

**C. LINNAEUS, W. H. AUDEN, J. B. AUDEN, A. G. WERNER AND F. MOHS:
CONNECTIONS BETWEEN EARLY SCIENTISTS AND POETS,
AND THE CLASSIFICATION OF MINERALS**

by

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1. Introduction

The year 2007-2008 marks the Tercentenary of the death of the Swede Carl LINNAEUS (1701-1778) and the Centenary of the birth of the Anglo-American poet Wystan Hugh AUDEN (1907-1973). The connection of them both and the proper names of things was discussed in a paper in the *Faseb* biological Journal by the biologist and editor WEISSMANN (2007).

LINNAEUS set the stage for the importance of taxonomic naming by recognising the similarities between man and ape. He even recognised that plants had sex and demonstrated the importance of grouping like things in natural science and in so doing LINNAEUS placed Sweden firmly on the map of natural science. Given the significance of LINNAEUS in taxonomy, the question of nomenclature and classification in the science of mineralogy is here briefly considered. Given the context of mineral naming and classification, some of the contributions of WERNER and MOHS are also considered in this article.

2. C. LINNAEUS

Luckily, in early times LINNAEUS had access to plants from various parts of the world ranging geographically from Arctic regions such as Lapland (Figure 1), to the tropical regions of the Dutch East Indies. In his *Systema Natura* (1735), LINNAEUS at the age of 22 composed his *Praeludia sponsaliorum plantarum* (a prelude to the wedding of plants) and divided plants into classes by the number of male genitalia, the stamens, and then into orders by their pistils, the female genitalia. The supporting structure (the calyx) became the ‘nuptial bed’. He even compared some structures to labia minora and majora and created a class of flowers named clitoria. LINNAEUS was appointed Professor of Medicine in Uppsala (1741) and with his students for the next three decades continued to elucidate the problems of assigning finite names to the infinite objects of nature. The key to this was a system of names. In *Philosophia Botanica* LINNAEUS (1750) introduced binomial taxonomy in which, “a plant is completely named if it is provided with a generic name and a specific one.” Additions and corrections to his *Systema Natura* followed apace (see WEISSMANN, 2007). WEISSMANN discusses interesting connections between AUDEN and LINNAEUS, particularly how the photo and registry of AUDEN’s wedding illustrate the poet’s belief that proper names are ‘poetry in the raw’.



Figure 1:
Contemporary image of LINNAEUS dressed as a Laplander.

3. W. H. AUDEN

Wystan Hugh AUDEN (Figure 2), the Anglo-American poet, was the third and youngest son of George Augustus AUDEN. W. H. AUDEN's older brother and the second son of the family, John Bicknell, was a professional geologist who worked for much of his life with the Geological Survey of India (GSI). J. B. AUDEN's professional work in the Himalayas is said to have given W. H. AUDEN the idea for writing the play 'The Ascent of F6' with co-writer Christopher ISHERWOOD. The play is in fact dedicated to J. B. AUDEN.

W. H. AUDEN initially studied biology at Oxford University but eventually changed his studies to English. He had a lifelong interest in geology and mineralogy, particularly of the mineral-rich English North Pennines, the area where I carried out my PhD research (WHITTAKER 1963). The stratigraphical geology of the North Pennines comprises thick sequences of alternating limestone, sandstone and shale known as cyclothem. These are depicted in Figure 3, an illustration from an unpublished stratigraphical diagram produced by the well-known Victorian geologist William WALLACE (1861) and in my personal possession at present. The main limestone in this sequence is the Great Limestone. Auden was familiar with this limestone landscape from boyhood. He later wrote (1948) the allegorical poem 'In praise of Limestone', when he was possibly influenced by the limestone scenery of the Mediterranean. However, because he was holidaying in Ischia, Italy, while writing this poem, some may have thought that AUDEN was inspired by the immediate scenery and its associated topography, whereas the area of Ischia is, of course, part of a volcanic province.



Figure 2
Image of AUDEN.

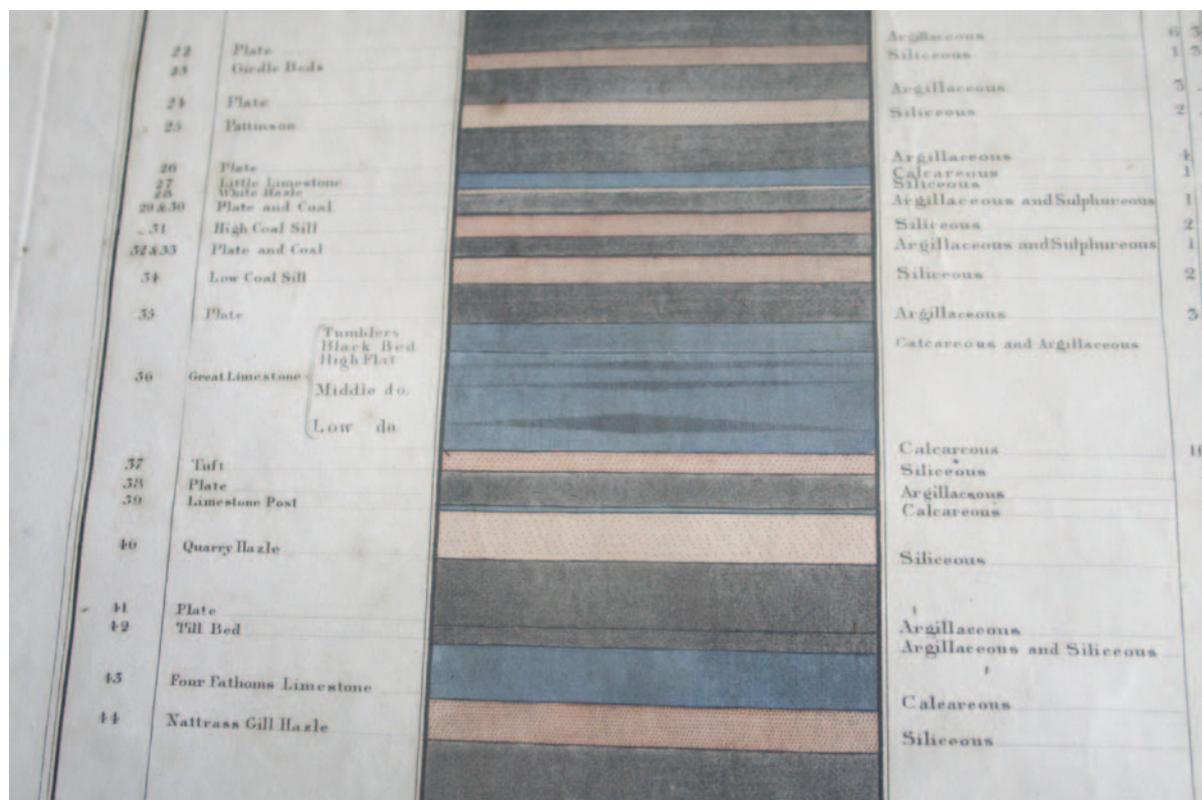


Figure 3:
A representative section of the strata of the Northern Pennines (Upper Limestone Group, including the Great Limestone) taken from William WALLACE (1861). Image copyright Morag WATSON, reproduced with permission.

Other poems by W. H. AUDEN relate to geology, mining and engineering. His interest in geology and its intimate relationship with industrial landscapes began at an early age. According to BICK (2004) AUDEN in his youth wanted to be a mining engineer. He wrote a poem about what is believed to be Rookhope mine when still a schoolboy (BICK 2004). Auden returned to the windswept hills of the Pennines throughout his life.

Further analysis of the poems related to mining can be found in MYERS and FORSYTHE (1999).

4. John Bicknell AUDEN (1903-1991) studied Geology at Cambridge University and went on to work at the Geological Survey of India. His geological interests were wide and included metamorphic tectonites of the Himalaya, engineering problems on damsites and even on seismicity associated with the Koyna Reservoir, Maharashtra, plus cement, as well as various geological maps, including one of the Southern Sudan. He was regarded as a great scientist by his Indian colleagues and co-workers and as a pioneer in the field of engineering geology and groundwater: 'a versatile genius with varied interests'. He also had a close interest in India and its culture. So widely regarded was he by his contemporary Indian colleagues that they produced several commemorative volumes in his honour.

The following quotation from the preface to RADHAKRISHNA's (2003) book illustrates the high regard in which John AUDEN was held by his colleagues. "This book is brought out to honour the memory of J. B. AUDEN, formerly of the Geological Survey of India (1927-1953), a truly great scientist specialized in studies of the Himalaya, a pioneer in the field of engineering geology and groundwater and a versatile genius with varied interests. His two essays on the Geology of the Krol Belt and the Geology of the Vindhyan sedimentation are excellent treatises which every student of geology of Indian [sic] should read. The lengthy introduction giving the outline of his career is intended to realize the memories of this large-hearted geologist, of his interest in India and its culture.

Younger geologists will derive inspiration from his works and become better geologists in following his footprints."

5. W. H. AUDEN in Europe

W. H. AUDEN became the Professor of Poetry at Oxford University (1956 to 1961) a post which required only three lectures a year. Towards the end of his life he and his American partner Chester KALLMAN moved to Austria and bought a house in Kirchstetten (Lower Austria).

W. H. AUDEN was a prolific poet, publishing about four hundred poems, including two of book length see MANDELSON (1991). W. H. AUDEN died in Vienna, Austria, and was buried in Kirchstetten. Despite his death in Vienna in 1973 and in his early years in Austria, W. H. AUDEN and his work were little known there, possibly because few of his poems were translated into German during his lifetime. This began to change in 1966 when he was awarded the prestigious Austrian State Prize for European Literature. In the same year he made a speech at the opening of the Salzburg Festival which greatly increased Austrian public awareness. It is also worth noting that together with his partner and co-author Chester KALLMAN (AUDEN & KALLMAN, 1956) he produced a Metalogue spoken by Sarastro as part of the opera *The Magic Flute* for an important production by NBC in America which was produced on television in 1956 on the occasion of the 200th anniversary of MOZART's birth.

The Internationale W. H. AUDEN- Gesellschaft (International W. H. AUDEN Society – see

Newsletter 2 September 1988) based in Vienna and Kirchstetten was founded in 1977 by Dr. Karlheinz ROSCHITZ, writer and journalist and Peter MUELLER. The main aims of the Society are the promotion of AUDEN's work in the German-speaking world and the care and maintenance of Auden's house and other memorials in Kirchstetten. Since its foundation in 1977 the Internationale W. H. AUDEN-Gesellschaft has held about 70 events.

6. Abraham Gottlob WERNER (1749-1817) (Figure 4) the 'Father of German geology' was born in Saxony into a family which had been involved for several hundred years in mining-related activities, thus giving him an early interest in minerals and rocks. At the age of nineteen he journeyed to Freiberg where he was soon invited to attend the mining academy established two years earlier. In 1771 he went to the University of Leipzig at first mainly studying law, but continuing to devote himself with great passion to mineralogical pursuits. While still a student he wrote his first work on the external characters of minerals which immediately gave him a name among the mineralogists of the day. In 1775 he was appointed inspector in the mining school and teacher of mineralogy at the Freiberg Academy.

It is particularly worthy of mention at this point that in addition to many subsequently distinguished scientists, WERNER's lectures were so highly regarded as to attract romantic philosophers, writers and poets like Gotthilf Heinrich von SCHUBERT (1780-1860), Henrik STEFFENS (1773-1845), and Friedrich von HARDENBERG, "NOVALIS" (1772-1801). So as well as inspiring numerous poets and philosophers, from that point onwards for about forty years of his life, WERNER turned the Freiberg academy from a mere provincial institution into one of the great scientific centres of Europe and one from



Figure 4:
Image of Abraham Gottlob WERNER of the Mining Academy, Freiberg.

which students from all parts of the world flocked to listen to his eloquent teaching. Although he wrote very little, he elaborated a complete system of geognosy and mineralogy, but was never persuaded to publish it. Accordingly he was one of the first scientists to classify minerals systematically. It is now well known of course that the classification of minerals has changed throughout the ages; the criteria of classification following the scientific development of mineralogical science. The criteria were first based on practical purposes such as appearance in the case of gemstones, then on physical properties, and later still, on chemical properties. Mineral classification today is largely structural. Although it was with WERNER that the physical classification attained its maturity and was generally adopted at the end of the eighteenth century it soon became far too complicated. For instance WERNER mentioned 54 varieties of colour. In the Middle Ages GEBER (JAVER Ibn Hayyaan, 721-803) proposed a classification of minerals based on the external characters and on some physical properties such as fusibility, malleability and fracture. This system was substantially refined by Friederich MOHS (1773-1839) see MOHS (1820) of Graz as the 'Natural History System of Mineralogy' (Dresden, 1820).

With regard to minerals, LINNAEUS classified them as follows:

<i>Erden Steine</i>	<i>Erze</i>	<i>Fossilien</i>
['Earthy' Stones ('earths')]	['Ores']	['Fossils']

A. G. WERNER (1749-1817) classified these minerals into the fourfold groups as follows:

<i>Erdartige Fossilien</i>	<i>Salzige Fossilien</i>	<i>Brennliche Fossilien</i>	<i>Metallische Fossilien</i>
['Earthy' Stones]	['Salty' Stones]	['Organic combustible' Stones]	['Metallic Stones']

Thus the three groups recognized at the time of LINNAEUS, had by the time of WERNER given way to a fourfold classification (see LÜDEMANN K. F. (Ed) 1967. Ab. Gottlob WERNER. Memorial Volume on the 150th year since his death. VEB. Leipzig. Of particular interest to WERNER and of great significance to mineralogy was his recognition of the importance of chemistry.

7. Friedrich MOHS (1773-1839) (Figure 5) was born the son of a merchant in Gernrode/Harz. He studied maths physics and chemistry at the University of Halle/Saale. He completed these studies as well as mechanics at the Mining Academy of Freiberg/Sachsen. He was a student of WERNER, who introduced MOHS to mineralogy. MOHS introduced a systematic classification of the realm of minerals which was in conflict with many of the other mineralogists of his time, due to his preference for physical attributes as the principals of classification (i.e. shape, cleavage, hardness, and specific weight), as opposed to the chemical composition of the minerals. In 1812, MOHS was appointed Professor of Mineralogy at the Joanneum in Graz and it was during this



time that he developed the MOH's Scale of Hardness. His stay in Graz was only of short duration and in 1817, he succeeded his teacher A. G. WERNER, at the Mining Academy of Freiberg. In 1826, MOHS was appointed Professor of Mineralogy at the University of Vienna. MOHS first came to Vienna in 1802 to sort and annotate the important collection of the banker J. F. van der NUEL. (This collection was incorporated into the Austrian Imperial Mineralogical Collection in 1827). In 1835, MOHS left the Mineralogical Cabinet upon his appointment as mining councillor at the Mining University in Leoben. MOHS died on 29th of September in 1839 during a visit to Italy.

Figure 5
Image of Friedrich MOHS.

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