

*Goethe's interest in British mineralogy.*

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JOHANN WOLFGANG VON GOETHE (1749–1832), the bicentenary of whose birth at Frankfurt-on-Main will be commemorated on August 28, 1949, gave us extensive accounts of the development of his studies in optics, botany, and meteorology; with regard to the history of his studies in mineralogy and geology, his most concise statement is his essay 'Geology, in particular that of Bohemia'. This essay, written in 1817, starts with three quotations. The first is in English:

What is the inference? Only this, that geology partakes of the uncertainty which pervades every other department of science.

The source of this quotation still remains to be discovered. At the end of this essay, Goethe said that he was:

fortunate in obtaining a series of minerals from all the principal countries. Herr Mawe, the mineral merchant in London, provided me with a most satisfactory collection from Cornwall, and to Herr Ritter v. Giesecke I am indebted for an important addition to my collection of English stream tin and Malacca tin. All these materials have now been well arranged in my collection, but my plan to write something conclusive on this subject could not be carried out, as so many other things I should have liked to do in the scientific field.

In the 1833 edition of Goethe's works the section of his mineralogical and geological writings concluded with his review of John Scafe's poem 'King Coal's levee' (4th edition, London, 1820), and this arrangement has been preserved in most editions of Goethe's works.

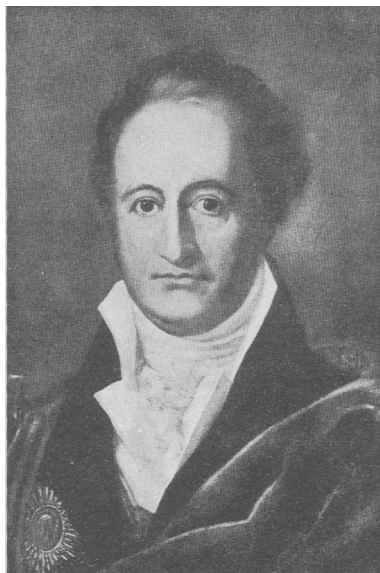
It is a well-known fact that Goethe's 'Theory of colours' is mainly a discussion of Newton's teaching; in the historical part of that work, no nation figures more prominently than does the British nation. In Goethe's botanical studies Robert Brown occupied an important place, and his meteorological studies were chiefly inspired by Luke Howard and J. F. Daniell. While Goethe clearly acknowledged his indebtedness to British scientists also in the mineralogical field, it has never been established what knowledge of the mineralogy of Britain was conveyed

to him through those contacts. It may be regarded as providential that as early as 1806 Johann Georg Lenz (1748–1832), the mineralogist at Jena, chose the name of goethite for a mineral, the best crystals of which come from Cornwall.

Shortly after writing his essay 'Geology', Goethe stated that his interest in mineralogy dated from his twenties. Among his earliest notes on this subject we have a reference to 'Galmey, cubic hollow crystals, apparently pseudomorphs, from Flintshire' (Weimar edition, 2nd series, vol. xiii, p. 392). However, Goethe admitted at that time he was merely toying with scientific subjects.

As in the meteorological field, in mineralogical studies his methodical interest was evoked through his patron, the Grand-Duke Karl August of Saxe-Weimar. In 1816, when touring England, the Grand-Duke had collected information on English minerals. On May 21, 1816, Goethe entered in his diary: 'The Grand-Duke had brought English books. Dinner at Court. Unpacked chrome-iron specimens.' On April 17, Goethe

had forwarded to Lenz notes on the 'Suiten' the Grand-Duke had brought from England, and on the iron and coal deposits near Birmingham, which the Grand-Duke had specially studied. These notes, Goethe requested, should be 'placed with the other materials', apparently a collection of information on coal and ore deposits in other countries to be studied with regard to the development of the mineral resources of the Grand-Duchy of Saxe-Weimar (a subject to which Goethe devoted his attention as early as 1797, see Weimar edition 1st series, vol. liii, pp. 320 f. and 525). It is not impossible that the visit of 'three geological Englishmen', recorded in Goethe's diary of July 11, 1816, was connected with the Grand-Duke's tour.



J. W. VON GOETHE  
(at the age of about 60)  
From a painting by Luise Seidler in the  
Mineralogical Museum at Jena.

It appears that the information supplied by the Grand-Duke coincided with a specific interest which Goethe had already conceived in the mineral resources of England. On November 11, 1815, he stated in his diary that in the morning and in the evening he studied 'English minerals'. In December 1814 he had written to C. C. von Leonhard, the mineralogist at Heidelberg, asking whether he could assist him in obtaining 'Zinnstufen' from England, which, he said, were still missing in his collection. Owing to the war Leonhard apparently was unable to help Goethe, for on June 23, 1817, Goethe asked Hüttner, the book agent of the Weimar Court in London, to procure for him

an instructive series of English tin formations. What is required, are not expensive and extraordinary pieces, though beautiful specimens among the instructive ones would be acceptable. The main interest is in both the nearest and the more distant strata. In Wallis [i.e. Cornwallis] as everywhere else, tin occurs in what is only apparently granite; it would be desirable to obtain specimens of the more distant original stratum, even when it is several hours distant. I do not dare to place an order, because, due to the trouble involved in the collecting of such specimens and the total absence of any standards of remuneration, such an order could not be made sufficiently definite. If it would be possible to give me an approximate idea as to the costs of obtaining such a collection wherever it may be, the details of the order could then be decided upon.

I suggest that this letter is an important record of the organization of the work of the early mineralogists.

Perhaps it was in connexion with Goethe's request that Hüttner obtained for the Weimar Library a copy of 'A descriptive catalogue of minerals' (2nd edit., London, 1816) by John Mawe, which Goethe borrowed from September 5, 1817 to July 20, 1818 (in his diary for September 6, 1817, referred to as 'Mawes Catalog').

Towards the end of September 1817, Goethe wrote to Lenz asking him whether

Herr G. [*sic*] Mawe, author of the 'Mineralogy of Derbyshire, Travels in Brazil, Treatise upon Diamonds, and others [*sic*] Precious Stones' should receive a diploma [of membership to the Jena Mineralogical Society], if not [Goethe obviously meant: 'if so'], I request that it should be speedily issued.

On October 23, Goethe's diary refers to 'Mawes Edelsteine' and on the next two days to 'Mawes Demanten' (read in conjunction with Lenz's manual of mineralogy), again on November 16, 1819, 'Mawe Abhandlung von Diamanten'. (Goethe's borrowing the German translation by C. G. Kühn (Leipzig, 1816) of Mawe's Treatise is recorded in the Weimar Library for October 24 to December 20, 1817 only.)

On November 4, Hüttner wrote to Goethe that

the diploma of the Mineralogical Society has given great pleasure to this truly worthy man, as is proved not only by his letter of thanks (which is enclosed), but also by the account, specially compiled by him for that Society, of his late tour in Cornwall. These notes on the remarkable Bovey coal works have never been published. . . . He continued in his letter [to Hüttner]: 'Any thing this Country or Brazil produces and which I either possess or can procure, I am willing freely to exchange for the mineral productions of the Continent.'

On November 27, Goethe's secretary dispatched to his master, then at Jena, by express mail the copy, obtained on loan from the Weimar Library (until July 4, 1818), of the German translation of Mawe's 'Travels in Brazil' (Bamberg, 1817), by E. A. W. Zimmermann, a friend of Goethe's. Apart from W. L. von Eschwege, also a friend of Goethe's, Mawe had been the first scientist to obtain permission from the Portuguese government to study the mineral resources of Brazil. There is evidence of the impression which Mawe's 'Treatise upon diamonds' made on Goethe. When on June 20, 1819, he thanked Pansner, the mineralogist at St. Petersburg, for sending him some amethysts, Goethe asked him to extend his studies to a comparison with similar minerals in England. In his letter to Sir Charles Giesecke of November 22, 1819, Goethe stated that he had learnt from Mawe's work that citrine was found in Cairngorm in Aberdeenshire.

Hüttner's letter of November 4, 1817, with the enclosures from Mawe, was received by Goethe on November 24, when the whole day was spent in a preliminary study of Mawe's essay, in meditations upon its contents and the prospects opened by this contact, and in discussions of these subjects with friends. Goethe's diary entry for this day concludes: 'In the night deciphered, and meditated upon, Mawe's essay.' On the following day, Goethe proceeded to 'translating Mawe's essay on the brown coal deposits of Bovey', and three days later he wrote to his son that

Herr Mawe feels greatly honoured by our diploma. We may expect the best from him. That winter day, which will bring me 'Zinnstufen' from Cornwall, shall be marked in red. In general, the study of this subject has become so clear that I can hope my ideas will be realized almost by themselves.

Goethe's meditations upon the contents and implications of Mawe's essay and the general conclusions he drew from it illustrate the philosophical manner in which he dealt with scientific details. This incident further illustrates the eagerness with which Goethe used to receive and assimilate information, especially in the scientific sphere, obtained from Britain. How conscientiously he proceeded may be seen from the fact that when, on December 17, he found the time to resume his work on

Mawe's essay, he first revised the first part of his translation before translating the rest; on the same day he discussed mineralogical subjects with Lenz. Early in 1818, Goethe submitted his translation to the Jena Mineralogical Society, adding the following 'Note and wish':

The Jena Mineralogical Society, especially its president and council, have learnt with great pleasure of the interest which Mr. Mawe is willing to take in its work. The account of his latest expeditions has been translated at once into German, and a copy of this translation is enclosed. Perhaps Mr. Mawe would examine it with the assistance of a person who knows both English and German and would inform us whether we have interpreted him correctly. This account would then be inserted into the proceedings of the Society. (Weimar edition, loc. cit., pp. 394 ff.)

It seems to be unknown whether Mawe revised Goethe's translation, and there is no indication either that the original of Mawe's essay has been preserved. It was not until 1823 that the 'Annalen der Societät für die gesammte Mineralogie zu Jena' (of which four volumes had appeared between 1802 and 1811) resumed publication under the title 'Neue Schriften der Grossherzoglich S[ächsischen] Societät für die gesammte Mineralogie in Jena'. Only two volumes appeared, in 1823 and 1825 respectively, and Mawe's essay is not found in either of them.

Considering the hesitancy with which Goethe released his translation of Mawe's essay, it requires some courage to offer a retranslation. However, with the recent publications on the lignite of Bovey Tracey and the interest lately taken in the industrial utilization of these deposits, my undertaking may be justified. 'Mr. Mawe's account of his late expeditions in October 1817' starts with a reference to Cornwall, Devonshire, and Exeter. It then concentrates on Bovey, 'a village in the east of Dart Mon' [*sic*]. I confine my retranslation to the passages of mineralogical interest:

The clay has stripes of various whiteness, usually of a light smoke colour. When burnt, it is pure white and after some preparation yields a splendid product. In the north and even more so in the west, we have granite minerals, especially the variety known as 'Monstein' which is richer in felspar than are other varieties. This felspar is now gradually decomposing. In the north, mountains of clay-slate, and syenite are rarer than those of granite. The plain covered by that clay has formed at the foot of the granite Dart Mon [*sic*] mountain. On the west side only a few feet below the surface is a deposit, about two miles wide, of a special variety of coal. It is covered by a layer of shale with bitumens (known as 'fuel slate'), friable and liable to decompose, five to seven feet deep. This coal is won in open-cast mining, and is up to 50 feet deep, 25 feet are visible above the water which fills the bottom of the pit. This coal has the appearance of a large heap of decomposed manure, its colour varying from brown to blackish-brown, with a fine lignite structure towards all sides. Some parts show a perfect lignite structure. It is neither brittle nor shiny, rather dull; interspersed is resinous asphalt, easily inflammable and agreeable in smell. The coal is excavated by means of a sharp spade and an

edged tool. It yields considerable heat, with an unpleasant smell, so that it is used only in lime kilns and in the houses of the poor. At careful handling this coal can be cut into boards of any length and not above one inch in thickness. At drying, these boards become hard and brittle. This substance, so different from what the English are used to call 'coal', deserves special attention.

There is no limestone or other overburden as otherwise found with coal; there are no clay-ironstone fossil plants, pyrites, or other sulphurous materials, as generally found with normal coal-fields, no remnants of sea-shells, only the aforesaid clay and bituminous slate and some quartz layers. The formation of this coal is so different from any other, that it deserves the attention of geologists. It is excavated down to 55 feet. As the works are at the bottom of the mine, they are easily flooded.

It may be mentioned at this point that on July 15, 1827, Goethe noted in his diary a reference to 'British Chronicle' (xxv, 1827), 'News of mining in Cornwall and Mexico'. With regard to Mawe's reference to the absence of fossil plants, two English items in Goethe's studies in fossil formations may be of interest. In April 1817 he translated from 'Annals of Philosophy' (1816, no. 144, p. 153) a note by one R. Y. on finds in prehistoric tombs 'opened by order of the British commanding officer, at Cephalonia'; this translation is an important record of Goethe's knowledge of English geological terminology. With regard to that account, Goethe said that its 'tact' in being 'satisfied with natural explanations' was exemplary, one of the earliest appreciations by Goethe of an English scientific text. On March 30, 1826, Goethe read E. T. Artis's 'Antediluvian Phytology, illustrated by a collection of the fossil remains, peculiar to the coal formations of Great Britain' (London, 1825), a work paying high tribute to German workers in the field, especially Count Sternberg, Goethe's mineralogical friend, and acknowledging its indebtedness to Noehden, one of Goethe's most important informants on England.

To come back to Goethe and Mawe, following the latter's suggestion to establish an exchange of minerals, Goethe carefully prepared for him a collection of minerals, chiefly from the Rhineland, and extensively indexed, labelled, and packed it; this collection was dispatched in July 1818. Referring to this collection in his report to the Jena Mineralogical Society, Goethe, curiously enough, did not say that he sent it in exchange for what Mawe had sent him. Reviewing his activities in 1817, however, he said that through Mawe's book on Brazil he obtained information of those parts of the world.

As for myself, I entered into personal contact with Mawe, receiving through his good offices a fine collection of English "Zinnstufen", as always [namely, as the specimens from other parts of Europe in Goethe's collection] obtained from the immediate vicinity of primitive rocks [granite], this time in chlorite minerals.

These were obviously not the 'Englischen Stufen', the receipt of which Lenz reported to Goethe on July 22, 1817. In 1827 Goethe again referred to his collection of tin formations 'from Sweden, Spain, and England' (in a letter to a mine official at Altenberg, in the Ore Mountains of Saxony, who was naturally interested in this subject).

Even before establishing relations with Mawe, Goethe had come into contact with scientific mineralogy in Britain. On March 22, 1817, he had written to Voigt (of whom more below):

I enclose an issue of the English journal edited by James Sowerby, showing instructive specimens and excellent illustrations on plates 43, 44, and 45. In return, he should receive a diploma, many thanks, and further requests. This issue will generally please your Excellency. The whole work will be obtained, the copper plates being most acceptable substitutes for the originals.

This was evidently no. 8 (June 1812) of James Sowerby's 'Exotic mineralogy' (2 vols., issued in 27 parts, London, 1811-20), where plates 43-45 show corundum, specimens of which had been received by Goethe on March 21, 1817. On the title-pages of vol. 5 (1817) of 'British mineralogy' and vol. 2 (1818) of his 'Mineral conchology' Sowerby figures as Honorary Member of the Mineralogical Society of Jena, but as he died in 1822, his name does not appear in the Society's list of 1823.

The high quality of copper-plates and hand-colouring in English books was frequently admired by Goethe; Sowerby's work was known to him from the early volumes of Curtis's 'Botanical Magazine', and from Sowerby's 'Elucidation of colours' to which he repeatedly referred. In 1822 he borrowed from the Weimar Library W. E. Leach's 'Malacostraca podophthalmata Britanniae' (London, 1815), which, with reference to the illustrations, he described as 'Sowerby Malacostraca'.

However, it was by no means only the external appearance of English scientific books that appealed to him.

In 1826 Goethe read Mawe's 'New descriptive catalogue of minerals' (fourth edition, London, 1823); while 'meditating upon the smallness and comprehensiveness of such manuals', Goethe realized 'the heaviness and clumsiness' of similar German works, a significant statement of Goethe's opinion of British scientific writing in general.

In the spring of 1819, Goethe met, at a meeting of the Jena Mineralogical Society, Joseph Green Cogswell, mineralogist and librarian at Harvard University. Among other books on America, he received from him Wm. Maclure's 'Observations on the geology of the United States of America' (Philadelphia, 1817) and 'Observations on the geology of the West Indies' (Journ. Acad. Nat. Sci. Philadelphia, 1817, vol. i, part 1); both works are still in Goethe's library. Through Cogswell, Goethe sent, on July 29, a diploma of membership of the Mineralogical

Society to Parker Cleaveland, in return for a copy sent to the Society of his 'Elementary treatise on mineralogy and geology' (Boston, 1816). This book, the first work of its kind in America, was alternatively referred to by Goethe by its title in German translation as 'Amerikanische Geologie', 'Mineralogie', or 'Geognosie der Vereinigten Staaten', the last title rather surprisingly, as otherwise Goethe insisted on the distinction between geognosy and mineralogy. Cleaveland appears in the list of foreign members in vol. i of the 'Neue Schriften' of the Jena Mineralogical Society; in vol. ii, his name appears among the foreign honorary members; and the second edition (1822) of his work (on the title-page of which Cleaveland described himself as 'Fellow of the Mineralogical Society of Jena') is listed among the accessions to the Society's library; of this edition Goethe spoke extensively in his letter to Count Sternberg of June 20, 1826. In the spring of 1826 Goethe read the work of another American scientist, namely 'Narrative of an expedition to the source of St. Peter's River' (London, 1825) by Wm. H. Keating; especially on March 24 he noted: 'Compared Keating's Journey through North America with a map'. These relations between Goethe and American mineralogists should be studied with a view to establishing Goethe's knowledge (rather than his opinion) of America. With regard to American minerals, Goethe's knowledge was not confined to mere reading; in his essay on 'Zinnformationen' (written in 1813, Weimar edition, 2nd series, vol. x, 121), he mentioned 'Tropfzinn aus Cornwallis, aus Amerika'.

In 1820 Goethe opened for himself another important source of information on British mineralogy. On March 24 he received from the Weimar Library 'new English books', one of the numerous consignments sent by Hüttner; the evening of the following day was spent in the study of these books. On March 26 and 28 he definitely referred to his reading Macculloch's 'Westliche Inseln Schottlands.' On March 25 he wrote to Bran in Jena that, in compliance with his request to send him new English books of possible interest to his ethnographical periodical, he returned to him two of these newly arrived works, one on the Antilles and one on Nubia, retaining Macculloch's, as, from the table of contents, it appeared to deal exclusively with mineralogy. (Later he discovered that the scope of this work was much wider.) On March 28 he wrote to the Grand-Duke:

The last consignment of English books was very important. . . . I am studying with great interest Macculloch's 'Westliche Inseln'. It is curious and agreeable for us old Neptunists that the words 'volcano' and 'volcanic' do not occur in this book, and that basalts are reckoned, in accordance with Werner's good custom, to the Trap formations.



Long after A. G. Werner's death (in 1817) Goethe and the Grand-Duke of Saxe-Weimar adhered to his neptunism, chiefly against plutonism as represented by Hutton and later by A. von Humboldt. In Thuringia, volcanism was supported by J. C. W. Voigt, the mineralogist at Ilmenau, a former pupil of Werner's. Referring to his controversies with Voigt, Goethe wrote on March 31, 1820, to Nees von Esenbeck, a mineralogist greatly admired by him:

As God has mercy on those who believe in Him, just when their distress is greatest, a work has reached me, from which I gather that beyond the sea at least there are still fellow adherents to the old creed. 'A Description of the western Island's [*sic*] of Scotland' [*sic*] by John Macculloch, London, 1819, two volumes text in 8°, the third in 4° with engravings and copper-plates, is an excellent work in every respect; closest observation of the formation of islands, partly from nature, partly raised to general conceptions and symbolical images. Of course, the sections of islands are more convenient for this type of study than are the solid masses of the continent. (Weimar edition, 4th section, vol. xxxii, p. 372.)

While admitting that he was biased in favour of this work because it was written from the neptunist point of view, Goethe concluded: 'At any rate, this work can be warmly recommended to any lover of nature, whatever his scientific creed may be.'

Only a few months later, Goethe received a further striking proof of the survival of neptunism 'beyond the sea'. On November 19 he wrote to the Wernerian Society at Edinburgh to thank it for the diploma of honorary membership which had been sent to him with a hand-written letter from Robert Jameson, its president. Only those who are unaware of Goethe's extensive interest in British mineralogy can doubt (with Leitmeir) 'whether this honour was conferred upon Goethe in his capacity of mineralogist or of poet'. In 1823 it was C. F. Schwägrichen, the botanist, who procured for Goethe the membership of the Royal Society of Edinburgh (then under the presidency of Sir Walter Scott); and in 1825 Giesecke, professor of mineralogy at the Royal Dublin Society, was instrumental in having Goethe elected honorary member of the Royal Irish Academy. Among Goethe's notes from Nose's 'Kritik der geologischen Theorien' (1822), there is a paragraph on the Wernerian Society of Edinburgh:

which not only recognised the value of the great German and his school in general but also knew how to adapt his teaching to the progress of science. This Society and its president Jameson consider the two opposed theories of neptunism and plutonism, outlining the higher laws or demands of nature.

Also with regard to the western islands of Scotland, Goethe's mineralogical knowledge did not remain confined to reading. In October 1826,

Vargas Bedemar, the Danish chamberlain, on his return from Scotland, brought for the Grand-Duke's collection of precious stones some 'Scottish topazes' (a few years earlier he had brought precious stones from the Faeroes). These stones were at once submitted to Goethe for ascertaining their mineralogical rather than their material or aesthetic value, and writing on October 30 to the Grand-Duke, Goethe stated that he was interested in learning that

such stones are also found in those parts of the world; similar topazes have been found in Ireland. Thus the sequence and congruity of original rock formation all over the earth is once again illustrated,

a typical example of the conclusions, often perhaps too far-reaching, which Goethe used to draw from minor data. The minerals of Staffa and Fingal's Cave were also mentioned in John Scafe's 'King Coal's levee' and Goethe's summary of it, to which I shall refer presently.

In his letter of August 30, 1830, to Wackenroder, the pharmacologist at Jena, Goethe referred to a paper which, according to the official report; Leonhard had read at the meeting of German scientists at Heidelberg in September 1829 on the subject of 'verglaste Burgen', doubtless based on Macculloch's 'Remarks on the vitrified forts of Scotland' in 'Transactions of the Geological Society of London', 1814, vol. 2, pp. 255 ff. On December 24, 1830, Goethe received a copy of Leonhard's paper and on January 6, 1831, a few specimens of this formation; this information was communicated on January 22 to Mahr, the mine inspector at Ilmenau, an illustration of the important part which Goethe played in the promotion of German knowledge of the mineralogy of Britain (see also his paper on vitrified forts (Weimar edition, 2nd series, vol. x, pp. 43 ff.). With reference to Mawe's essay translated by Goethe, it may be of interest that in the same volume of the 'Transactions of the Geological Society of London' Macculloch had an article on distillation, relating also to Bovey lignite or brown coal.

There is no evidence of Goethe's reading the 'Transactions', but among the notes which he took from Nose's work there is a passage on the Geological Society of London and on Greenough, its President, who point to the wrong methods in the formation of theories, but do not sufficiently state the right method. Greenough rejected the theories of both Werner and Hutton, but failed to throw new light upon the subjects.

Goethe then noted Nose's remarks on the works by Greenough and Macculloch. 'A critical examination of the first principles of geology' by G. B. Greenough (London, 1819) was mentioned in Goethe's diary of August 9, 1820. In his Annals for 1820 he said that the arrival of

this work 'from England was very welcome'. Once again he was biased in favour of the work by a British mineralogist because of its neptunist point of view: 'Though I have been accustomed for many years to hear Werner's views stated in a foreign language, this work has been both exciting and delightful to me.' Greenough had studied in 1798 at Göttingen under Blumenbach (on whom in 1840 he delivered an obituary address, praising him as 'the John Hunter of Germany') and subsequently at Freiberg under Werner. In 1811 he became the first president of the Geological Society of London, encountering some opposition from Sir Joseph Banks who wished to subordinate it to the Royal Society. Goethe was much interested in the organization of scientific societies in Britain, very well acquainted with the history of the Royal Society, and aware of Sir Joseph's various activities; in his letter to Sternberg of September 13 to 21, 1826, he referred to Cuvier's praise of Banks's mineralogical achievements. Greenough generously acknowledged his indebtedness to Werner and other German geologists, and most of the books which he presented to the library of the Geological Society were German. Re-reading his work with Goethe's eyes, one cannot fail to recognize that it was a source not only of the first principles of geology but also of the geology and mineralogy of the British Isles. Goethe also seems to have known Greenough's 'Memoir of a geological map of England' [and Wales] (1820), or it would appear that such a map, 'particularly extensive and neat' was included in his copy of Greenough's 'Critical examination' (it is not in the copy of that work which Greenough presented to the Royal Dublin Society, now in the National Library of Ireland). In his diary for July and August 1820, Goethe repeatedly speaks of a large geological map of England in his house, in which also the Grand-Duke and the Princesses were greatly interested. On the same day, when he received the Scottish topazes, mentioned above, Goethe asked the Jena Museum to send him 'the petrographic map of England', and in November 1828 he discussed with Eckermann 'the English geological chart'.

Through his extensive reading, Goethe had become thoroughly acquainted with English mineralogical terminology. In 1822, in his essay 'Kalk-Gebirg', mainly dealing with Thuringia, he specially discussed this subject, stating that '*Chalk* is in English not what we understand by it [*Kalk*, i.e. lime] but *Kreide*. If contained in *Letten-Flötze* it is called *clay*', and comparing the English terms 'red clay', 'black earth', and 'sand' with their German equivalents. The most interesting illustration of Goethe's knowledge of English mineralogical terminology

is his summary of John Scafe's 'King Coal's levee'. While Goethe's literary appreciation of this poem has been studied before, there is still room for an investigation into the contribution made by that work to Goethe's English scientific vocabulary. While in many cases no translation of the mineralogical terms was necessary (because these were either international or of German origin), the translations of 'limestone' by 'Urkalk', 'Lias' by 'Tuffstein', and 'chalk' by 'Flötzkalk' prove Goethe's intimate acquaintance with the subject. The passage: 'Chalk when at home was never seen without him' [flint] was expanded by Goethe to: '*Flötzkalk*, residing in southern England, was never found without this rogue', thus showing that he had knowledge of English mineralogy of his own. The notes which Scafe added to his curious poem were doubtless an important source of Goethe's information of the mineralogy of the British Isles. Shortly after writing his review of this poem, Goethe told Crabb Robinson that 'Scafe's "King Coal's levee" contains all the geology a man needs to know'. In the beginning of his review Goethe made the still more significant statement:

The English nation is at a great advantage by the fact that her scientists try to make practical use as soon as possible of both their comprehensive theories and the individual details of their investigations. The safest way of doing so is by spreading knowledge as far as possible.

As late as March 1831, Goethe tried through John Murray, the publisher, to establish personal contact with Scafe.

On the strength of his reputation as a poet, Goethe succeeded in carrying information on scientific subjects into circles which otherwise would scarcely have taken any interest in them. Without such popular and practical interest the development of modern science cannot be thought of. While the attempt sometimes made to describe Goethe as a great discoverer of scientific facts and theories, such as the glacial period, cannot be excused, it is hard to be patient at the harsh verdicts frequently passed on amateurish activities. Such criticism is expressive not only of lack of historical perspective, but even more so of ingratitude towards the pioneers of mineralogy. By his adherence to Wernerianism, Goethe was in a position to understand intimately the work of the British mineralogists of his time. Through his adherence to Werner's conception of descriptive geology, he played a prominent part in establishing petrography and mineralogy as independent branches of scientific research. Happy times when the rulers of states and their ministers had the leisure to enter seriously into such matters.

Investigating the details of Goethe's scientific activities we become

aware of the overwhelming breadth and depth of his interests. No part of the world was too remote, no detail of information too minute, to become to him a source of inspiration. The study of Goethe's relations with British scientists reveals his overruling sense of reality. While primarily interested in personal and philosophical aspects, he derived from these contacts an abundance of factual information, which he humbly accepted, digested, and assimilated. In many instances the emphasis which Goethe laid on, or the interpretation which he gave to, the various points in this information was far ahead of his time. His collection of minerals, still in their original arrangement, is preserved in the Goethehaus (now national Museum) at Weimar.

*Summary.*—As in other spheres of his scientific activities, in Goethe's mineralogical studies British scientists, notably Mawe, Macculloch, Greenough, and Scafe occupied a prominent place. From personal contacts with, and the reading of the works of these authors, Goethe derived detailed knowledge of the British mineralogy of his time and of the minerals of Britain, which were well represented in his collections.

#### *References*

Quotations given above (in my English translation) are taken from the Weimar edition of Goethe's collected works (133 vols., 1887-1919; including scientific works, 13 vols.). None of the references given below deals with Goethe's relations with British scientists.

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