

The evidence available from the study of the various 'undifferentiated races' can be held to support a theory that some, if not all, of the members of the old vertebrate stock were protogynous hermaphrodites, and that only afterwards were separate sexes established by the evolution of a chromosome mechanism which caused a progressively earlier sex change in the forming males and a progressively later one in the forming females. Thus *Monopterus* may be to-day in a condition similar to that of the earliest vertebrates. Unfortunately for this theory, the primitive nature of any of the features of *Monopterus* cannot be lightly assumed. It belongs to an aberrant order, the Symbranchii, the affinities of which have not yet been fully settled, and it may well be that the mechanism of its sex reversal is as specialized as is its bodily structure. One test which might be applied is to search for some trace of a Y-chromosome. If the hermaphrodite condition is primitive, this chromosome may be lacking; but if it is secondary, it may still be distinguishable by its shape. It is clearly a matter of great interest that further and more detailed research should be carried out on this unusual fish, and also that a search for similar conditions should be made in the other members of the order Symbranchii.

<sup>1</sup> Liu, C. K., *Sinensia*, 15, 1 (1944).

<sup>2</sup> Witschi, E., Chapter 5 of "Sex and Internal Secretions" (London, 1932).

<sup>3</sup> Witschi, E., Chapter 4 of the 2nd edition of "Sex and Internal Secretions" (Baltimore, 1939).

<sup>4</sup> Bullough, W. S., *J. Exp. Zool.*, 85, 475 (1940).

<sup>5</sup> Crew, F. A. E., *J. Genet.*, 11, 141 (1921).

<sup>6</sup> Bullough, W. S., *Proc. Leeds Phil. Soc.*, 3, 638 (1939).

<sup>7</sup> van Oordt, G. J., *Z. mikr. anat. Forsch.*, 19, 1 (1929).

<sup>8</sup> Witschi E., Cold Spring Harbor Symp. Quant. Biol., 10, 145 (1942).

## OBITUARIES

### Sir Thomas Holland, K.C.S.I., K.C.I.E., F.R.S.

WITH the unexpected death of Sir Thomas Henry Holland, on May 15, British geology in general and Indian geology in particular has lost its most illustrious figure, one whose outstanding position was recognized by the fact that he was president designate of the Eighteenth Session of the International Geological Congress to be held in Great Britain in 1948, and was also president of the Organising Committee of this Congress.

Thomas Henry Holland was born on November 22, 1868, at Helston, Cornwall, and was the son of John Holland, of Springfield, Manitoba, Canada, and Grace Treloar Roberts.

He was educated at a small dame's school at Helston, and when only sixteen won a National Scholarship to the Royal College of Science, London, where he took a first class associateship in geology with honours, in 1888, winning also the Murchison Medal and Prize. After a period at South Kensington as assistant to Prof. Judd, he gained a Berkeley Fellowship to Owens College, Manchester, in 1889. In 1890, at the age of twenty-one, he was appointed an assistant superintendent in the Geological Survey of India. He did not, however, proceed direct to his appointment, but travelled to India via the United States, Canada and the Far East, his service dating from his arrival in Calcutta in October 1890, when he was made curator of the Geological Museum and Laboratory. In addition, he became the part-time

lecturer in geology at Presidency College, Calcutta, where (there being then no professorship in geology) he organised the courses in geology and established securely the custom that prevailed for many years by which the curator of the Geological Survey of India usually also lectured at Presidency College. While curator, Holland effected many improvements in the arrangement of the Mineral Gallery of the Museum, continuing the work begun by F. R. Mallet. In particular, he assembled and arranged typical collections of the pre-Cambrian (including Archæan) formations of India.

Although, by holding the post of curator for some years, Holland was nominally stationed at headquarters in Calcutta, he made repeated excursions into the field, and was also available to the director of the Geological Survey for emergency inquiries as they arose. He thus soon established for himself a reputation as a petrographer, and as one interested in the economic side of geology; that he was a man of energy and organising ability the Government of India soon became aware.

Throughout its history, the Geological Survey had devoted a considerable part of its energies to the mapping and study of the Indian coalfields, and had also recently had a specialist (F. H. Hatch) at work on certain gold deposits. Yet on the whole the department was then, in the view of the Government of India, giving too much attention to the theoretical side of geology and too little to the practical side. The consequence was that in February 1903 Holland was appointed director in succession to C. L. Griesbach, who was retiring on superannuation. This meant the supersession of several geologists senior to Holland, some of them (for example, R. D. Oldham, C. S. Middlemiss and T. D. La Touche) of first-class quality. After the initial shock, however, they collaborated loyally with the young new director (Oldham retiring two years later), and Holland set to work to reorganise the work of the department and to raise its status, both with Government and with the business public. He secured from the Government of India an increase of staff and better terms of pay, and detailed some of his officers to make comprehensive studies, scientific and economic, of particular minerals (for example, coal, manganese ore, and petroleum) on the lines he had already set for mica before his promotion.

In addition, Holland secured the transfer from the Revenue and Agriculture Department of the Government of India to the Geological Survey the duty of collecting and collating the statistics of mineral production of India, in annual reviews published in the *Records of the Geological Survey of India*, which he resuscitated after their suppression by his predecessor. Further, he instituted the well-known quinquennial reviews of mineral production, the first one actually covering a six-year period, 1898-1903. These quinquennial reviews are not mere assemblages of the annual figures. They contain, also, geological and economic data, covering each mineral, that are not in the annual reviews; and they were, until 1933, a special feature of the *Records* of the Indian Geological Survey that had no parallel among the publications of any other geological survey in the world.

Holland also secured the transfer to the Geological Survey of the duty of advising the Central and Provincial Governments concerning the terms of the grant of mineral concessions throughout British India, the existing rules being still based on the rules

as revised by him. He was also president (1908) of the Burma Oil Reserves Committee, which drew up the rules for the regulation of the Burma oilfields with the object of preventing their wasting competitive exploitation by rival companies.

In spite of the great number of administrative improvements effected by Holland, he was director of the Geological Survey only until 1909, when he accepted an invitation to the chair of geology of the University of Manchester. One of the reasons for his early retirement from India was his disappointment that the Government of India had not implemented in full his scheme for the increase of staff and scales of pay of his department. However, Holland's outstanding services to science in India were recognized by the award of the K.C.I.E. in 1908.

It is not too much to say that as a result of Holland's directorship the Geological Survey of India was permanently faulted up, to use a geological simile, into a position of prestige in India, both with Government and with the public, from which it has never fallen back. His successor, Sir Henry Hayden, for example, quite early secured the increased cadre and scales of pay for which Holland had fought.

Sir Thomas, as he had now become, was, however, destined to return to India; in 1916 he was appointed chairman of the Indian Industrial Commission, the report of which may be taken as a basis of the Government of India's help in the modern industrial development of India. The knowledge of Indian industries obtained during its investigations led to the whole Industrial Commission being converted, also in 1916, into the Indian Munitions Board, with Holland as president; and all who had the privilege of working under Holland in this Board know the skill and energy with which he built up the giant organisation that kept the Indian armies, wherever employed, supplied with all the varied munitions and stores required for modern warfare. It is fair to say that three men, the Commander-in-Chief, the Finance Member to the Government of India, and the President of the Board of Munitions, were the principal organisers and directors of India's military effort in the First World War. For his share in this Sir Thomas was created K.C.S.I. in 1918. When the War ended, the Indian Munitions Board became, in 1919, the Department of Munitions and Industries, Holland thus becoming a member of the Viceroy's Executive Council. In 1921 he was also appointed Member for Commerce, so that he held two portfolios simultaneously. At the end of 1921 a difference with the Viceroy (Lord Reading) on the withdrawal of a munitions prosecution in Calcutta led to Holland's resignation; but the sympathies of all who knew the inner facts were with Sir Thomas Holland.

This check in Holland's career was but of brief duration. In 1922 he succeeded Sir Alfred Keogh as rector of the Imperial College of Science and Technology, London; and his success as an educational administrator in this post led to his appointment in 1929 as principal and vice-chancellor of the University of Edinburgh in succession to Sir Alfred Ewing. In spite of his dictum that seven years in one appointment was sufficient, Sir Thomas held the Edinburgh office for fifteen years, retiring in 1944 at the age of seventy-six with the title of emeritus principal and vice-chancellor of the University.

It must also be recorded that after retiring from the Geological Survey of India, Sir Thomas retained his interest in oil problems. Thus, he was a member of the Royal Commission on Navy Fuel, 1911-13.

In 1928 he visited Trinidad and reported to the Colonial Office on policy in promoting the maximum and most efficient exploitation of the Island's oil resources. He was for many years geological consultant to the Burmah Oil Company and for nearly twelve years a member of the geological advisory board of the Anglo-Iranian Oil Company.

Although Holland was thus almost continuously in harness for fifty-four years, his outstanding energy and organising ability led naturally to his taking also a prominent part in the administration of scientific and technical societies and institutions. He commenced by founding in 1906 (with the late W. H. Pickering, chief inspector of mines in India) the Mining and Geological Institute of India, of which he became the first president. He was chairman of the trustees of the Indian Museum, Calcutta, 1906-9, and in 1909 he was president of the Asiatic Society of Bengal (now the Royal Asiatic Society of Bengal). In 1915-16 he was president of the Institution of Mining Engineers, London. Later, he was president of the Institution of Mining and Metallurgy, and of the Institution of Petroleum Technologists, and chairman of the Royal Society of Arts, all at the same time (1925-27). During 1927-30 Holland was chairman of the Empire Congress of Mining and Metallurgical Institutions, and in 1933-34 he was president of the Geological Society of London and in 1933-36 of the Mineralogical Society. He also served the British Association as a sectional president (geology, 1914, and education, 1926) and was president of the Association at its meeting in South Africa in 1929. He was a vice-president of the Royal Society in 1924-25.

On his retirement from Edinburgh in 1944, Sir Thomas returned to London with vigour of mind and body unimpaired, and resumed his practical interest in the administration of learned and technical societies. He rejoined the Council of the Institution of Mining and Metallurgy as a past-president, and became foreign secretary to both the Geological Society and the Mineralogical Society, his seniority and personal friendship with many geologists and mineralogists abroad making him peculiarly suitable for such work. Further, as already mentioned, he was to be president of next year's International Geological Congress.

It was inevitable that a man of such outstanding ability and energy should be the recipient of many honours in addition to the awards of K.C.I.E. and K.C.S.I. already mentioned. In addition to honorary degrees from many universities he received the Bigsby Medal of the Geological Society of London (1913), the Albert Medal (1939) of the Royal Society of Arts, and was an honorary fellow of the Royal Asiatic Society of Bengal.

Although Holland, from the time of his promotion to the directorship of the Geological Survey of India at the very early age of thirty-four, devoted his energies and abilities mainly to scientific and educational administration, yet he had already to his credit a considerable volume of first-class research, mainly on the petrographical (and chemical) side of geology; this was recognized by his election to the Royal Society in 1904. His published papers include five *Memoirs*, of which one is on the charnockite series (1900), another deals with his discovery of elaeolite-syenites in India (the Sivamalai series, 1901), and a third is a comprehensive work on the mica deposits of India (1902), dealing with both the scientific and economic aspects of a mineral of which

India is the world's chief source of supply. Many of his papers in the *Records of the Geological Survey of India* also deal with petrographical problems, of which the most noteworthy are perhaps those on the mica-apatite-peridotite intrusions in the Bengal coalfields (1894) and on the origin and growth of garnets (1896). Holland also recognized early the essential identity of bauxite and laterite (*Geol. Mag.*, 1903). One of Holland's earliest papers, that on the Gohna landslip, Garhwal (*Records, Geol. Sur. India*, 27; 1894), recorded work that created a sensation with the Indian public. A landslip had thrown a dam across a Himalayan valley and created a large lake where there had been none before. Holland, who was sent to investigate, gave a middle date for the breaching of the dam and the depth to which it would be cut down when this happened. He also recommended the evacuation of the population endangered by the prospective floods some time in advance of his date. This was done, and the dam was breached on almost the exact date predicted. Holland also gave valuable advice in connexion with landslips in the hill stations of Naini Tal and Darjeeling.

The research for which Holland is best known to science is that described in his *Memoir* (28, Pt. 2, 1900) on the charnockite series, in which he described a peculiar series of granulitic rocks ranging in composition from acid to ultrabasic and forming an important part of the Archæan terrain of the Madras Presidency. The common denominator in these rocks is the presence of hypersthene; and for the type rock, a hypersthene-granite, Holland selected the name 'charnockite' after Job Charnock, the founder of Calcutta. Charnock's tomb is in St. John's Churchyard, Calcutta, and, as Holland discovered, is fashioned out of a block of hypersthene-granite brought from Madras. In Holland's view, all the members of his charnockite series are consanguineous and form a petrographic province of genetically related plutonic igneous rocks. Similar rocks have been found since in other countries, for example, Antarctica, West Africa and Uganda, and their origin has for many years been a matter of controversy. Whatever may be the final verdict on the origin of this interesting suite, there can be no doubt as to the importance of Holland's work thereon, and of the stimulus it imparted in many countries to the study of their hypersthenic rocks, and in India to that of the Archæan terrain in general.

Whatever Holland wrote, whether in official correspondence, or for publication, was precise and clear, and often trenchant. His presidential addresses to learned and technical societies never went into details, but always dealt with broad outlines, so that they were of widespread interest. In his earliest such address (that to the Mining and Geological Institute of India in 1906) he proposed a new scheme for classifying the geological formations of India, holding that the main divisions suitable for Europe, where stratigraphical nomenclature originated, were not suitable for Gondwanaland with its very different geological history. Thus came to be introduced the terms 'Aryan', 'Dravidian' and 'Purana', with Archæan at the base, for the larger subdivisions of the geological column in India. This interest in stratigraphical nomenclature caused Sir Thomas after his first retirement from India to write his "Indian Geological Terminology" (*Mem., Geol. Sur. India*, 43, Pt. 1; 1913), in which he was helped by the late Mr. G. H. Tipper (see *Nature*, June 21, p. 834), and of which a second edition appeared in 1926.

In his first address as president of the Geological Society of London (1933), Sir Thomas discussed "The Geological Age of the Glacial Horizon at the Base of the Gondwana Systems", showing that this horizon is one of the most important datum lines of the geological column. In his second address (1934) he took as his theme the ideal composition and minimum strength of a geological survey department if it was to be fully efficient. This address has been, and is likely in the future to be, of great use to directors trying to convince their Governments of the needs of their departments. In his address as president of the Geological Section of the British Association in Australia in 1914, Sir Thomas reviewed recent advances in developing theoretical conceptions regarding the interior of the earth that are of direct importance to geologists. In his address as president of the Association at Johannesburg in 1929 he discussed "The International Relationship of Minerals". Sir Thomas was greatly interested in the impact of the economics of mineral deposits upon national and international affairs, as was shown by this and other addresses, and as was summarized in a small book entitled "The Mineral Sanction as an Aid to International Security" (Oliver and Boyd, 1935), in which he showed, before the recent War, that if the British Commonwealth, the United States of America and the U.S.S.R. were to adopt a common policy on the export of minerals of use for munitions purposes to potentially aggressor countries, such as Germany and Japan, the outbreak of war could be prevented.

As will be judged from the foregoing, Sir Thomas Holland was a man of outstanding ability and energy. His worship of efficiency meant that he could not suffer fools, and that in his official relations his reactions to his colleagues and subordinates were mainly determined by his desire for efficiency, with handsome recognition of good work. But in private life Holland could be a delightful companion, especially as he was a good *raconteur* with an endless fund of amusing stories.

Holland married first, in 1896, Frances Maud (who died in June 1942), daughter of the late Charles Chapman, Deputy Commissioner in Oudh, and by this marriage he had one son (now Major-General John F. C. Holland) and one daughter (Margaretta, widow of Col. A. G. Shea); and secondly, in 1946, Helen E. Verrall, of Bramley, near Guildford.

L. L. FERMOR

#### Prof. F. Pavlíček

PROF. FRANTÍŠEK PAVLÍČEK, who died on January 4 at the age of seventy-two, was one of Brauner's earlier pupils. Brauner and Pavlíček undertook in 1900 the revision of the atomic weight of lanthanum, and their results were eventually published in the *Transactions of the Chemical Society* in a lengthy paper. The figure they obtained, 139.04, is still accepted. Most of Pavlíček's later work was connected with mineralogy, fuel technology and thermochemistry, since he held appointments first at a technical college in Brno and later at the Příbram School of Mines in South-West Bohemia. These investigations, mostly published in Czech, relate to the calorific values of various coals (including local lignites) and the utilization of coal gas, industrial gases and coke in metallurgy. Prof. Pavlíček also wrote, in 1927 and 1931, the standard Czech work on the chemistry of coal. J. G. F. DRUCE