a Journal of Intelligence History (2001). The secondary literature on the history of knowledge is itself organized for the most part either by nations or by disciplines. By contrast, the aim and indeed the justification for this essay is to cross frontiers – national, social and disciplinary – bearing in mind E. M. Forster’s advice ‘Only connect’, and trying to evade what Aby Warburg called the intellectual ‘border police’ in the hope of producing a polyphonic history of knowledges, a history viewed from multiple perspectives.

Although this book is not concerned with recommending a particular attitude to knowledge, let alone a policy, readers should be warned that its author is a pluralist in the sense of believing that knowledges in the plural, like opinions, are desirable, since understanding emerges from intellectual dialogue and even conflict.
Part I
Knowledge Practices
A social history of knowledge obviously needs to be concerned with the ways in which different groups of people acquire, process, spread and employ knowledge, a sequence that in the world of intelligence – in other words, spying – is sometimes divided into four main stages: collection, analysis, dissemination and action (or, for short, CADA).\(^1\) It is of course impossible to separate these stages completely.\(^2\) Collecting or observing is not done with an empty head. As the anthropologist Clifford Geertz put it, ‘In the study of culture, analysis penetrates into the very body of the object’, a point that has been reiterated if not exaggerated by scholars who speak of the ‘cultural construction’ of almost everything.\(^3\) Dissemination often involves analysis.\(^4\) The stages may seem to be timeless: each of them is situated in time as well as space.

These four stages will be discussed in order in part I of this book, introducing further distinctions along the way. This chapter focuses on the first stage, the process of collecting or gathering knowledge.

### Gathering Knowledge

Vivid metaphors such as ‘collecting’ or ‘gathering’ knowledge conjure up an obviously oversimplified picture, as if knowledge could be picked up like shells from the seashore or pulled from bushes and trees like fruit or netted like butterflies. A similar point might be made about the metaphor of ‘hunting’ or ‘capturing’ (a favourite in today’s management studies).\(^5\) These terms are used here as no more than shorthand for a series of processes that include exploring,


Knowledge Practices

observing, surveying and experimenting, not to mention buying, looting and, not least, asking questions and listening to local informants.

In academic language, these processes are described as doing ‘research’. Employed on occasion before 1750, the term became increasingly common in book titles from the mid-eighteenth century onwards in a number of European languages – recherches, ricerche, Forschung, and so on – to describe investigations in a variety of intellectual fields, among them anatomy, astronomy, political economy, demography, geography, physics, chemistry, palaeontology, medicine, history and oriental studies. To cite only a few famous examples:

1768 de Pauw, Recherches philosophiques sur les américains
1788– the journal Asiatic Researches
1794 Lamarck, Recherches sur les principaux faits physiques
1799 Davy, Researches, Chemical and Philosophical
1812 Cuvier, Recherches sur les ossements fossiles
1838 Cournot, Recherches sur les principes mathématiques de la théorie des richesses

The examples mentioned above concern research carried out in archives, museums and laboratories, but others involved what we now call ‘fieldwork’, as in the obvious case of exploration. John Barrow, secretary to the British Admiralty, who was in a position to commission expeditions, published an account of some of them under the title Voyages of Discovery and Research in the Arctic Regions (1846). Explorers offer memorable examples of knowledge-gathering that have prompted reflections on the process by which knowledge is produced.6

The Second Age of Discovery

The amount of new knowledge gathered or collected in the first century of our period, 1750–1850, was staggering, especially the knowledge collected by Europeans about the fauna, flora, geography and history of other parts of the world. No wonder then that some historians speak of a ‘second great age of discovery’ in this period.7

The first age of discovery, from Vasco da Gama and Columbus onwards, had been marked by the extensive exploration of coasts. The second age extended the exploration of coasts to the South Seas and elsewhere, but it also involved the intensive exploration of the inte-
rior of Africa, North and South America, Australia, Siberia, Central Asia and elsewhere, filling in what Joseph Conrad famously called the ‘blank spaces’ on the map. One of these explorers, Alexander von Humboldt (figure 1), whose name will recur in these pages, has been described as ‘the German Columbus’.

An explorer has been defined by one of them, John Hemming, as ‘someone who penetrates beyond the world known to his own society, discovers what lies there, and returns to describe it to his own people’.

Hemming’s definition excludes some women (below, p. 238) as well as the many explorers who failed to return, but his emphasis on bringing back knowledge is in tune with the aims of this book.

The stories of the difficulties, the successes and the tragedies of the explorers lend themselves to heroic narratives, and they have been told again and again. Among the most famous names are James Cook and Louis-Antoine de Bougainville in the South Seas, Mungo Park and David Livingstone in Africa, Meriwether Lewis and William Clark in the western United States, Alexander von Humboldt in South America, Robert Burke and William Wills in Australia, Alexander von Middendorff in Siberia and Nikolai Przhevalsky in Central Asia. Today, the contributions to knowledge by these explorers are receiving increasing emphasis.

Humboldt, for example, together with his friend the botanist Aimé Bonpland, spent five years exploring Spanish America (1799–1804), climbing mountains (including the volcano Mount Chimborazo) and travelling along rivers (the Orinoco and the Amazon). Out of this expedition came contributions to geology, botany, zoology (the study of electric eels, for instance), meteorology and a number of other disciplines (more exactly, as chapter 6 will explain, contributions to what would later become disciplines).

However, there were many more explorers of the period who achieved less fame. Frenchmen and Germans as well as Britons investigated the interior of Africa: René Caillié, for instance, who responded to the challenge of the Société géographique de Paris and reached Timbuktu in 1828; Pierre de Brazza, after whom Brazzaville is named; Henri Duveyrier, who explored the Sahara desert at the age of nineteen; Duveyrier’s friend the German geographer Heinrich Barth, another explorer of the Sahara; and the German botanist Georg Schweinfurth, who discovered the Azande of Central Africa.

In the South Seas, alongside famous figures such as Cook and Bougainville, Jean-François de La Pérouse, Nicolas Baudin and Matthew Flinders all led voyages of discovery. Baudin, for instance, embarked on his voyage round the world from 1800 onwards, among other things to map the coast of Australia, with the support of a major
Figure 1: Alexander von Humboldt, statue in Berlin by R. Begas (1883) Photo by Adam Carr (2006).
learned society, the *Institut de France*, and the help of some savants aboard, including astronomers, botanists, mineralogists, zoologists and a medical man who also functioned as what we would call an ethnographer.

Russian and North American explorations of the interior of these vast countries ran in parallel, with the Russians moving eastwards and the Americans westwards. Between 1803 and 1806, Meriwether Lewis and William Clark, chosen by President Jefferson to lead the ‘Corps of Discovery’, travelled from Pittsburgh to the Pacific Coast and back, exploring two-thirds of North America. Lewis described the planned expedition as ‘about to penetrate a country at least two thousand miles in width, on which the foot of civilized man had never trodden’. Clark did the surveying and mapping, while Lewis was responsible for natural history.

The explorers found animals unknown to western science, such as prairie dogs, the plains horned toad and the eastern woodrat, and they sent back botanical, zoological and mineral specimens. Lewis and Clark were also instructed to learn the names of the Indian tribes that they encountered, their languages, occupations, tools and customs. They described the Sioux, the Shoshones and the Nez Perce, and returned with some vocabularies of Indian languages.12

Descriptions of their achievement have not always done justice to the role of indigenous informants such as Sacajawea (below, p. 205) in orienting their expedition, as well as ‘the Native American geographic knowledge encoded into the various maps that informed and guided their journey’.13 All the same, the achievement of Lewis and Clark, like that of many other explorers, was considerable and allowed scholars to see the big picture – in this case the whole American West – that locals lacked.

In Russia, the Geographical Society, the Academy of Sciences, the Russian Ethnographic Museum and other institutions organized expeditions to map and explore distant parts of the empire, including Siberia and the Arctic. The German scholar Peter Pallas was sent to Siberia by Catherine the Great to investigate its natural resources (1768–74); the Russian botanist Mikhail Adams conducted research there (1806); the Norwegian Christopher Hansteen went to Siberia to study the magnetism of the earth (1828–30), while Alexander von Humboldt also paid a visit (1829).

However, the first major scientific expedition to Siberia was that of the zoologist Alexander von Middendorff (1842–5), funded by the Russian government and supported by the Russian Academy of Sciences in order to study organic life in an Arctic environment. In fact, Middendorff did much more than this, leading what has
been called ‘the most outstanding Russian scientific expedition of the nineteenth century’, and throwing his net as widely as Lewis and Clark had done in the American West. Middendorff and his small team mapped the region, studied the climate, measured the soil temperature, and collected not only specimens of flora and fauna but also the tools, songs, stories and vocabularies of the indigenous peoples, among them the Ostyaks, the Yakut and the Tungus. Russian expansion into Turkestan resulted in a series of geographical, archaeological and ethnographic expeditions to Central Asia led by Nikolai Przhevalsky (1872), Samuil Dudin (1900–2), and others. Central Asia was finally mapped by the Swedish geographer Sven Hedin following a series of expeditions between 1894 and 1908.

**Scientific Expeditions**

On land and at sea, major contributions to knowledge, especially the knowledge of geography, were made by individuals with no claim to be scholars, the explorers themselves, with the aid – often unacknowledged – of some of the indigenous inhabitants of the region they were exploring.

However, there was an important difference between the first and second ages of discovery. The ships of the first age had carried soldiers, merchants, missionaries and administrators. Those of the second age, an age of increasing specialization (discussed below, pp. 160ff.), also carried astronomers, naturalists and other scholars. There was an increasing number of what we would call ‘scientific’ expeditions, organized partly or even primarily to gather knowledge not only of sea routes of strategic, political or economic significance but of the natural world in general and (less frequently) of different cultures.

It has sometimes been suggested that the scientific expedition was invented at the end of the eighteenth century. This suggestion passes over early modern parallels such as the case of Francisco Hernández, physician to King Philip II of Spain, who was sent on a seven-year mission (1571–8) to Mexico and the Philippines in order to study medicinal herbs. All the same, it is surely correct to date to the late eighteenth century the rise of the scientific or knowledge-gathering expedition as an organized and recurrent phenomenon – in other words, an institution.

In the case of voyages of exploration, the names of some of the ships suggest the importance of scientific concerns, at least at the level of self-presentation. James Cook sailed in the *Discovery*, Alessandro Malaspina in the *Descubierta*, La Pérouse in the *Astrolabe*, Baudin
in the *Naturaliste* and the *Géographe*, and Flinders in the *Investigator*, while the French expeditions to the Pacific (1792) and the Arctic (1835) sailed in the *Recherche*.

Knowledge-gathering was included in the instructions to the captains, and a team of scholars might be taken on board. For example, an astronomer travelled with Captain Cook on his first voyage, when the Royal Society commissioned him to observe the transit of Venus across the sun, due in 1769. The ship also carried the botanists Joseph Banks and his Swedish colleague Daniel Solander (hence the name ‘Botany Bay’, given by Cook to what is now part of the city of Sydney). In similar fashion, La Pérouse received detailed instructions from the Geographer Royal and the Academy of Sciences about what knowledge to gather. He took ten scholars with him, among them astronomers, geologists, botanists and zoologists – not counting artists, who were commissioned to record the landscapes, fauna, flora and indigenous inhabitants of the places visited. 17

In the tradition of Philip II and Hernández, Spain launched over sixty expeditions in the eighteenth century, mainly botanical expeditions to the New World, while France launched even more. They include the expedition to the Orinoco (1754–61); the Franco-Spanish expedition to Peru (1777–88); the expedition to New Granada, now Colombia (1783–1808); and the expedition to New Spain, now Mexico (1787–1803).18 In other words, although Humboldt’s expedition to Spanish America attracted more international attention and produced discoveries in a wider variety of fields, it was far from the first or even the most protracted.

**A Third Age of Discovery?**

A concentration on the century that runs from the 1760s to the 1860s, or from Cook to Livingstone, leaves out some of the most epic narratives of the battle between explorers and harsh environments, in the Arctic and Antarctic (though Captain Constantine Phipps had made an expedition to the North Pole as early as 1773). Here too the search for knowledge is an important part of the story. In 1895, the Sixth International Geographical Congress declared that ‘the greatest piece of geographical exploration still to be undertaken’ was in the Antarctic, and that it would result in ‘additions to knowledge in almost every branch of science’.19 The famous chemist Dmitri Mendeleev urged the Russian prime minister to support the ‘conquest’ of the North and South Poles for the sake of the ‘triumph of knowledge’.20 Nansen was a zoologist and an oceanographer. Nathorst
was a geologist and a paleobotanist. On Amundsen’s Arctic expedition of 1918–25, a geophysical observatory was erected on the ice.

As the North and South Poles were reached at last, there seemed no part of the world left to conquer or at least to explore, and in 1904 the British geographer Halford Mackinder announced with regret what he called the end of the ‘Columbian’ era and the coming of ‘closed space’.

However, another frontier was opening: the world under the sea. Deep sea exploration began with the expedition of the British ship the *Challenger* (1872–6; figure 2), which made a geological map of the ocean floor, measured the temperature of the water at different depths and discovered some 4,700 previously unknown forms of marine life. From the 1930s onwards, deep sea exploration was undertaken by scientists in specially designed submersibles with large windows for observation – the bathysphere (lowered from a ship on a cable) and the bathyscaphe (which was self-propelled).21

After land and sea came the exploration of space, the ‘third great age’ of discovery.22 The launch of the artificial satellite Sputnik by the Russians (1957), closely followed by the foundation of the American National Aeronautics and Space Administration (NASA, 1958), was supposed ‘to advance fundamental scientific knowledge’ as well as national prestige. The name of the American space shuttle *Challenger* (in service 1983–6) paid homage to the nineteenth-century ship.

As in the case of polar exploration, the epic quality of the exploits of Yuri Gagarin and Neil Armstrong (not to mention the tragedy of the astronauts who died in accidents) has overshadowed the knowledge acquired in the course of the many missions carried out by manned and unmanned spacecraft: the collection of geological samples from the moon, for instance, the study of oceanography by means of instruments in space, the transmission of data to earth from Venus, Mars, Jupiter, Saturn, Uranus and Neptune and, recently, the analysis of soil from Mars, collected by the Phoenix space probe (2008).23

**In Search of Past Cultures**

A few expeditions in search of knowledge were concerned less with nature than with culture, past and present. An early example was the Niebuhr expedition to Arabia (taking in modern Egypt and Syria) between 1761 and 1767. Suggested by the German biblical scholar Johann David Michaelis, in order to throw light on the peoples described in the Old Testament by studying them in their own envi-
Figure 2: HMS *Challenger* (1858)
ronment, the expedition was financed by the king of Denmark and included the German surveyor Carsten Niebuhr and a Swedish botanist, Peter Forsskål, as well as a philologist and an artist. The fate of the majority of the participants was as tragic as that of many explorers in Africa or the Antarctic, though Niebuhr himself survived to publish a famous description of Arabia, offering new information about local customs and languages and the sculptures remaining in the ruins of Persepolis. The one-man expedition of the philologist Rasmus Rask, who visited Sweden, Finland, Russia, Persia and India in search of manuscripts (1816–23), was also financed by a Danish king.

A generation later, the Niebuhr expedition was dwarfed by the more than 150 scholars who accompanied Napoleon’s army when the French invaded Egypt in 1798. Following this model, a Mission scientifique de Morée (1828–33), appointed by the Institut de France, accompanied the French army when it intervened in the Greek War of Independence. Again, what was officially known as the ‘scientific exploration’ of Algeria was carried out between 1841 and 1843 on behalf of the French government. Some scholars also accompanied the French army that intervened in Mexico in 1862 in support of the emperor Maximilian. The uses of knowledge in the construction and maintenance of empires will be discussed further in chapter 4.

Some of the scholars accompanying the Egyptian, Greek, Algerian and Mexican expeditions were archaeologists. A number of remarkable discoveries of the material remains of past civilizations had already been made in the eighteenth century, including the ruins of the ancient Roman cities of Herculaneum (1738) and Pompeii (1748) and the Mayan city of Palenque in Mexico (1773).

However, many of the most famous archaeological expeditions and excavations date from the middle and late nineteenth century. The ancient Assyrian city of Nineveh was excavated by the English diplomat Austin Layard (1845 onwards), the city of Troy (near Hisarlık in Anatolia) by the German Heinrich Schliemann (1870–). Sumerian civilization was discovered by the French archaeologist Ernest de Sarzec at Telloh in Iraq (1877–). A number of ancient sites in Egypt were excavated by the Englishman Flinders Petrie (1880–). The city of Babylon was excavated by the German Robert Koldewey and the palace complex of Knossos in Crete by Arthur Evans (both from 1899 onwards).

Spectacular discoveries remained to be made in the early twentieth century. The civilization of the Hittites began to be uncovered from 1906 onwards in excavations at Boghazkoi in Anatolia. The