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# ON THE ORIGIN OF THE TERM "HYDROLOGY" AND DERIVATIVE SCIENCES

It is for some time now that the science on water in nature, particularly its branch dealing with the circulation of water on the Earth, has been given a name of hydrology. However, hydrology is a relatively young science, that is why it is just forming its specialist terminology; it is difficult to define more precisely a date of emergence of the term "hydrology". It originates from two Greek words: *hydor* (water) and *logos* (word, idea, science). Meanwhile, apart from Thales of Miletus, "hydrologist of antiquity" (Biswas 1970), water was studied i.a. by Plato and his pupil, Aristotle, founder of the school of science "Lyceum", author of the treatise *Meteorologica* containing also a considerable load of hydrological knowledge.

Relatively early, that is in the mid-17th century, a term "hydrography" appeared in the work *Geografia generalis* published in 1650 in Amsterdam (Fig. 1) by Bernardus Varenius (1622-1650), "the most famous geographer of those times" (Biswas 1970). The author understood the term "hydrography" as a description of water on the terrestrial globe, and first of all as a description of oceans. Soon this term was used by a well-known Italian astronomer, mathematician and physicist Giovanni Battista (Giambattista) Riccioli (1598-1671) in his work *Geographie et hydrographie reformati libri duodecim* published in 1661 in Bologna.

At that time, the term "hydrostatics" appeared in 1663 in the work by Jesuit mathematician and naturalist Kaspar (Casparus) Schott (1608-1666) of Würzburg, entitled *Anatomia physico-hydrostatica fontiumae fluminum*. A little later this term could be found in a title of work by a physician Bernardino Ramazzini (1633-1714), professor of the University of Padua. At the beginning of the 18th century, the term "hydraulics" was used by Domenico Guglielmini (1656-1710) in the title of his work.

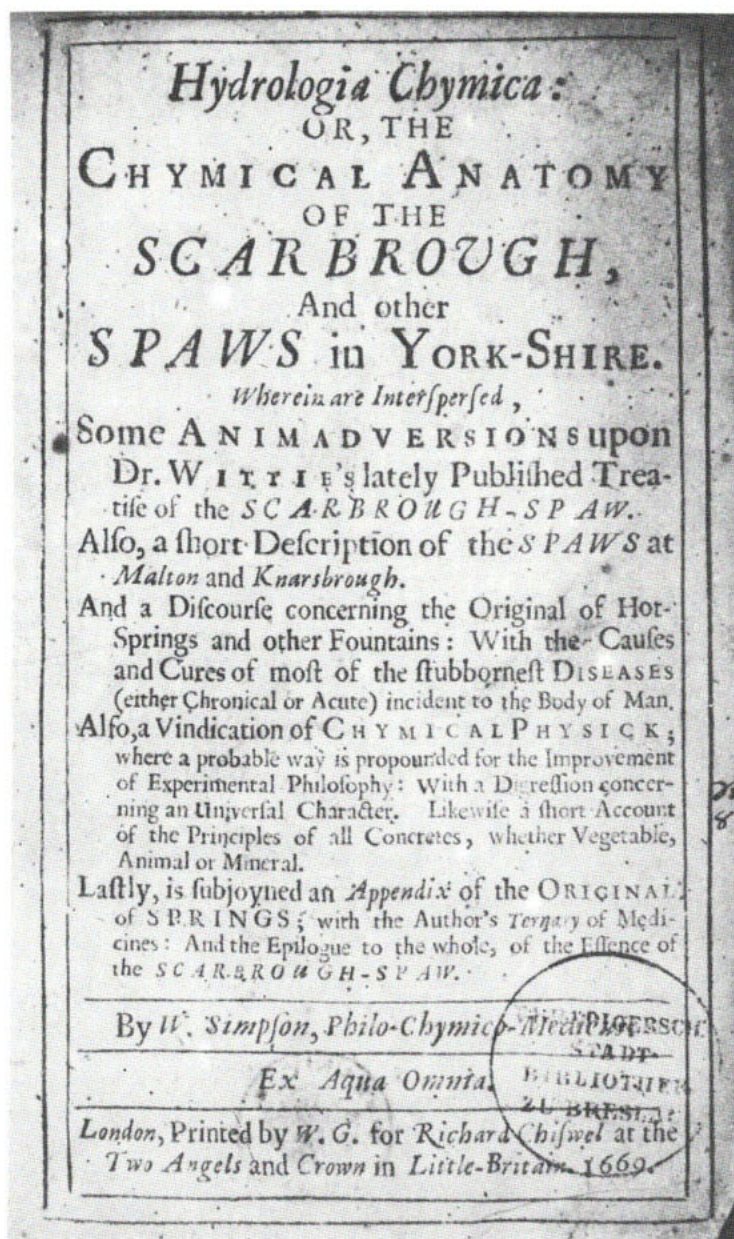
The Origin of the term "hydrology" in its actual meaning dates back to the second half of the 17th century, sometimes called "a cradle of modern science" (Biswas 1970), and which is associated with such scientists as: Galileo, Descartes, Newton as well as with the foundation of the first scientific societies, such as Royal Society (London), Academie des Sciences (Paris), and Academia Naturae



Fig. 1. Front page of Varenius book *Geographia generalis* of 1650

Curiosum (Halle). Some time later appeared Domenico Guglielmini (1656-1710) who in 1690 became professor of hydrometry of the University of Bologna (Fig. 2), and in 1697 published a work on the subject. Thus it should be assumed that it was Guglielmini who first used the word "hydrometry". Spengler (1975), a translator of Biswas' work (1970) into Russian, even considers that Italy can be recognized as a cradle of hydrometry.

Meanwhile, in 1669 in London William Simpson (1636/7?-1680), physician and naturalist published his work *Hydrologia chymica* (Fig. 3), and a year later *Hydrological Essays*. It was probably the first work in the title of which the name

Fig. 2. Front page of William Simpson's book *Hydrologia chymica* of 1669



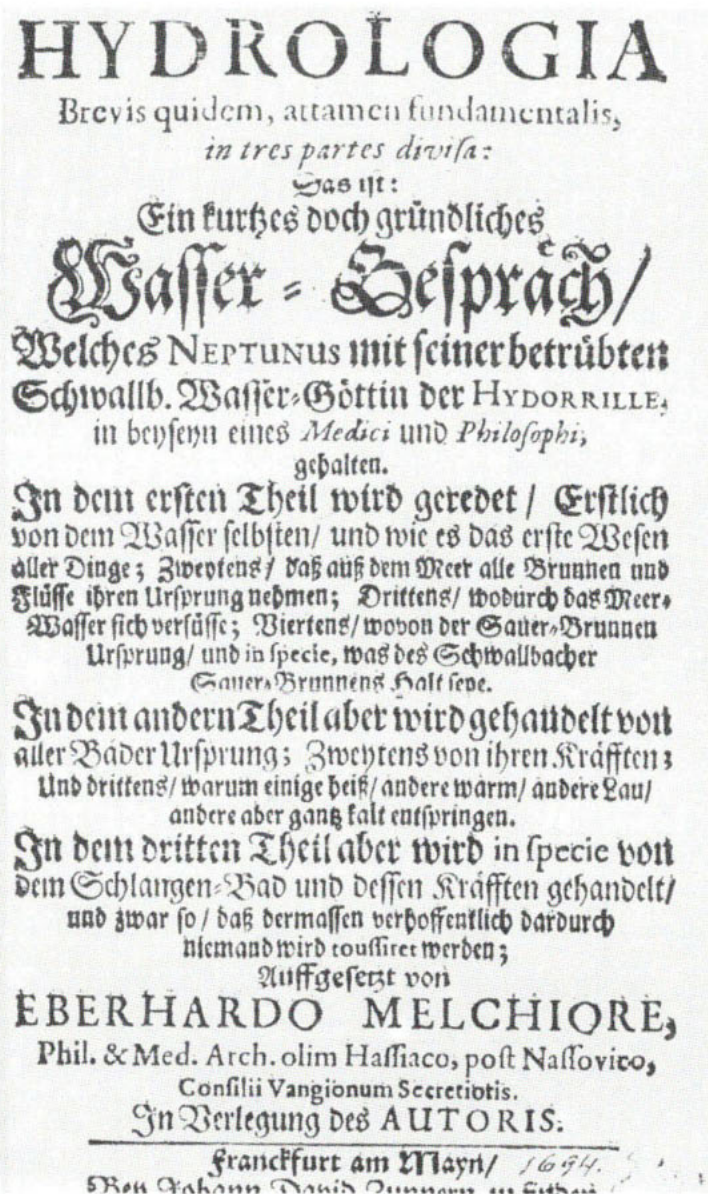


Fig. 3. Front page of Eberhard Melchior's book *Hydrology* of 1694

"hydrology" was used, of course with slightly different meaning than it is used now. Simpson pursued the so-called iatrochemistry (chemiatry or chymiatry, Greek *iatros* — physician) that had its origins in Hippocrates and was developed by Paracelsus (1493-1541). He was interested in therapeutic proprieties of mineral

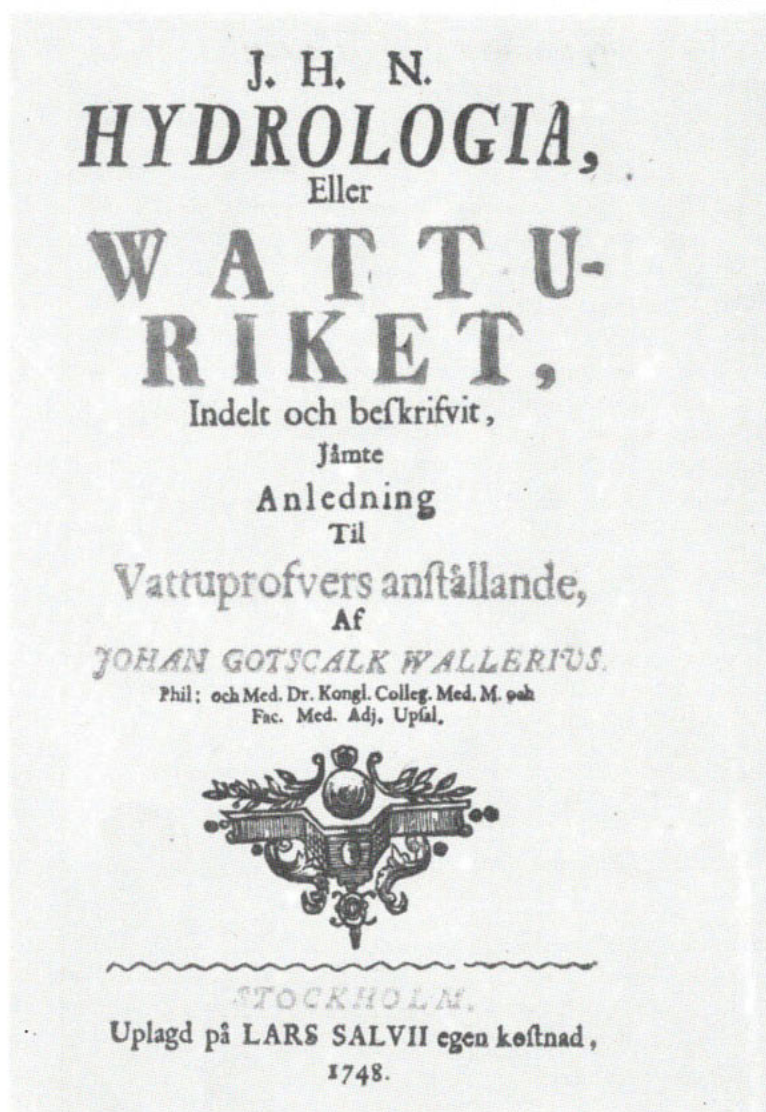


Fig. 4. Front page of Wallerius' book *Hydrology* of 1749

springs in the seaside locality of Scarborough, not far away from his native city of York (near Leeds). Such were probably the beginnings of therapeutic balneology (water treatment) (Greek *balneum*-bath).

It was not until the end of the 17th century that Eberhard Melchior, a physician of Frankfurt-am-Mein published his work *Hydrology*, devoted also to the use of mineral springs for therapeutic needs (Fig. 4).

However at the beginning of the 18th century, the first maps appeared which included in their titles a name "hydrography", for example, *Hydrographia Germaniae* by a well-known Bavarian cartographer and publisher Johann Baptist Homann (1664-1724), and unfound map *Hydrographia Sarmatica* (Piasecka 1970).

Yet it is difficult at that time to find a term "hydrology" in our meaning. It is worth indicating, however, that the term "hydrology" was mentioned in the law passed by Peter The Great (1672-1725) which pointed to the need of learning of languages and translating scientific books of the following fields: "mathematics even with elements of meteorology, mechanics, surgery, architecture, law, anatomy, botanics, military questions, hydrology (underl. Z.M.) and the like (Barenbaum 1988). It is known otherwise that on the initiative of Peter I the first measurement of the Neva river's flow was made in 1700, and in 1715 observations of the level of the Neva waters were started on the water-level gauge at Petropavlovskaya fortress in Petersburg (Zajkov 1973).

In 1738 Daniel Bernoulli (1700-1782) published in Strassburg his *Hydrodynamics*, written during his several years' sojourn in Petersburg, at that time the most important work on the matter, in which he also described the equation of continuity of motion of fluids. Daniel Bernoulli can be considered a founder of hydrodynamics (Kucharzewski, Kluger 1873).

Soon, a well-known Russian historian and geographer, Vasilij Nikityč Tatiščev (1686-1750), in his work "*O geografii voobščee i o russkoj*" (On general and Russian Geography) in 1746 formulated a definition of hydrography: "Hydrography is a description of waters, that is waters, backwaters, lakes and rivers, their width, depth and location of all waters, that is necessary for sailors; although the surface of the terrestrial globe is in prevailing part covered with waters, one cannot omit description of banks while describing waters" (Zajkov 1973).

In the mid-18th century the work "*Hydrology*" (Fig. 6) by a Swedish physician and naturalist Johann Goscalk Wallerius (1709-1785) was published. Wallerius made a review of land waters classifying them into common (*aqua communes*) and mineral (*aqua mineralis*). As early as in 1751 his work was translated into German and published in Berlin.

Ten years later the term "hydrology" appeared in a treatise by German physician Friedrich August Carthéseur, D.Sc. of natural sciences of the University in Frankfurt-am-Oder and later professor of Giessen University, who dealt with mineral waters (Fig. 7). Russian naturalist P. Wagreatis in his article "General remarks on natural history" (1762) said: "under whatever name one would have spoken about water, yet knowledge about it, i.e. hydrology (underl. Z.M.) is a useful and needed part of natural history" (Fiedosieyew 1960).

Some years later (1768) in Frankfurt an Leipzig the first, as it seems, hydrographical dictionary was published by Johann Hermann Dielhelm, also depicting some more important rivers of Northern and Southern Germany. A particular attention should be given to the then *Ancient Russian hydrography* published

in 1773 by a well-known publishing house of Mikołaj Iwanowič Novikov (1744-1818) an outstanding writer, representative of The Enlightenment in Russia. In this work *Kniga bolshomu chertezhu* (Book of great plan) — a composition from the 17th century about waterways in Russia (Barenbaum, 1988) was first published.

In Poland in the 18th century the term "hydrology" was used solely by Krzysztof Jan Kluk (1731-1796) in one of his manuals entitled *Rzeczy kopalnych...* (Of things to be mine-digged...) Vol. I of the work *O rzeczach kopalnych w powszechności, o wodach, solach, tłustościach ziemnych i ziemiach* (Of things to be mine-digged in general, of waters, salts, ground fats and ground) (Warszawa, 1781) contains much orderly arranged information from the sphere of occurrence of waters.

At the turn of the 18th and 19th centuries more works appeared with word "hydrography" in their titles. They include first of all the first Polish hydrographic map whose author Karol de Perthées (1740-1815) was the most outstanding Polish cartographer of that time. The first hydrographic map of Perthées appeared in 1785, and its title was probably *General hydrography of the Polish Kingdom* (Piasecka 1970). For the second time it was published in Paris in 1809 under the title *Carte hydrographique de Pologne*, it covered the area of Poland within its old frontiers, and "it was surely one of the most detailed hydrographic maps of our country" at that time (Mikulski 1978).

In 1816 the Royal Warsaw University was founded. The University statute provided i.a. for lectures on hydrostatics and hydraulics (within the framework of physics) in the Department of Philosophy. These subjects were taught, almost from the beginning, by Professor Karol Skrodzki (1789-1832), head of physical laboratory, physicist and zoologist, excellent teacher of the Warsaw Lyceum (Mikulski 1989). In 1819 additional lectures were introduced on analytic mechanics which were lectured by a mathematician, Rev. Rafał Skolimowski (1783-?), and from 1821 onwards by Professor Adrian Krzyżanowski (1788-1852) who taught also hydrostatics and hydrodynamics. In 1820 Skolimowski was transferred by Grand Duke Konstanty to the Application Military School, where in 1824 he published, for the first time in Poland, an original manual of mechanics and hydraulics *Historia nauki polskiej* (History of Polish science) (1977). At that time manuals on the subject appeared also in Germany; their author was Johann Albert Eytalwein (1784-1848), lecturer at the Berlin Polytechnical Institute, who in 1796 translated the above-mentioned work written by Du Buat, in 1801 published his manual on mechanics and hydraulics, and in 1826 a manual on hydrostatics.

Let us, however, come back to the term "hydrography" often appearing in Polish literature. Around the mid-19th century it was used by a well-known mineralogist and geologist Ignacy Domeyko (1802-1889), who after the November Insurrection undertook the work in Paris on a hydrographic map of Poland. First, he wrote a description part "Essai sur l'hydrographie, la géologie et de la production de la Pologne" that remained in manuscript (Piasecka 1970), and in 1838 he published *Carte hydrographique de la Pologne*.

In 1849, a geographer and poet Wincenty Pol (1807-1872) was appointed professor of the first in Poland Chair of Geography in the Jagiellonian University, and in 1851 he began the pioneer lectures on hydrography and oceanography. For the first time in Poland hydrography (and oceanography) became University science and Wincenty Pol, his only 4-years didactic activities in the Warsaw University notwithstanding, became the first lecturer on hydrography in Poland. Meanwhile, the term "hydrology", apart from the lapse of almost two centuries since its appearance in the literature, could not still acquire its right of citizenship. In the second half of the 19th century an English engineer, Nathaniel Beardmore (1816-1872), Chairman of the Royal Meteorological Society published the first English *Manual of Hydrology* in London, a revised and supplemented edition of his hydraulic tables of 1850 (Biswas 1970). In Poland, in 1923 Professor Mieczysław Rybczyński published in the Warsaw Polytechnical Institute the first Polish mimeographed lecture on hydrology and a year later he began regular lectures on this subject. On the international scale an intensive development of hydrology began upon calling into being in 1919 of the International Geodesy/Geophysics Union (now the International Union of Geodesy and Geophysics-UGGI), and particularly of its Section (1922) and in 1930 of a separate International Association of Scientific Hydrology (transformed only in 1971 into a present International Association of Hydrologic Sciences). In 1965 the Association called into being the International Hydrological Decade (1965-1974) which has been continued since 1975 as the UNESCO International Hydrologic Programme.

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