BOOK REVIEWS

MINERALS, LANDS, AND GEOLOGY FOR THE COMMON DEFENCE AND GENERAL WELFARE, Volume 1, Before 1879, 331 pages (1979) ($11.00); Volume 2, 1879-1904, 407 pages (1980) ($11.00); Volume 3, 1904-1939, 479 pages (1986) ($22.00); by Mary C. Rabbitt: United States Government Printing Office.

Twenty years ago, tucked away in a corner of Nature, there was a fascinating but, I suspect, little-read article on the evolution of the MG car. Not you would think at first sight an appropriate subject for a scientific journal of the status of Nature, and even less as an introduction to a review of a major scholarly work on the history of the United States Geological Survey, but there are close similarities. Rowland (1968) was concerned to draw a parallel between natural selection and the evolution of different models of the MG car after its migration from Britain to the United States. In the genetic sense, it was all to do with gene-pools, selection pressure and the appearance of new species; in the commercial sense, it was about value for money, public interest, competition, performance and by what name it should be called. I had quite forgotten about the MG article until the ramifications of the evolution and revolutions of the USGS made the comparison very obvious. Few chapters escape without the guest appearance of the MG car hidden in one guise or another.

The history of the USGS is gradually unfolded in three splendidly illustrated volumes. Mary Rabbit has chosen to tell the story in chronological order, rather than building it round a series of major themes. She takes us through the historical background and the long period of conception supported by piecemeal handouts of Government and State funds which ultimately led to the birth of the USGS in 1879 (vol. 1), the excitement of what might be called the gold and silver era of the first 25 formative years up to 1904 (vol. 2), and the deceptively quiet middle age of the Survey from then until the beginning of the Second World War (vol. 3). A fourth volume, bringing the Survey up to the present day, is in process of completion.

By the 1830's, State Geological Surveys had been formed in most of the eastern States, but as is common among those who hold the purse strings though know little geology, they were viewed as temporary organizations and few survived. In 1859, the Comstock lode had been discovered in Nevada, the first successful oil well had been drilled in Pennsylvania, and the state of Colorado had been created. In that year too, as Mary Rabbitt shrewdly records, Darwin's Origin of Species was published. (One is tempted to ask which of the motives leading to these major events has had the greatest impact on mankind, the pursuit of greed, power, or intellectual curiosity?) In the following year, 1860, the State Survey of California was established, but the looming civil war led to the suspension of all the state geological surveys, with the exception of Illinois and California. Peace and the subsequent scientific exploration of the west, with its vast Federal lands, spectacular scenery and exciting geology, required a different organization. In one way it seems extraordinary, in another completely natural that the USGS should have been born out of a mixture of tariff laws passed with the intention of protecting industries dependent on mineral resources, of geographical and geological surveys intended for military purposes, of the planning for a Pacific railroad, and of a real public concern expressed over a century ago about the need to conserve the natural environment.

The scientific exploration of the West began in earnest in 1867. The Secretary of War(!) was authorized to direct a geological and topographical survey of the territory between the Rockies and the Sierra Nevada mountains. Clarence King was put in charge and, with a budget of $100,000 spread over three years, he was authorized to hire a scientific staff of eight (including two geologists, three topographers, two collectors and a photographer) plus the necessary camp men to explore an area roughly the size of Europe on either side of the 40th parallel. In that same year, F. V. Hayden was appointed to make a geological survey of Nebraska. For this more modest task he was allotted the sum $5000.

The great International Exposition held in Paris in 1878 provided an opportunity for many travellers to inspect the new Eifel Tower - and for the International Congress of Geologists to form two committees to consider the possibility of unifying colors and signs on geological maps and agree on a system of geological nomenclature. A century later, this elusive goal is being pursued with even greater vigour by many more committees which goes to prove, I suppose, that geologists are determined to resolve the problem! By contrast a committee of the National Academy of Sciences, formed later in 1878, considered a plan to survey and map the Territories. They reported unanimously on the 6th November 1878 - the date matters, as I shall show - with the recommendation that a United States Geological Survey and a US Coast and Interior Survey should be formed. That report was submitted to Congress on December 2nd 1878; it was debated in both houses and on March 3rd 1879 was approved in the House by 148 to 107 and in the Senate by 33 to 24; President Hayes signed the bill late that evening in the dying hours of the 45th Congress.

The USGS had been born with breathtaking speed and given a remit (I, vol. 1, p. 283) of spectacular brevity and clarity - to classify public lands and examine the geological structures, mineral resources and products; to deposit all collections (rock, mineral, fossil and archaeological) with the National Museum when no longer required for work in hand; and to publish maps, memoir and reports in octavo or where necessary quarto series, each with a print run of 3000. The entire legislation of less than one thousand words should be read by all geologists who strive to write good English; and be mandatory reading for those who do not! Committees occasionally can be effective.

Clarence King became the Survey's first Director and in two brief years had organized it into two divisions - Mining and General Geology. Thus, at the outset the Survey was mission oriented, but King's view of the purpose of the Survey soon became submerged in personalities and political infighting. Not surprisingly, his proposed programme of scientific activity for the Survey was considerably underfunded. King resigned and was replaced by John Wesley Powell in 1881 as the new Director - an action prophetically forecast by Hayden eight months previously in a letter to Archibald Geikie in Britain "I understand that the defeat of King's great plans has so disgusted him that he will resign soon and place Powell in the chair. Powell has been his devoted parasite..."

Powell's approach, now that he was in the driving seat, was completely different from that of King. Geographical and geological mapping were to be all important, as was examination of the problem of irrigating arid lands. Agricultural interests were to get more attention - indeed President Garfield had said much the same thing in his inaugural address a few days before Powell became Director! Science was to be pure rather than applied, and so certain programmes went into reverse. Mining was strictly for the miners; geologists had to take a broader philosophical view! And for the next thirteen years Powell's policies waxed and waned according to the whims of his political masters. Powell was able to report progress on geological nomenclature and cartography to the Bologna meeting of the International Congress of Geologists in 1881. In the following year he succeeded in suppressing the formation of a proposed bureau of mines being considered by a House Committee; instead, a geological map of the USA was commissioned and the budget was almost doubled. But the first necessity was an adequate topographical map and, so, by the autumn of 1882 more topographers than geologists were employed by the USGS!

Powell increasingly ran into political problems. A Joint Commission of Senate and House called for greater efficiency and economy in the operation of a number of governmental organizations including the USGS. A frightening shot was fired across the bows of the USGS in 1886 when a bill was filed which, had it been passed, would have effectively dismembered the Survey, including the sale of laboratories and the obligation of its scientific staff to publish at their own expense! In 1888, a proposal for an Irrigation Survey ran into hostile criticism concerning both the scheme and its proposed cost. It was eventually made law only after the proposed appropriation had been considerably watered down! 'I submit that this House ought not to enter upon a scheme involving so large an expenditure on the unsupported opinion of one man (Powell).' Being a Director was never meant to be a sinecure! Adverse comments on the financial affairs of the Survey continued in the years ahead.

Come 1894, with a deteriorating financial situation, Congress had had enough and on the flimsy pretext of requiring an operation for wounds, Powell resigned. The operation required one day in hospital! Powell had lost support: he was getting the Survey to do the wrong kinds of work: he had fallen out with the lawmakers: there was too much nepotism in the form of jobs for Congressional relatives: and he was not an efficient administrator. The mineral industsry required a more practical Survey. It got it after the appointment of Charles D. Walcott.

One week after the resignation of Powell, President Cleveland had sent to the Senate the nomination of Walcott as the third Director of the USGS. Once again the administration had lost no time! Under Walcott's leadership the Survey again became mission-oriented. Its purpose was to make scientific investigations to aid the economic development of the country - mining geology, geologic and topographic mapping, agriculture, mineral fertilizers, soils, problems of water supply and so on. The list seemed endless but the objectives were clear - to bring the Survey more into touch with the economic and educational interests of the country. Mapping was carried out in 21 States and included studies on coal, bauxite, iron, phosphate, gold and silver; work on irrigation, river measurements and searches for artesian wells were undertaken in areas ranging from California and Alaska to Alabama and Tennessee. The Survey carried out the first investigation of Alaska' gold resources in 1895, the year before the great discovery of gold in the Klondike. A geological and topographical survey of Alaska began in 1898; and it is fascinating to note from statistical records that while Alaskan gold may have made fortunes for individual prospectors, the increase in the wealth of the nation owed almost as much to the remarkable growth of the cement industry! Walcott also made it clear to the Survey staff that he expected that investigations that had been in progress for several years should be completed and published. Sadly the disease of 'Perish rather than publish' is still endemic among some scientists in this increasingly competitive world! Amidst all his activity Walcott even had time to arrange for permanent bronze bench marks to be sited as an aid to more accurate topographic surveying.

The Hydrographic Section was transferred from the Topographic to the Geologic Branch

and modified to cover engineering, geology and general reconnaissance work, and a new series of water-supply papers was started in 1896. That year, the discovery of gold in the Klondike River led to the start of a more systematic geological survey of Alaska. The Survey was obviously very much alive and responding to the perceived economic needs of the nation.

Walcott, befittingly an associate editor of the Journal of Geology, became involved in a poll on nomenclature, a subject of considerable importance to the Survey. That poll elicited the following splendid comment from G.K. Gilbert "teachers and geological surveys must have definite systems, and the task of making and remaking them is a sort of necessary evil." Walcott also tried to interest Congress in establishing a new national park - Teton National Park. It came to fruition - but not until 1929, two years after he had died.

By 1902 Walcott had also become Director of the Reclamation Survey and was by now one of the most influential scientists in Washington. In that year too the USGS started the annual Contributions to Economic Geology. But concern about conservation of forests and water was growing, and with it opposition to the success of geology for purely economic ends. The appointment in 1907 of James Garfield as the new Secretary of the Interior, took place amidst a growing dispute about public lands. The role of the USGS in this had been primarily scientific, without consideration of the political consequences. They were to come! Eight days after Garfield's nomination, Walcott resigned to take the post of Secretary of the Smithsonian Institution. In his place Garfield appointed a relatively unknown (except to Garfield) young man of 36, George Otis Smith - an unexpected choice. Smith was to remain as Director until 1930 and readers of Mary Rabbitt's narrative will be curious to know how he and the USGS were to fare in the long years ahead.

Smith inherited a Survey that was widely respected in Congress, capable of theoretical research, geological surveying, forest conservation and reclamation work. Smith's view appeared to be that the Survey should be a practical organization with a business policy for the public domain. Research was not to be encouraged. Not surprisingly Survey geologists left for more appealing work with better pay in the mineral industry, leaving the remaining staff to deal with economic matters as best they could. Later on when the oil industry realized that geologists could be helpful in finding black gold, there were further raids on the USGS, and the universities too were able to recruit. Eventually Smith said that he felt that he was the head of a high-class employment agency! For 20 years he presided over an essentially static budget, watching - if he were aware of it - the substantial growth in the funds made available to other competing Federal agencies. Mary Rabbitt blandly sums up Smith's stewardship by quoting from his introduction to the 50th annual report of the Survey and discreetly illuminating Smith's text with a photograph of the posterior of a large extinct titanothere (vol. 3, p. 314). Smith forecast that the hundredth report of the USGS (in 1980) would be a report of progress - to which Mary Rabbitt allows herself the luxury of the laconic comment that Smith's prediction that there would be a Geological Survey in 1980 may have been his greatest contribution to the organization! Smith had turned out to be a chauffeur rather than a driver!

Good fortune returned to the Survey with the election of Herbert Hoover as President of the United States in 1928. To start with, he was a Survey alumnus and he had a strong commitment to basic scientific research and to conservation measures for oil and water. Funds for the Survey rose markedly. Smith resigned within two years of Hoover's accession to become Chairman of the Federal Power Commission, and was succeeded by Walter Mendenhall who had previously served as his Chief Geologist. Although the country was in the depths of a depression there was now hope for a Geological Survey led by a man who, although of Smith's age, gave the appearance of being very much alive. Mendenhall saw the need for basic research and money was available to help him achieve that and develop the conservation program. Unfortunately, with the increasing depression, funds were cut again. House and Senate Appropriations committees savaged the Survey funding to less than 70% of what it had been the previous year. But work continued! Geologists of the calibre of James Gilluly and T.B. Nolan studied mining areas in Arizona and Nevada; W.W. Rubey, J.B. Reeside and others produced an important new stratigraphic code; ground-water investigations were carried out--all under a worsening economy.

President Franklin D. Roosevelt was inaugurated in 1933. Although further economies were required, scientific research was encouraged where it could be seen to help public works. Funds from the Public Works Administration eventually strengthened the Survey, shell-shocked by the dramatic fluctuations in funding over the previous five years. By 1936 the USGS was able to put 59 parties into the field with programs weighted towards economic geology. Mendenhall, however, was quite clear that there could be no applied science unless there was science to apply! America became more aware of its natural resources as war clouds gathered over Europe, and in 1939 a bill on strategic materials was passed that was to have its effect on the USGS in the years ahead. That will no doubt be a part of Volume 4!

The Survey was now 60 years old and under Mendenhall's guidance had become a successful arm of Government policy, with a capable staff and good research base. It had been born in an agrarian society which had changed rapidly into the most powerful industrial country in the world; born in a country whose natural resources were largely unknown, hidden in public lands which had not even been mapped topographically, including

vast areas of arid lands which had never been studied. How different from the long-established Old World! In Britain, for instance, tin had been mined in Cornwall since at least Roman times, William the Conqueror had made sure that private lands and possessions in England were recorded in the Domesday Book in the 11th century and the first English National Park (The Peak District) was designated as early(!) as 1950. Time has a more leisurely dimension in the Old World!

What impresses me so much about the USGS is the enormous range of the responsibilities that it had, or chose, to shoulder. Rocks yes, topographic mapping yes, but irrigation surveys, water flow measurements, forest management, reclamation, conservation, classification of public lands all assumed varying degrees of importance according to the whims of Government and Federal administration. Added to that were - and perhaps still are - the uncertainties over the annual budget determined by the antics of the Appropriations Committees where senators and representatives demonstrated their scientific skills in public debate and reflected the views of the electorate that kept them in the corridors of power.

Clear, creative writing and scholarship are the quintessence of Mary Rabbitt's work and are well exemplified in these three handsome volumes. But do spare a thought for the other kind of work that is so necessary in this history - choosing the hundreds of illustrations to illuminate the text and ensuring an appropriate caption, size and space for each. Many aspects of the work of the USGS and its staff, and the politicians (who are not shown at work), are seen in the illustrations, which range from line drawings, wood cuts and etchings to lithos, daguerrotypes and more modern photographs of practically every geological activity and product. Many of the illustrations are superb; some few, blurred and indifferent, are as often modern as old. All form an essential pictorial chronicle of the evolution of the USGS and in themselves are a major contribution to the history of the art of geology.

I have chosen to write this review round the theme of Drivers and Directions. Had I wished I could have used the excellent Notes and Indexes to record geological developments from Alabama to Alaska, trace the Survey's activities in oil and gold, catalogue the progress of geological mapping or applaud the policy over the creation of National Parks. The wealth of information and ease of access to it are most impressive. Minerals, Lands, and Geology for the Common Defence and General Welfare will certainly become the bible of the history of much of the land, water and geology of the United States and be heavily used as a reference book.

Sadly all three volumes are cursed with flimsy paperback covers. What you do about this must be your own choice. Mine lies within a mile of my home in a coal-mining village called Loanhead, where there is a small bookbinding firm by the name of A.S. Lumsden. At present, the firm has two major contracts, one to bind the facsimile reproduction of the Domesday Book in 11th century oak boards and the second to bind the facsimile reproduction of Audubon's Birds of North America in natural hide. I am sure that Mary Rabbitt will enjoy being properly bound in the company of William the Conquerer who classified land and Audubon who brought so much color to natural history in North America. She deserves it.

Reference

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TIME'S ARROW/TIME'S CYCLE: Myth and metaphor in the discovery of geological time. 1987, Stephen Jay Gould. Harvard University Press, Cambridge, Massachusetts, and London, England, xii + 222 p., hardbound. $17.50

In a geological context, Gould proposes, time has been conceived in two quite different ways: linear and circular. The concept of linear time envisions "an irreversible sequence of unrepeatable events," a view embodied in the metaphor "time's arrow." By contrast, "time's circle" has no direction: "apparent motions are part of repeating cycles," products of nature's timeless laws.

Gould believes that both of time's metaphors embody great intellecltual insight. In his words, time's cycle "seeks immanence, a set of principles so general that they exist outside time and record a universal character, a common bond, among all of nature's rich particulars. Time's arrow is the great principle of history, the statement that time moves inexorably forward...." In support of these propositions, he analyzes the concepts of time as interpreted from his critical reading of three texts: Thomas Burnet's Sacred Theory of the Earth (1680-1689), James Hutton's Theory of the Earth with Proofs and Illustrations (1795), and the first edition of Charles Lyell's Principles of Geology (1830-1833).

Burnet conceived that our planet is in its fourth stage of development. From an original chaotic jumble of particles, a perfectly smooth paradisical earth had emerged. Its crust foundered, waters rushed up from below to cause Noah's Flood and then on retiring left the world in its present ruinous state. Guided by Scripture, Burnet predicted that the earth will pass through two more stages before turning into a star. First it will be consumed by fire, and then, as the soot and ashes settle, it will again become perfectly smooth.

Gould interprets Burnet's account of the

earth's history as a fascinating mixture of time's arrow and time's cycle. The concerns of time's arrow dominate the text. But "the arrow moves forward within a framework of repetition that forms the signature of inherent order and good sense in the cosmos." A similar case is made for Steno's reconstruction of the geological history of Tuscany.

As for Hutton, Gould argues that he imposed "upon the earth, a priori, the most pure and rigid concept of time's cycle ever presented in geology." But in discovering "deep time," Hutton denied history. His endless cycles of destruction and renovation of continents through the operations of a terrestrial heat machine lead nowhere.

The chapter on Lyell contains a detailed analysis of the Principles. Here Lyell is described as a "partisan thinker" who "constructed the self-serving history that has encumbered the study of earthly time ever since." His a priori commitment to gradualism has "acted as a set of blinders" on geologists. For years he denied that the record of fossils indicated progress in life's history. When finally converted to Darwin's views, he didn't accept evolution because the facts proclaim it, but because "evolution is the fallback position of minimal retreat from the rest of uniformity, once life's progress be admitted."

On the positive side, Gould acknowledges that the Principles was the most important, most influential, and most beautifully crafted work of 19th century geology. Lyell deserves his status as "the greatest of all geologists." He "shared Hutton's commitment to time's cycle, but not his ahistorical vision." Thus is he christened "Historian of Time's Cycle."

In addition to anlayzing the influence of temporal metaphors on geological thought, Gould aims to debunk the standard stories accepted by geologists for the discovery of time. He conceives that geologists still perceive Burnet as a villain, whose theory was tainted by theological dogmatism; Hutton as the founder of modern geology, who formulated his theory on the basis of patient fieldwork; and Lyell as the codifier of modern geology. Of course professional historians know better, but their views have not seeped through to working scientists, he claims. That disclosure will probably come as a shock to members of The History of Earth Sciences Society, to members of the History of Geology Division of the Geological Society of America, to the 121 members of the Canadian Committee on the History of Geological Sciences, and to the members of the International Commission on the History of Geological Sciences.

In his acknowledgments, Gould identifies some of the seemingly unrelated events that finally came together to shape his ideas on "the arrows of history and the cycles of immanence." These include his viewing of the skeletal remains of the Siamese twin girls from Sardenia, his perception of the relationship between Burnet's frontispiece and James Hampton's The Throne of the Third Heaven of the Nations' Millenium General Assembly, and the manifestations of time's arrow and cycle in glass and statuary at places of worship. The concluding chapter is an exercise in self-psychoanalysis that brings these disparate impressions into focus.

On reading this book, one wonders if a labored analysis of metaphors, such as presented here, is necessary to convey the idea that whereas the fundamental properties of matter and energy are assumed to be timeless, the configurational aspects of the earth and the assemblages of organisms upon it are forever changing. That seems to have been what Adam Sedgwick had in mind in 1831 when he accused Lyell of confounding "the immutable and primary laws of matter with the mutable results arising from their irregular combination."

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CARAVAN ACROSS CHINA: An American geologist explores the Northwest 1937-1938. J. Marvin Weller, edited by Hariett Weller, 394 p. March Hare Publishing Company, 1251 Dolores Street, San Francisco 97110, 6x9 inches, soft cover. $16.95.

Those who are accustomed to hopping down to the Antarctic for a week to collect a few samples will be bemused by this true story. Just as 1937 began, J. Marvin Weller took leave from the Illinois State Survey to investigate oil prospects in China for the Standard Vacuum Company and a syndicate of potential investors.

Five months after leaving home, Weller finally got off to the field. This interval was occupied by sea voyages, conferences, travel by increments to western China, but mostly just by waiting for permission to travel. Ten months later, he finally left China. One tangible result was discovery of the first oil well in western China, a critical element in the war against Japan.

Several times each week, Weller wrote home. His daughter has compiled his letters in a most satisfactory manner. Geologists take a secret pride in being good observers and clear writers; in truth, some are and some are not. For those who want a model of how to write a fine newsfilled letter, the prose herein is excellent. China has changed dramatically in half a century, but the bits and pieces I have seen leave no doubt that this is an exceedingly accurate and thoughtful account of life as it was in western China and southern Tibet.

With one other American oil company geologist and one Chinese geologist as the scientific staff, this was not a huge expedition. However, added to them was a Chinese intermediary and his servants, a number one boy, a number two boy, cook, sedan chair carriers (for the intermediary, not the

geologists), and occasional assorted trucks with drivers, horses, donkeys and camels. Add mud in large quantities and you get a mixture which Weller viewed with patience and wry humor.

This book does not contain detailed geologic observations, but there is sufficient geology to make it particularly attractive to those who study the earth. For those who have travelled in China, who want to travel in China, who are interested in the daily life and observation of a field man, or just want an interesting book to read, this is recommended.

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FROM PLANE TO SPHEROID -- Determining the Figure of the Earth from 3000 B.C. to the 18th Century Lapland and Peruvian Survey Expeditions, by James R. Smith, 1986, Rancho Cordova, Calif.: Landmark Enterprises, xv + 219 p., 45 fig. + 32 plates, index. ISBN 0-910845-29-8. $40.

From Plane to Spheroid is a delightful, informative, and well-illustrated history of important steps to resolve a complicated problem. The author wrote basically to commemorate the 250th anniversary of the French expeditions sent to Peru and Lapland in 1735 to determine the nature and extent of the flattening of the spheroid (or ellipsoid) representing the shape of our planet.

He begins with the earliest recorded conceptions of the Earth as a circular island on a plane; he describes the development of mathematics, astronomy, and related instrumentation through the centuries; and he ends with detailed chronicles of the persons and traverses involved in both of the expeditions mentioned. The numerous later readjustments of the "Figure of the Earth" and the concepts of datums and recentered ellipsoids are not mentioned, but this is a caveat, not a criticism.

The interweaving of technical details, including some equations, with appropriate minibiographies of numerous innovators from early Greeks through Asians to 18th-century western Europeans, keeps the technically inclined reader interested both academically and socially. This interest is aided by the short lengths (2-4 pages) of most chapters preceding the descriptions of the expeditions. Five of the 21 chapters are entitled "Astronomers and Mathematicians" with subtitles stepping through history from "pre-Eratosthenes" to Cassini I to Cassini III." More emphasis is given to the beginnings of triangulation not only in 1615 by Willebrord Snellius, the generally accepted originator, but also by Gemma Frisius and Tycho Brahe during the preceding century. Their respective triangulation networks are shown, redrawn complete with station names and recorded bearings.

The climactic expeditions described in the book resulted from the well-known controversy between the French Royal Academy of sciences and the English Royal Society over the shape of the Earth replacing the simple sphere. The French, led by Cassini, believed the Earth to be a prolate spheroid (lengthened at the poles) based on Cassini's measurements of various French portions of the meridian of Paris. The English believed the Earth to be an oblate spheroid, flattened at the poles to agree with Newton's theories of centrifugal force and gravity.

To resolve the dispute, the French Academy sent two expeditions to locations as near the North Pole and Equator as feasible to get more decisive measurements of changes in meridian curvature, thus obtaining the shape of meridians and therefore of the Earth spheroid. Half of Smith's book is devoted to these two hallmarks of geodesy. The group sent to Peru, actually present-day Ecuador, was led by Louis Godin. They left France in 1735 and generally returned in 1744, plagued by harsh weather, earthquakes, and even murder of the medical doctor. Pierre L.M. de Maupertuis led the Lapland expedition, operating near the Arctic Circle, beginning in 1735 and completing only 18 months later. Smith provides vivid accounts of the human stories as well as the details almost bit-by-bit of the survey data. Both groups accomplished their technical tasks, which also included studies of the effects of latitude and Andes elevations on refraction, gravitation, and the speed of sound.

The more quickly completed Lapland meridian measurements, combined with those determined earlier in France, confirmed Newton's theory of oblateness. The actual flattening was overestimated by Newton and slightly underestimated using the French measurements, but later refinement is another story.

The book has only minor flaws: There could have been more editing in several portions that are more appropriate as spoken story-telling. Some familiar numbers are slightly in error (for example, the presently accepted flattening has been about 1/298.26 for several years, not 1/297.4 as stated). Smith properly uses units of the era, such as toises for length, but it is difficult to find the proper conversions to modern units. These problems are not serious, and the book is recommended to a broad range of earth-science enthusiasts as a fascinating account of the gradual solving of a fundamental problem of geodesy and geography.

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HISTOIRE DE LA GÉOLOGIE, 1987, Gabriel Gohau. 259 pages, 5 1/4" x 8 1/2", paperbound. 89 Frence Francs. Éditions la Découverte: 1, place Paul-Painleve, 75005, Paris France.

The French have had an active program in the history of geology for

more than a decade, even if their work is not well known to Americans. The Comité Francais d'histoire de la géologie (COFRHIGEO) was founded in 1976, with Francois Ellenberger as a guiding force. Over the years COFRHIGEO members have produced a variety of valuable papers on particular individuals, concepts, and epochs in the history of the geosciences. These articles have been put together in annual packets, but until now there has been no real synthesis of recent French research on the broad sweep of geology's development.

Gabriel Gohau, one of the most active of COFRHIGEO's core, has now resolved that lacuna with his excellent HISTOIRE DE LA GÉOLOGIE (1987). The book is available in paperback and has fewer than 250 pages of text. As a consequence, the reader should not expect encyclopedic coverage of every person and event relevant to geology's growth to a modern science. Outweighing a potential lack of detail is Gohau's ability to tell a coherent and informative story as he moves from Aristotle to Harry Hess. The text is, of course, written in French for a French-speaking audience; although the narrative is beautifully presented, American readers with remedial or rusty French will want a good dictionary handy.

Of particular value to Anglophones, beyond brushing up on their language skills, is the insight and perspective gained by reading a contemporary French analysis of geology's evolution. Charles Lyell is there, but he is not the all-pervading hero of so many Anglo-American accounts. Descartes and Deluc get more pages of coverage than Darwin. Dana and Hall receive a sentence each, but the tectonic concepts of Elie de Beaumont, Emile Haug, Marcel Bertrand, and Eduard Suess are considered in richer detail. None of this is done in a narrow nationalistic way, and my point is not to introduce any arguments about depth of coverage -- rather it is to acknowledge the fact that Gohau presents a fresh account which should enrich the average Anglophone's appreciation of European contributions to geology.

One of the strengths of the book is that Gohau explains rather than recounts. A specialist in geology or in history may not find a particular hero or event in such a confined text, but most readers will be well served by the author's care in setting the broader intellectual context which surrounded an idea or a person. Even the specialist may be impressed with Gohau's ability to use concise language in order to include a surprising amount of detail. Because of my own interest in 18th-century geoscience, for example, I was attuned to the author's presentation of work from the late-17th-century theories of the earth to Hutton, Werner, and the birth of Lyell'sideas. Not only were most of the familiar names there, individual contributions were placed in a larger context. The importance of fundamental concepts such as Providence, the presumed role of the Deluge, Aristotle's lingering influence, and the desire to demonstrate natural Order were all explained in a well-structured manner.

HISTOIRE dates the birth of geological sciences from Steno's 1669 PRODROMUS, but that is not until the fifth chapter -- after Gohau has presented a wealth of information about ancient Greek, medieval, and Renaissance writings which shaped 17th-century worldviews. A nicely-linked narrative then carries the reader through chapters on mountain origin, Buffon, industrial demands on geology, subterranean fire, fossils, geochronologies, catastrophism, primordial time, breaking up of the crust, continental drift, and finally, the birth of ocean basins. Biographical sketches are spare, but often contain memorable elements. The language is clear and lively. Typographical mistakes are very rare (e.g., "gand" for "grand," and 108, not "198", in the Index as a page citation for Dana).

Of value for anyone using the book as an introduction to the history of geology is the attention given to such contemporary concerns as the danger of "precursuritis" (looking for simplistic steps to a modern theory) or the merit of placing an idea in its proper temporal/intellectual setting. Using the noachian Deluge as a prime agent of geologic change is one example. Late 20th-century geologists see no reason to call upon the Flood, but it was a critical element of many sincere and reasoned theories in the 17th and 18th centuries. Not only could an early 18th-century natural theologian explain aspects of the observed geologic record, it was deeply satisfying for him to see God's action manifested in the natural world.

Throughout HISTOIRE DE LA GÉOLOGIE the reader is treated to informative analyses of major themes or debates -- examples include actualism/catastrophism; continuous versus discontinuous geologic records; directionalism; and short as opposed to long chronologies for the earth. Some of the older Anglo-American dictums about the unimpeachable merit of Lyellian uniformitarianism are subjected to a bit of rational French criticism. Cuvier's belief in directionalism and discontinuity is shown, for example, to be a valid way to interpret then-existing data, and to be a more productive base for stratigrapahic paleontology than a Lyellian stady-state world of recycled life forms. Themes are not presented in an isolatd fashion, never to be mentioned again. For example, Gohou relates how the short chronologies of the 17th-century natural theologians have contemporary echoes in the U. S. Supreme Court's 1987 ruling that Louisiana is not justified in requiring equal teaching time for "Creation Science" and

evolution. Debates about whether nature presents a record of continuity or discontinuity are likewise traced from ancient times to the present. For example, can plate motion be translated continuously into the geologic past, and is a gradualistic or punctuated model the best way to describe evolutionary change in organisms?

Appendices include a Chronological Summary, Bibliography, Glossary, Geologic Column, Index, and 5-page Table of Contents (at the back of the book, as is typical of French formating). It is likely that only neophytes in geology or history will profit from most of the aids because they are, understandably in a brief survey, quite general and minimal. The Chronological Summary is designed for a French audience, so some of the major political tie-points may not ring bells for American readers. Citations in the text relate only to a title in the Bibliography; no page-number references are given even for direct quotations. The table of contents provides an excellent overview of the material to be covered and gives a clue to the organizational thought built into the work.

If you have been seeking a valuable summation of the history of geology, you will be very well served by this book. Whether French is your native language or a rusty tool, you should profit from reading what a recognized French scholar has to say about familiar and not-so-familiar people and themes. Gabriel Gohau has managed to be informative and stimulating at the same time. The book deserves a wide audience.

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GOLD AND OTHER STORIES AS TOLD TO BERRY RICHARDS, 1986. W. O. Kupsch and S. D. Hanson, eds. Saskatchewan Mining Association, 730 Avord Tower, Regina, Saskatchewan S4P 0R7, Canada, 307 p.

For me reading this book was a nostalgic experience and joy. As a landed-immigrant in Canada in the early to mid-1950's I lived and worked in northern Canada prospecting for mineral deposits, evaluating prospects, cutting lines, staking, preparing geologic and geophysical maps, and supervising drilling operations. I moved through the bush on snowshoes with pack on back in winter, or by bush plane which landed on pontoons in summer and on skis on ice in winter. This book, dedicated to prospectors, deals with the kinds of people I worked with. I could easily extend the tales and yarns spun in this volume. Taped interviews recorded the experience of 58 people involved in prospecting and mining in northern Canada, especially Saskatchewan. Berry Richards of Prince Albert, Saskatchewan, recorded the oral history of prospectors, miners, geologists, businessmen, and government officials who could recall "impressions, facts, fancies and, above all, stories about the activities of prospectors and miners." When Richards died, W. O. Kupsch, professor of geology at the University of Saskatchewan, took over the publication of this oral history for the Saskatchewan Mining Association and S. D. Hanson, university archivist, helped prepare the manuscript for publication.

The oral history is that of mining people involved in all aspects of mineral exploration and production; the tapes are on file in the archives of the Saskatchewan Mining Association. For the most part the stories record the experience of individuals in the bush. As the book notes "there is so much that is fortuitous in the history of mineral exploration that the reader should not expect to be presented with a smooth-running account. It will be found to be somewhat erratic, and not particularly chronological".

Numerous photographs of float planes, canoes, prospectors, mines, aerial and other views illustrate this volume, but not a single photograph shows a prospector on snow shoes. I will never forget my personal experience of a mid-winter staking on snow shoes with my field man Sam Bobowash. With my kind of background I particularly enjoyed the stories which bring these people to life in this book. An appendix serves as a memorial to James B. Mawdsley, and an interesting chronology of prospecting, exploration and mining makes up the final section of this book.

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NATURAL HISTORY MUSEUM PUBLICATIONS. BOOK CATALOGUE (Catalog of Publications), 1988. The British Museum (Natural History), London, England. 72 p.

This catalog lists and briefly describes new and forthcoming books in biology and geology. Of interest are Charles Darwin's Edited Notebooks and two books by H. B. Carter titled Sir Joseph Banks and Sir Joseph Banks Bibliography.

Sir Joseph Banks was one of the mentors of William Smith when Smith prepared his 1815 map of England, Wales, and parts of Scotland, and his Memoir to the map.

The Northeastern Science Foundation has Banks' original map and Memoir with Smith's beautiful handwritten dedication. A lithograph of Banks fronts the Memoir volume. Sir

Joseph Banks was a rich landowner who became President of the Royal Society at the age of thirty-five and who was an extraordinary example of a late eighteenth-century landed gentleman devoted to the well-being of his country.

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MEMOIRS OF A GEOLOGIST. FROM POVERTY PEAK TO PIGGERY GULCH. Harold T. Stearns, 1983. Hawaii Institute of Geophysics, Honolulu, U.S.A., 244 pp. $10.00.

Autobiographies of geologists are not numerous and have most commonly been written by one of two classes of geologists--vertebrate palaeontologists recounting with remembered pleasure their dramatic finds or economic geologists dwelling triumphantly upon the discoveries and deals that brought them wealth and power. Certainly there are a handful by geologists of other sorts--Cecil Barber's reminiscences of field work in Burma (Barber, 1978) and Francis Pettijohn's account of involvement in the development of sedimentology (Pettijohn, 1984)--but only a handful.

To this handful can be added what is surely the autobiography of one who, though working at times in a variety of other fields, was principally a hydro-geologist and engineering geologist. Though this is also a success story of the rags-to-riches kind, it is in his geological, rather than financial, attainments that the author properly takes pride.

Harold Thornton Stearns was born in Connecticut, one of a family of 11 children (nine surviving), with a father desperately involved in the day-to-day struggle to find food for his family yet striving nevertheless to educate him-self--and, one imagines, taking great pride in a son who achieved so much. It was a boyhood for Harold of few toys and much effort to supplement the family income by any available means. Chance finds of a beautiful mass of quartz crystals and of arrowheads made him into a keen collector, while an early visit to the Yale Peabody Museum brought awareness of the scientific side to collecting. His principal concern at first was archaeology; it was only after enrollment at Wesleyan University, Middletown, Connecticut that the advice of a professor caused him to concentrate instead on geology.

Stearns' first appointment was as Mineral Examiner at the U.S. General Land Office in Idaho; but from the outset he was working with the U.S. Geological Survey and he transferred to the Survey two years later. Already he had become involved in the hydrogeology of volcanic terrains and was soon involved in engineering geology also. His assignment to Hawaii in 1924 allowed him to augment his knowledge of both these fields and to gain a greater understanding of vulcanology. His account of the development of the special sort of wells known as "Maui-type" and "Lanai-type" is of particular geological and geotechnical interest.

A request from the U.S. Navy for a geological and groundwater survey of the island of Guam in the Marianas marked the beginning of wide-ranging studies under their auspices of Pacific island geology. During the Second World War, this work took Stearns to Samoa, the Ellice and Wallis Islands, Espiritu Santu, New Caledonia, Guadalcanal and Saipan, where he was perilously involved in the battle with the Japanese. He visited also Ascension Island in the Atlantic, producing a detailed geological map that was inexplicably classified by the authorities and, in consequence never published. He returned to work in Hawaii but, disillusioned by poor salaries and promotion prospects, resigned from the Survey in 1946.

Stearns had married in 1940--the first of multiple marriages, but always to the same wife, Claudia--and, at this point in his life, might well have settled in Canada. Indeed, he bought a lighthouse and surrounding land at Pilot Bay in British Columbia. However, there were frustrating delays in acquiring the title; and, instead, he and his wife settled in Idaho, buying a property on Poverty Peak. There they built a house, overcoming the obstacles of a postwar unavailability of building supplies and an overabundant wild-life destined soon, alas! to vanish as the region was developed. And there Harold was drawn into the consulting practice that was soon to make him rich.

By 1954 this practice had taken him several times back to Hawaii and he decided to acquire land there, buying the Piggery Gulch valley as a speculation for development. After many difficulties and much tiresome litigation, eventually this proved profitable (under the new, primmer name "Waipio Acres"!). Stearns's knowledge of Hawaiian geology led to several major publications, in particular his Geology of the State of Hawaii (1966), and a Research Associateship at the Hawaii Institute of Geophysics, publishers of this volume.

As do so many geologists when writing about themselves, Harold Stearns tends to veil from view his personal life. He says little about home life in childhood and almost nothing about those eight brothers and sisters. Though Stearns's wife gains much affectionate mention, we are told only a little about their children, in the very last pages. After learning that Harold could not "tolerate anything but classical music" (p. 18), it is a little startling to discover that he and Claudia were skilled and enthusiastic dancers, presumably to very different sorts of music!(p. 195). We learn nothing of his other interests outside the earth sciences; perhaps there were none. Although many readers will applaud such reticence as a dispensing with irrelevancies, my own desire to form a picture of "the whole man" causes me to find it rather frustrating; and I am grateful for the few personal glimpses that are afforded in these pages.

All in all, however, this is an exceptionally lucidly written and fascinating account of a geologist's life. Its relatively obscure publication has, no doubt, been the reason why it has received so little critical attention during the four years

following its appearance. However, it is still in print and deserves to be bought; I trust this review may help to bring it the wider attention it deserves.

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Decade of North American Geology -Centennial Field Guides. Volume 1. Cordilleran Section of the Geological Society of America, Mason E. Hill, editor; 490 p. Volume 5. Northeastern Section of the Geological Society of America. David C. Roy, editor; 481 p. Geological Society of America, $43.50 each. 81/2 x 11, deluxe binding.

These volumes, the first two released by the Geological Society of America, provide a useful summary of the entire series. Even though the original intent was to pick in each of the society's sections 100 localities important to the geology of that region, almost all are small areas, rather than individual spots. For each, location and accesibility is given, followed by a section on geological significance; headings vary slightly and, the standards were modified a bit among authors and volumes.

Occasionally the "significance" section dips into history of studies, but typically is concerned with current understanding of the geology. This part is then followed by an illustrated description of the site itself and the appropriate references. Number of illustrations and text length varies, though most hold close to the average of about five pages and two illustrations. Photographs, maps, and block diagrams are all used.

The hardest job, of course, was to select the localities, although getting all the pieces together must have been nerve-racking. The guide editors deserve our considerable thanks. I know the Northeast area moderately well and many of the sites that I would judge historically important are included. Which areas have been chosen and which have been ignored in each region are interesting to ponder, but it is clear that decisions were not made lightly.

In my view, the heart and soul of the history of geology lies in study of field investigations; these volumes are certain to find considerable use as secondary historical references. Regardless of their utility in that sense, for the working geologist, they will be invaluable and the decision to use sturdy binding which will stand up to field use was a wise one. For the individual geologist they may be an very wise investment. Absolutely, no geological library should be without this set.

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Boyle, R.W., Gold: History and Genesis of Deposits, 676 pp., 1987, Van Nostrand Reinhold. $49.95

It is not clear from the title of this book whether its subject is the history of gold and the genesis of gold deposits or the history of deposits of gold and of theories concerning their origin. The same ambiguity persists in the author's characterization of his objective, viz, - "the collections, sifting and analysis of landmark papers on the history and genesis of the deposits of the most noble of metals." In these terms, even ignoring the ambiguity of its title, the book is difficult to evaluate, primarily because in the natural sciences the term "paper" now has a fairly well-defined meaning which Dr. Boyle simply ignores. Eleven of the 18 chapters in his book are entirely the work of his own hand, and were prepared especially for this volume. They are thus not "papers" in the usual jargon sense of the term, and they are certainly not "landmark" papers, since prior to their appearance here no one has had the opportunity to read or be influenced by them. The same may be said of his multipage introductions to five of the other chapters. In sum, he himself is the author of at least 200 of the 662 pages in the book. Perhaps this is what he means by "sifting and analysis," but the bulk of his own contribution is not, or at least not primarily, an evaluation of the specific papers he includes in the book.

Of the 42 contributions by others, six are excerpts from general geochemistry texts or references, mostly well known and widely circulated. Another five are chapters or parts of chapters from monographs specifically devoted to gold, and in material prepared de nuovo for this volume Dr. Boyle quotes aptly and generously from another of these, his own monumental memoir on the geochemistry of gold. Though often neither novel nor primary, much of this quoted text and reference material is of high quality, and some of it is splendid. But none of it is drawn directly from the periodical and occasional journals most of us think of as the repository of "papers," and especially of "landmark papers."

On the whole, the contributions by Dr. Boyle rather outshine the competition; it seems a pretty safe guess that no one has known or cared as much about the subject since the days of del Mar, Emmons and Rickard. I particularly enjoyed Chapters 2 through 6, in which he traces the exploitation of gold deposits and the development of ideas concerning their origin through historic time. The non-specialist who races through these chapters, as I did on the first pass, makes a grievous error; they are to be sampled slowly or browsed through in leisurely fashion. His chapters on, respectively, the granitization (11), "exhalite" (12) and secretion (13) theories of the origin of gold deposits are admirably lucid and thorough. Comparing them to the rather mixed bag of other peoples' work, I found myself wondering why he didn't just go ahead and write his own book. (But then, of

course, he has; called "Geochemistry of Gold and its Deposits," it is Bulletin 180 of the Geological Survey of Canada.)

Footnotes or end references appear as in the original works. They are in some cases supplemented by the editor, whose own contributions are, of course, well documented. There is a very full and usually correct author citation index, and a disastrously inadequate and misnamed "subject index" which contains about as many author names as subject terms, and not many of either. (A first class subject index would have been a great boon to the casual reader, a category I think will include most users of the book.)

Of many of the papers only excerpts are given, usually introduced by annotation that is sometimes quite extensive. The annotation is often quite as informative as the excerpt, and where the latter has been reset it is rather disconcerting to discover only ex post facto that the passage from one to the other occurred some paragraphs ago. Sometimes, indeed, it is difficult to draw the line between annotation and assimilation. What is one to make, for instance, of reference to work published in 1951 incorporated in an essay certainly written before 1940 by a man who died in 1947? Dr. Boyle himself doesn't do this sort of thing, but in a work of this kind he should not quote from people who do.

For reasons already noted, I found the announced rationalization of the design and purpose of the book rather unpersuasive, and from the elegance of its cover was prepared to discover it was essentially a coffee table ornament. In fact, it is nothing of the sort. Rather, it is a curiously idiosyncratic work very large sections of which, chiefly those of which Dr. Boyle is author rather than merely editor - that is to say, the products of his "sifting" and "analysis" rather more than of his "collection" - require and richly reward careful study.

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Czerkas, S. J., and E. C. Olson, eds. 1987 Dinosaurs Past and Present. An exhibition and symposium organized by the Natural History Museum of Los Angeles County. Natural History Museum of Los Angeles County in association with University of Washington Press. Volume I, 180 pp., 55 color plates, 60 black and white illust. Volume II, 164 pp., 33 color plates, 100 black and white illust. Hard cover price, $35.00 per volume. Available in soft cover only at museums sponsoring the exhibition.

These volumes are first-class, from their dazzling covers, nice heft, and sound workmanship, to the high quality of their technical content and exposition. The story they tell, in six technical articles per volume, centers on the restoration to lifelike appearance of animals that no human has seen alive, but is not restricted to that process. It also includes the raw data from bones to footprints on which restoration is based, constraints encountered by the restorers, and significant elements of history, both of dinsaurs themselves and of the efforts to restore them. These volumes will be useful to all who are interested in dinasaurs, from the viewpoint of technology as well as of esthetics, for each article is carefully researched, rigorously argued, and includes a comprehensive technical bibliography. The story is not complete without both volumes, but if you are a little short this month, each can stand on its own, except that the Index and Table of Contents for both volumes is in Volume I.

The color plates and some of the black and white figures are representative of the exhibition. They are exquisitely reproduced and bring with them some of the pizazz of the show itself. In consequence, the publication cannot be reviewed without reference to the exhibition, and to me the most important point made by both is historical. Both reveal that the idea of dinosaurs as sprightly and active is not as new and revolutionary as much popular writing leads one to believe. It was clearly expressed, for example, as early as 1897, in Charles R. Knight's dramatic "cock-fight" rendition of Dryptosaurus. Even R. T. Bakker concedes that an "active" school of thought was influential early in the study of dinosaurs, though it went into eclipse until it was revived in the late 1960's, largely through Bakker's efforts.

I must take vigorous exception, however, to Bakker's patronizing treatment of C. W. Gilmore, whose influence he asserts is responsible for reducing dinosaurs to the leaden stereotypes of the 1920s and '30s. From 1909 until his death in 1944, Gilmore produced a steady stream of detailed information based on the U. S. government's share of the collections of O. C. Marsh, all seven boxcar loads of fossil bones and rock. Much of Gilmore's effort was devoted to "spadework," for the Marsh material that came into his hands had been studied only superficially or not at all, and so was essentially new to science. If it had not been for Gilmore's concentration on fine detail, and his skill and dedication in expounding it, today we would have far less reliable data from which to spin our daring extrapolations. To dismiss this work as "plodding adequacy" suggests a reluctance to accept the fact that what we accomplish depends on the spadework of our predecessors, however much we may deplore their conclusions. As for Gilmore's influence on the field, his activity must be viewed in context, which includes his equally productive contemporary, Charles R. Knight. Gilmore's output of life restorations was orders of magnitude smaller than Knight's, much of which was produced in critical consultation with such luminaries as H. F. Osborn, Barnum Brown, and W. K. Gregory.

Given the stature of Knight and his colleagues, and the assertiveness of Osborn, Brown, and Gregory, I find it much easier to believe that it was their influence, rather than Gilmore's, that produced the patterns we see in the work of the '20s and '30s.

The influence of Bakker is evident throughout both volumes in the vigorous, dramatic poses exploited by modern workers. By and large it is beneficient, the more so as the contributors are not mere imitators, but express a variety of original viewpoints in their renditions. Many, for example, are obviously inspired by birds, which are more appropriate for animals of birdlike skeletal detail than the mammalian models persistently favored by Bakker. There are even those who achieve drama by emphasizing the majesty of large size and deliberate movement, exploiting the reality that large animals are more frequently statuesque than sprightly.

This work will doubtless be criticized for its conjectural nature. Most such criticism can be ignored, for it is disciplined conjecture from solid data that gives the work its quality as well as its charm. Without conjecture, paleontology, like any historical discipline, would be pretty dull stuff.

One item, however, is bound to give conjecture a bad name, for it is divorced from data that lies right under our noses. I refer to the "dinosauroid," a chimera dreamed up to answer the question, "If a dinosaur had evolved humanoid intelligence, what would it look like?" The answer, on pages 127 to 130 of Volume I, is, "Like a human." One must assume that this configuration is based on anthropological hypothesis that the anatomical prerequisites for humanoid intelligence are bipedal gait, which frees the hands for manipulative function, and stereoscopic vision. Bipedal striding is an extremely eccentric gait for mammals; most of them are obligate quadrupeds, as were their synapsid reptilian ancestors. To modify our ancestral quadrupedal gait to the one we now enjoy, we humans had to twist our backbones into a vertical S-curve, and adjust the positions of the big locomotor and postural muscles of our hind legs. In the process we lost tails and developed a characteristically protuberant hind end. In these features the dinosauroid looks just like us, clear evidence that it, too, evolved from quadrupedal ancestors. But dinosaurs are not basically quadrupedal. The bipedal striding dinosaurs that inspired the dinosauroid had forelimbs that, if not manuplative, were grasping, and stereoscopic vision. Thus, all of the hypothetical prerequisites for humanoid intelligence were already in place to start with, in dinosaurs that we know very well, and there was nothing to keep them from attaining humanoid "smarts" as soon as conditions were right. This is not to argue that because they did not they could not, but only that a smart dinosaur would look very little different from a dumb one, except perhaps for a little swelling of the braincase over the face. It would still have a long neck and a short, horizontally oriented body cantilevered across the hips by a long tail, and it would still walk, birdlike, on its toes instead of flat-footed like the dinosauroid. Despite its atypical stance, human anatomy cries "Mammal!" Dinosauroid anatomy should cry "Dinosaur!" equally loudly, in part because of typical stance. But it does not The dinosauroid is only a human with dewlaps, a funny face, and funny hands and feet. Too bad its originators missed the bus, because "might-have-been's" are almost as much fun as "were's."

But you cannot win 'em all. Between the eclectic nature of dinosaur restoration and the flakiness of the fossil record, the wonder is not that an occasional worker goes off the deep end, but rather that there should be as much consensus as we see in these volumes. As I said to start with, they're first-rate. Read and rejoice!

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REPORTS

REPORT OF THE SECRETARY -- 1987

As this report is being written it is just one year since Ellis Yochelson ended his five-year tenure as the Society's Secretary. A first item of business for anyone assuming his mantle is to extend personal and Society-wide thanks for the considerable time and effort he expended on behalf of H.E.S.S. As is evident from the Acting Treasurer's Report, Ellis continues to serve us well even though no longer wearing the Secretary's hat.

The year 1987 was a strong one for H.E.S.S. We gained new members and institutional subscribers from around the world. The largest issue to date of EARTH SCIENCES HISTORY was produced -- Volume 6, number 1, concerning the development of the New York State Survey. It promises to be a valuable reference on a variety of topics relating to the history of American geology.

Individual membership has crossed the 500 level and more than 100 institutions receive our journal. We have a truly international constituency, with members from northern Canada to southern South America and institutions from the Soviet Union to Australia. Such facts are gratifying, but it would be rewarding to have an even larger base of support. This report is a reasonable place to request your help. We cannot spend much money on advertising, so personal contact by members is our most potent way of becoming known. Institutional subscriptions are particularly helpful, because our visibility is increased when the journal is displayed in libraries and listed in catalogs. Financial crunches abound, we realize, but our journal is one of the most "cost-effective" publications in the world. In an era when many journal subscriptions cost $500 or more per year, we offer institutions two issues per year at just $25.

A prime reason for the excellent value of EARTH SCIENCES HISTORY is all the hard work accomplished by the journal's staff in Troy, New York. The Society owes a large vote of thanks to Gerald and Sue Friedman and to the new Managing Editor, Sheila Kopaska-Merkel.

It is always sad to have to report on deaths of colleagues. In 1987 the Society lost Andre Cailleux and Sir Charles A. Fleming. It would be appreciated if members could notify the Secretary of deaths within the Society. Although that is not an enjoyable task, it is best to have up-to-date records so that deceased members can be honored in timely fashion.

On a more upbeat note, it is a pleasure to report that election results for 1987 confirm the proposed slate. Ellis L. Yochelson will be our President-Elect in 1988 and President in 1989. Jordi Martinell, Universitat de Barcelona, has been elected Councilor for 1988-89.

Respectfully submitted,
Kennard B. Bork

REPORT OF THE ACTING TREASURER FOR 1987

Treasurer Taylor spent the academic year 1987-1988 in Paris; I filled in to collect dues and subscriptions, but balancing the books and a more formal report must await his return. The key point is that the society is still solvent, although the new rise in US postage will cause future difficulties. It is the function of the Treasurer to worry about funds, and I must report that we are certainly not swimming in wealth. Indeed, the principal reason for solvency lies in the generosity of members who contributed toward publication. The society thanks those listed below for their additional support.

Michele Aldrich, William Allen, Robert L. Bates, Roger L. Batten, Kennard Bork, Kent A. Bowker, Arthur L. Bowsher, William R. Brice, Roy S. Clarke, Jr., J. W. Cooke, W. R. Dearman, Allen Debus, Robert H. Dott, Jr., Ellen T. Drake, John S. Ferguson, Jr., C. A. Fleming, Henry Frankel, Clifford Frondel, David H. Geiser, Richard J. Gentile, Robert N. Ginsberg, W. Dean Grafton, Mott Greene, Hollis D. Hedberg, David H. Hight, Jennifer Hines, Charles J. Hoke, Alan Horowitz, Charles B. Hunt, W. M. Jordan, P. F. Krueger, Walter O. Kupsch, Rachel Laudan, Alan E. Leviton, Kathleen Mark, Gary E. Melickian, Robert C. Milici, Anne Millbrooke, S. E. Newcomb, W. A. Oliver, Jr., Leroy E. Page, Joe Webb Peoples, J. W. Phillips, G. (Rip) Rapp, Jr., William D. Rice, Daniel B. Sass, Charles K. Scharnberger, Marie Siegrist, Jack A. Simon, Brian Skinner, Richard E. Stearns, Myron T. Sturgeon, Tsutoma Tanimoto, Joshua I. Tracey, R. Trimpy, D. M. Triplehorn, J. W. Tucker, A. G. Unklesbay, A. B. VanRiper, Glenn S. Visher, Malcolm Weiss, Peter M. Whelen, Frank C. Whitmore, Mark Wilson.

The Assistant Treasurers have continued to help with collection of dues payment for members outside of the United States. Our Society is in their debt for this assistance.

In preparation of volume 6 (1), the society thanks the New York State Geological Survey for much help. The United States Geological Survey made a signficant monetary contribution to this issue.

One other useful financial development to the society should be noted. Our journal has been granted distribution privileges though the International Exchange Service of the Smithsonian Institution. In previous years, the cost of mailing the journal overseas was substantially greater than mailing in North America. This new arrangement removes that inequity and will also save the society some money. Thus, we doubly appreciate this action on the part of the Smithsonian Institution.

Ellis L. Yochelson
Acting Treasurer

ANNOUNCEMENTS

18th International Congress on the History of Science

The First Circular for the XVIIIth International Congress on the History of Science, which will take place in Hamburg and Munich from 1 to 9 August, 1989, is now being distributed by the National Commissions and Societies for the History of Science and Technology. Please ask for your copy, if you have not yet received one, and return the reply card to Hamburg. The Second Circular will be mailed in the fall of 1988 directly to all colleagues who by returning the reply card have expressed interest in further information.

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THE PRICE OF FOSSILS

Angela Milner and Ian Rolfe are collecting information on historic and present prices of fossils, as a guide to current pricing practice (and thus to insurance and indemnity values of museum collections). To make this study reliable, they would welcome dated examples of prices that museums and others have paid for fossils, or for collections of them. They need examples of expensive, mid-range and cheap fossils; copies of old priced lists of fossils are particularly welcome, as are illustrations of priced specimens, references thereto, and references to discussion of this topic. Results will be presented at a Geological Curators Group / Palaeontological Association / Geological Society meeting in London in early October 1987, and published thereafter. Please contact them at the Palaeontology Department, British Museum (Natural History), Cromwell Road, London SW7 5BD (01-589 6323 ext 727) or the National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF (031-225 7534 ext 239).

INTERESTING PUBLICATIONS

Since the start of this journal, Editor Gerald M. Friedman has prepared this column. Contributors wishing to list recent books and papers of interest to our membership are requested to send them to the Editor.

Abel, Olivier, 1986, La paleobotanique de Gaston de Saporta: Etude bachelardienne: Rev. Metaphys. Morale, v. 91, p. 445-461.

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Allen, J.E. and Burns, Marjorie, 1987, Cataclysms on the Columbia. Portland, OR, Timber Press, 120 p. $19.95.

Anonymous, 1987, 107 years in the life of Edwin Beer: Geology Today, v. 3, p. 112-113.

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Bailes, K.E., 1986, Soviet science in the Stalin period. The case of V.I. Vernadskii and his scientific school, 1928-1945: Slavic Rev., v. 45, p. 20-37.

Bassett, M., 1985, Transition rocks and graywacke--the Silurian and Cambrian Systems through 150 years: Episodes, v. 8, p. 231-235.

Blinderman, Charles, 1987, The Piltdown inquest. Buffalo, NY, Prometheus Books, 261 p. $22.95.

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Branagan, D.F., 1986, Strezelecki's geological map of southeastern Australia: An eclectic synthesis: Hist. Rec. Aust. Sci., v. 6, p. 375-392.

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Brice, W.R., 1987, Cornell, Charles Frederic Hartt and Brazil: Geol. Soc. America, Abstracts with Programs, Annual Meeting, Phoenix, Arizona, v. 19, No. 7, p. 601.

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Brush, Stephen, The history of modern science: a guide to the second scientific revolution, 1800-1950. Ames, IA, Iowa State Univ. Press, 512 p., $34.95.

Bull, W.B., 1987, Exploration of alluvial fans in the American Southwest: Geol. Soc. America, Abstracts with Programs, Annual Meeting, Phoenix, Arizona, v. 19, No. 7, p. 668-669.

Carozzi, A.V., 1987, La geologie: de l'histoire de la Terre selon le recit de Moise aux premiers essais sur la structure des Aples et a la geologie experimentale, 1778-1878, *in*, Trembley, J., ed., Les savants genevois dans l'Europe intellectuelle du XVII au milieu du XIX siecle. Editions du Journal de Geneve, case postale 439, 1211 Geneve 11.

Carozzi, Marguerite and Carozzi, A.V., 1987, Sulzer's antidiluvialist and catastrophist theories on the origin of mountains: Archives des Sciences, v. 40, p. 107-143.

Champlin, Peggy, 1987, Raphael Pumpelly's explorations in Turkestan, 1902-1905: crossing the boundaries between geology, geography and archaeology: Geol. Soc. America, Abstracts with Programs, Annual Meeting, Phoenix, Arizona, v. 19, No. 7, p. 617.

Clements, E.S., 1986, Of asteroids and dinosaurs: the role of the press in the shaping of scientific debate: Soc. Stud. Sci., v. 16, p. 421-456.

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Dexter, R.W., 1987, Aspects of Agassiz's lectures on glacial geology (1860-1861): Raleigh, North Carolina, paper presented at History of Science Society Annual Meeting.

Drake, C.L., 1987, International Geological Congresses and plate tectonics: Episodes, v. 10, p. 235-237.

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Eyles, Nicholas, 1987, The life and times of Arthur Philemon Coleman -- geologist, mountaineer and artist (1852-1939): Geoscience Canada, v. 14, p. 183-192.

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Fleming, C.A., 1987, Science, settlers and scholars. Royal Society of New Zealand Bull. 25.

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Grasso, T.X., 1987, Geology of the Erie Canal, Amos Eaton and the Rensselaerian flotillas: Geol. Soc. America, Abstracts with Programs, Annual Meeting, Phoenix, Arizona, v. 19, No. 7, p. 682.

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CALENDAR

1988

July 5-7 - I Brazilian Colloquium on History and Theory of Geological Knowledge, University of Campinas (UNICAMP), Campinas, State of Sao Paulo. Sponsored by Instituto Geologico de Sao Paulo/Secretaria do Meio Ambiente; Area de Educacao Aplicada as Geosciencias/IG-UNICAMP; co-sponsored by: International Commission on the History of Geological Sciences (INHIGEO); Brazilian Society on the History of Science. Topics: History of Geological Sciences in Latin America; Mining; Theory of Geological Knowledge. Official Languages-Portuguese, Spanish, and English. Cost: $250. Address correspondence to Profa. Maria Margaret Lopes, Instituto de Geosciencias/UNICAMP, Cx. P. 1170, 13100 Campinas-SP BRAZIL; Profa. Silvia Fernanda de Mendonca Figueiroa, Instituto Geologico/SMA, Cx. P. 8772, 01000 Sao Paulo-SP BRAZIL.

Sept. 18-23 - Intl Symposium on "Engineering Geology as related to the Study, Preservation and Protection of Ancient Works, Monuments and Historical Sites," Athens, Greece. Organized by The Greek National Group of the International Association of Engineering Geology (IAEG), with the collaboration of the Greek Ministry of Culture. Mtg., field trip and post-symposium tours (SEPT. 23-28, 1988) to historical sites and archaeological monuments with Engineering Geology interest through continental Greece, Crete and the islands (Peloponnese, Knossos, Athos, etc.) Official languages of the Symposium-English, French & Greek. DEADLINE for reduced-fee registration-May 30, 1988. Scientific Program Contact: Scientific Secretariat of the Symposium, Greek Committee of Engineering Geology, P.O. Box 19140, 117 10 Athens-Greece. Telex: 21 6834; Telefax: (1) 3238792; (Att. Prof. P. Marinos). Registration Information Contact: Secretariat Office, Congress Center: Organization Idea, 24, Voulis str., 105 63 Athens-Greece. Telephone (1) 3242045; Telex: 21 5277; Telefax: (1) 3238792. (Att. Mrs. M. Bessieri). Accommodation and Post Symposium Tours and General Tourist Activities Contact: Hermes en Grece, 4, Stadiou Str., 105 64 Athens-Greece. Telephone (1) 3237431; Telex: 215594 HERM GR; Telefax: (1) 3238792; (Att. Mr. J. Alimonos).

Sept. 23-25 - History of Geomorphology Conference, Canada. Contact: Dr. K. J. Tinkler, Brock University, St. Catharines, Ontario, Canada L2S 3A1. Telephone (416)688-5550.

Oct. 31-Nov. 3 - Centennial Meeting, Geological Society of America, History of Geology Division Symposium on "History of the Establishment of a Geologic Framework for Human Evolution," Denver, Colorado. Contact: Dr. Leo F. Laporte, Earth Sciences, Applied Sciences Building, University of California, Santa Cruz, CA 95064.

Dec. 27-30 - Annual History of Science Society Meetings, Cincinnati. Program Co-Chairs: Joan L. Richards, Box N, Dept. of History, Brown University, Providence, RI 02912; Shirley A. Roe, Dept. of History, U-103, University of Connecticut, Storrs, CT 06268.

1989

March 28-April 9 - "The Murchison Symposium: An International Symposium on the Silurian System," sponsored by the Subcommission on Silurian Stratigraphy, The Palaeontological Association, The Geological Society of London. University of Keele, U.K. Convenors: Dr. M. G. Bassett, Department of Geology, National Museum of Wales, Cardiff CF1 3NP, U.K. Telephone: (0222) 397951 and Dr. P.D. Lane.

July 9-19 - 28th International Geological Congress, Washington, D.C. USA. NOTE K1.-K.4: History of Geology Symposia. NOTE FIELD TRIP T169: "Boston to Buffalo, in the footsteps of Amos Eaton and Edward Hitchcock," Wed. 28 June through Sat. 8 July. Cost: $1,000. NOTE FIELD TRIP T206: "Geology and History of the Chesapeake and Ohio Canal, Maryland," Sat. 15 July. Cost $52 (minibus, breakfast on canal boat, box lunch). DEADLINES: Abstracts October 1, 1988. Preregistration at normal rate - Feb. 1, 1989; Late Preregistration - May 1, 1989. Congress Registration and Payment: 28th Int'l Geological Congress, P.O. Box 727, Tulsa, OK 74101-0727 USA. Inquiries and general correspondence: Dr. Bruce B. Hanshaw, Secretary General, 28th Intl Geological Congress, P.O. Box 1001, Herndon, VA 22070-1001 USA. Telephone 703/648-6053. Telex: 248418.

July 24-Aug. 4 - International Association of Geomagnetism and Aeronomy, Exeter. Interdivisional Commission on History presents two 1/2 day sessions entitled "The History of Geomagnetism and Aeronomy," and "Problems of Uncertainties in Geophysical Time Series." First Session Program: Scientific Biographies and general aspects of the History of Geomagnetism and Aeronomy. Second Session Program: Long-term Data Analysis, Long-term Relationship in Solar-Terrestrial Physics, Auroral Physics, Maunder-Minimum, Short-term Data and Geophysical-Meteorological Data Analysis. ABSTRACT DEADLINE: March 15, 1989 (Title, Author(s), Address(es), Text within rectangle not exceeding 160mm wide by 32mm high). Convener: W. Schroder, Hechelstrasse 8, D-2820 Bremen-Rodennebeck, Federal Republic of Germany.

Aug. 1-9 - XVIIIth International Congress of the History of Science to be held in Hamburg and Munich, Federal Republic of Germany. General theme: "Science and Political Order (Wissenschaft und Staat)" intended to comprise all facets of the relations between science (technology and medicine) and the numerous forms of political order. Symposia, Scientific and Poster Sessions. Chairman, National Program Committee: Prof. Fritz Krafft (Fachbereich Mathematik, Staudinger Weg 9, D-6500 Mainz, F.R. of Germany. Chairman, Organizing Committee: Prof. Christoph J. Scriba, Institut fur Geschichte der Naturwissenschaften, Bundesstr. 55, D-2000 Hamburg 13, F.R. of Germany.

MISCELLANEA

Society members will be interested in the historically oriented field trips and technical sessions planned for the 28th INTERNATIONAL GEOLOGICAL CONGRESS to be held in Washington, D.C., in July 1989. A synopsis of events relating to the history of geology will be presented in the next issue of EARTH SCIENCES HISTORY.

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The SUE TYLER FRIEDMAN Medal was awarded to M.J.S. Rudwick (Princeton) by the Council of the Geological Society of London for his outstanding contribution to the understanding of the history of the Earth Sciences. His contributions in this field clearly qualify him as the first recipient of this award. Professor Rudwick will receive his award on June 8, 1988.

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The CLOUGH MEDAL (Edinburgh Geological Society) for 1987 was awarded to Professor GORDON Y. CRAIG, of the University of Edinburgh, for his distinguished contributions to increasing our knowledge about Scotland's geology. Professor Craig is currently President of the International Commission on the History of Geology.

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In July 1988 there will be a BRAZILIAN COLLOQUIUM ON HISTORY AND THEORY OF GEOLOGICAL KNOWLEDGE. It will be hosted by the University of Campinas in the State of Sao Paulo, 5-7 July.

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Our current President, WALTER O. KUPSCH, invites all interested persons to submit articles relevant to a SPECIAL POLAR ISSUE of EARTH SCIENCES HISTORY, planned for next year. Topics relating to the history of geocience in either the Arctic or Antarctic are of potential interest. Contributions do undergo a peer review and should be sent to Editor Friedman in Troy.

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Anniversaries are always with us! This year is the Michigan Geological Survey's 150th. You may have seen the striking poster celebrating the event. Please inform me if you are aware of an anniversary of note to our membership -- it will be announced in a future issue of ESH.

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INHIGEO NEWS

The 1987 INHIGEO symposium was held in Italy in September 1987, with the theme of "Rocks, Fossils, and History", in the very appropriate Italian settings of Pisa, Padua, and the Apennines. Beryl Hamilton has written a full account of this meeting to appear in a forthcoming issue of *Episodes*.

In the next decade, INHIGEO looks forward to forging closer links with China, India, and Japan. National Committees on the history of geology now exist in Australia, Bulgaria, Czechoslovakia, Federal Republic of Germany, France, German Democratic Republic, Hungary, Italy, Poland, Rumania, Spain, United Kingdom, the USA and the USSR. Others may well be alive and well but we have not heard from them officially. Some have their own newssheet: all are invited to contribute to the annual INHIGEO Newsletter which has a print run of 1200 copies and is widely distributed. The INHIGEO Newsletter will celebrate its 21st birthday in 1988 and I urge readers with anything of interest to report on the history of geology to send their submission to:Dr. Endre Dudich, Secretary-General INHIGEO, UNESCO SC/GEO, 1, rue Miollis, B.P.3.07, 75015 Paris, France.

The HISTORY OF GEOLOGY is to be the theme of a two-day meeting to be held in the University of Bristol, England on **Thursday and Friday, 29 and 30 September 1988.** Peter Crowther of the City Museum has agreed to act as local organiser. The meeting will focus on the development of geology, both in England and on the continent of Europe , during the century or so up to 1839 - the year of William Smith's death.