The first use of the word hydrogeology, or more correctly “hydrogéologie”, as he was writing in French, can be traced back to Jean-Baptiste de Lamarck, writing almost 200 years ago (Lamarck 1802). Lamarck was born in 1744 and devoted the first part of his life to the study of botany. At the age of 50 he was appointed to a Professorship at the Muséum d’Histoire Naturelle in Paris, not of botany but of invertebrate zoology, which he had not specially studied previously. In this position he recognised the importance of relating living animals to fossil material and is now acknowledged as the founder of invertebrate palaeontology.

It was perhaps as a result of his palaeontological work that he became interested in some of the wider problems of geology. He published his ideas in 1802 in a small volume of 268 pages which he called “Hydrogéologie”. It never reached a second edition and according to Geikie (1906) appears to have excited little interest among his contemporaries. The subtitle of his book concisely describes its theme as:

Studies on the influence of water on the surface of the Earth; on the reasons for the existence of ocean basins, of their position and their successive transport on to different parts of the globe; finally on the changes that these lively bodies exert on the nature and state of the surface.

Thus the term hydrogeology was used to describe the role of water in shaping the surface of the earth and was not applied in any sense to the study of underground water.

It was to be over 70 years before the term again appeared in the scientific literature when it was used by Joseph Lucas, a junior officer in the Geological Survey in Britain. Lucas joined the Survey in January 1867 as a young man of 20 and was assigned to mapping the Carboniferous, Permian, and Jurassic Formations of northeast England. According to the memorandum that he submitted to accompany his unsuccessful application for the Professorship of Geology at Oxford (Lucas 1888) his interest in “subterranean water systems” was aroused by Joseph Prestwich’s Presidential Address to the Geological Society in 1872. Prestwich had been a member of the Royal Commission on Water Supply which reported in 1869 and chose for part of his address the subject “Our Springs and Water Supply” (Prestwich 1872). The Royal Commission received conflicting evidence on the amount of groundwater that was available from the underlyng Cretaceous Chalk aquifer to augment the water supply of London. The debate between the scientists who recognised that heavy abstraction could lead to reduced water levels and saline intrusion and the engineers who visualised an almost limitless reservoir was extremely acrimonious and continued throughout the nineteenth century (Mather 1998).

Lucas realised that little hard information existed on the water-bearing formations in the south of England and in January 1873 started to collect and make observations to the south of London. After 18 months of work, and on the basis of the data that he had collected, he proposed a scheme for the improvement of London’s water supply (Lucas 1874). This consisted of a series of galleries driven along the strike at the base of the main water-bearing formations in order to capture groundwater otherwise discharged as springs or seepages. Galleries many kilometres in length were visualised. The scheme was never implemented and the small 86-page quarto volume probably would have been forgotten but for the fact that it includes the first British map showing groundwater contours. Contours on the upper surface of the water in the Chalk were plotted for two periods during 1873. In an appendix, Lucas also uses the word hydro-geological. It is used only once as the heading of a section entitled, “Objects and Mode of Constructing a Hydro-geological Survey of the Water-bearing Formations”. In this section he discusses the parameters to be measured; rainfall, evaporation, percolation, spring discharges, and the “height of the water line” and considers how these can be used to determine the quantity of water passing under the overlying impervious beds.
The term hydro-geology was immediately taken up by Prestwich, whose Presidential address had inspired Lucas. Prestwich had already produced a map of the London basin which included groundwater information. His ideas for improving the water supply of London had been accompanied by a map and sections illustrating the relative positions and areas of the principal water-bearing formations, in which individual strata were marked according to their permeability (Prestwich 1851). In 1876 he produced a further report, this time on Oxford, which included a “Hydro-geological map of the basin of the Thames above Oxford”. As with his previous map, this did not include water-level contours but categorised formations on the basis of their permeability and this time also included the positions of major springs which might be harnessed to supply Oxford (Prestwich 1876).

Lucas continued to develop his ideas and his work brought him to the attention of engineers involved in water supply. On 28 November 1876 he gave his first scientific presentation at the Institution of Civil Engineers on “The Chalk Water System” (Lucas 1877a). He records in this paper that his observations had extended over four years, ranging over about 200 square miles, on which almost every accessible well had been measured. Unfortunately, during much of this period he was employed by the Geological Survey to map in northeast England. The first signs of disquiet with his performance as a field geologist came in November 1874 when he was castigated for his failure to collect any fossils from the area he was mapping. His explanation was that he thought he had been directed to map on purely physical principles. In June 1875 he was asked to explain why he was absent from his field station. His Senior Director wrote:

Your movements are so erratic and your place of residence so uncertain, that it has of late been impossible to tell where you were to be found, in addition to which you have apparently chosen your stations more with regard to your own personal convenience than the requirements of the Survey. Besides this the accounts of your work are so unsatisfactory that I feel myself, at last, unwillingly compelled to take notice of this.

Clearly, his need to make regular observations on wells to the south of London was having an impact on his mapping work and matters came to a head in January 1876 when he was reported for assaulting his senior officer “while officially engaged on Survey business” and suspended from duty. He was advised to resign and did so, his resignation dating from 7 January, the day of his suspension.

His abrupt exit from the Geological Survey enabled him to concentrate full time on his groundwater work. His paper on the Chalk (Lucas 1877a) contains a wealth of data and includes a “Hydrogeological Map showing water contours on the Chalk water system” and a series of hydrogeological sections. The term hydrogeology, now without a hyphen, is used throughout the paper and is defined in the first sentence as “Hydrogeology...takes up the history of rain-water from the time that it leaves the domain of the meteorologist and investigates the conditions under which it exists in passing through the various rocks which it percolates after leaving the surface”. In a further paper (Lucas 1877b) he provided a more concise definition: “Hydrogeology takes up the history of rain water from the time that it touches the soil and follows it through the various rocks which it subsequently percolates”. He also introduced the term hydrogeologist. Other papers followed and information from them was abstracted to prepare two “hydrogeological survey maps” of the northern and southern parts of the central Thames Basin where coloured ornament was used to illustrate various features of the hydrogeology (Lucas 1877c, 1878).

It might be imagined that, by now in his early 30s, he would have a glittering career in front of him. However, although he produced further work during the late 1870s, after 1881 he disappears into the background and his obituarist records that “although he continued to practise as a water engineer for some years, he ceased after this to make any further publications of general scientific interest” (Anonymous 1926).

The work of Joseph Lucas can be seen as the culmination of some 50 years of systematic water-level observations. This started with measurements of individual wells in 1819 (Bland 1832), and continued with the preparation of cross-sections in which levels in a line of wells were drawn to demonstrate a gradient in the Chalk aquifer from the hills north of London southwards towards the River Thames (Clutterbuck 1842, 1843). The contribution of Lucas was that he made observations over a large area and was able to bring these together in the form of a hydrogeological map. He claimed to have founded the science of hydrogeology (Lucas 1888) and certainly made an innovative contribution which probably deserves more recognition than it has received.

Although after 1876 the term hydrogeology started to be used in Britain, it failed to achieve widespread acceptance even within the Geological Survey. Lucas’s colleague de Rance, writing near the end of the nineteenth century, comments that “The term hydro-geology...appears to the writer to deserve more general acceptance than has been accorded to it” (de Rance 1896). The first of the Geological Survey Water Supply memoirs, describing the water supply of Sussex (Whitaker and Reid 1899), does not use the word and nor do subsequent memoirs, many of which were prepared by William Whitaker, another Survey colleague of Lucas.

Although the term must have been known to later workers such as Oscar Meinzer, his classic papers do not use it but refer to the subject as “ground-water hydrology”. In his historical review, Meinzer (1934) accepts that this is an awkward term and suggests “phreatology” as a possible alternative. Lucas (1877b) considered hydrogeology as a branch of geology and this association is probably the reason why many workers with an engineering background did not accept the term, preferring to