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*The Rev. William Gregor (1761–1817), discoverer of
titanium.*

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IN view of the important uses to which the metal titanium has been applied in recent years, it seems fitting that some tribute should be paid to its Cornish discoverer, the Rev. William Gregor, and with this end in view I have collected the following facts concerning this now almost forgotten distinguished early chemist.

The Rev. William Gregor, M.A., chemist and mineralogist, was the younger son of Francis Gregor, member of an old Cornish family of Trewarthenic, Cornelly, Cornwall. Born on December 25, 1761, he was educated at Bristol Grammar School, and it was while there that he first developed a taste for chemistry. From Bristol he went to St. John's College, Cambridge, from 1780 to 1787, becoming a Platt fellow, his classical and mathematical attainments being of a high order. Ordained in 1787, he was appointed Rector of Diptford, Devonshire, and in 1790 married Charlotte Anne Gwatkin, daughter of a Bristol merchant, by whom he had one daughter. In 1793 he was presented with the living of Bratton Clovelly, Devonshire, but exchanged this in the same year for that of Creed, Cornwall, where he remained until his death in 1817. Gregor was made an honorary member of the Geological Society of London in the year of its inception, 1807, and was an original member of the Royal Geological Society of Cornwall on February 11, 1814. Among his intimate friends were his neighbour John Hawkins of Trewithen; Samuel Drew the Cornish metaphysician, the acquaintance of whom he made in 1803; and John Ayrton Paris, M.D., resident at Penzance from 1813 to 1817 and one of the founders of the Royal Geological Society of Cornwall.

It was at the remote and quiet vicarage of Creed (one mile south of Grampond) that this erudite, modest, and kindly man carried out, with little or no convenience or apparatus, his original and for those days surprisingly accurate analyses of various Cornish minerals. The writer has in his possession several letters written by Gregor in 1804 and 1807 to John Hawkins, and from these an insight can be obtained of the painstaking enthusiasm he displayed in the analysing of minerals, but never allowing his love for science to interfere with his parochial duties.

Gregor's most important discovery, that of the metal titanium, was occasioned by his analysis in 1790 of the mineral menaccanite (originally spelt menachanite or alternatively menacanite and menakanite), a variety of ilmenite which occurred in the sand of a stream at Tregonwell Mill, Menaccan (also spelt Manaccan and Menachan), Cornwall. This he pronounced to be iron in a magnetic state, united to the calx of a new metallic substance which he proposed to call menacanite or menachine. His account of this mineral was first published in 1791 in German and French journals (see Bibliography). It was also read before the Royal Society of London, but the prior publication in a foreign journal prevented its insertion in the *Philosophical Transactions*. It was not until 1795 that M. H. Klaproth, on analysing rutile, called the new metal Titanium or Titankalk, and on subsequently analysing menaccanite and finding it contained the same metal, he graciously acknowledged Gregor's prior claim to the discovery. Gregor's choice of names for his new metal was unfortunate and naturally gave rise to ambiguity, there being no distinction between the mineral and the metal.

He subsequently determined the presence of titanium in corundum from Tibet, and in black tourmaline from the so-called tin floors at Botallack mine, St. Just, Cornwall. Of the former he wrote in a letter to John Hawkins, dated February 14, 1804: 'It was out of *respect* to the Royal Society and Sir Joseph Banks that I did not obtrude my Paper on a variety of Corundum, on them. Nothing but what is perfectly new and remarkable should, I think be inserted in "The Transactions" of that learned Body. There are many facts and observations, which are worthy of being preserved, but not worthy of a place in so good company. Every reptile is not worthy of being preserved in proof-spirits.' Of the tourmaline he sent a crystallized specimen to James Sowerby who figured and described it in his 'British Mineralogy', 1809, vol. 3, plate 210, p. 19.

This same letter and one dated May 20, 1804, show that Gregor was

the first to examine chemically and describe the species wavellite, his experiments being performed on specimens of the mineral which he had collected at Stenna Gwyn mine, St. Stephen-in-Brannel, Cornwall, at the end of 1803. The results of his analysis on 30 grains were described by him in a paper in 1805. Later in the same year Humphry Davy and William Babington described the Devonshire wavellite (*Phil. Trans.*, 1805, part 1, pp. 155–162), Davy proposing for it the name hydrargillite and Babington wavellite after Dr. W. Wavell of Barnstaple who had supplied the material. Both Gregor and Davy considered the mineral to be a hydrate of alumina. Gregor, however, had detected phosphoric acid and fluorine, although in the case of the former in so small quantity ‘as not to admit of being subjected to experiment’. Davy, on the other hand, missed both the phosphoric acid and fluorine, hence his name hydrargillite. Gregor also describes his experiments on uran-glimmer (*torbernite and autunite*), from Stenna Gwyn mine, and deplures the fact that the mine had closed as he had insufficient material to complete his analysis; he adds ‘I shall however rummage the piles and deads of the mine’.

The mineral scorodite had also received his attention, for James Sowerby in his ‘*British Mineralogy*’, 1817, vol. 5, plate 547, p. 275, figures and describes a massive specimen of this mineral ‘broken from a rock on a down in the parish of Perranarworthal, Cornwall’, which had been presented to him by Gregor in 1808 with the information that a preliminary chemical examination showed it to be an arsenate of iron. Scorodite, since Bournon first described it in 1801, had always been supposed to be a compound of iron, copper, and arsenic.

Gregor’s attachment to Cornwall is shown in another letter written on February 5, 1807, to Hawkins congratulating him on having settled at Bignor Park, Sussex: ‘You enjoy the great advantage of being at a commodious distance from London—We in this County are thrown too far off from that great source of information and entertainment. However, I am contented where I am—I have struck my root and could not bear to be transplanted even under a more genial sky without suffering inconvenience—How happy a circumstance it is, that we are so much the *Children of Habit!*’

He is described as having been a man of singular charm of character, and possessed of the highest intellectual qualities, though of a most modest disposition. He was an excellent and devoted parson, and in addition to his scientific attainments was a painter of landscapes, an etcher of considerable merit, and a musician. One of the first to

introduce vaccine inoculation in Cornwall, he succeeded in overcoming popular prejudice. Gregor died on July 11, 1817, from tuberculosis which had more or less incapacitated him during the last few years of his life, and was buried at Creed. Inquiries have failed to show that any portrait of him exists.

In 1818 John Ayrton Paris described, under the name *gregorite*, *menaccanite* sand which had been sent to him by Colonel Sandys from the latter's estate at Lanarth, St. Keverne, Cornwall.¹ G. J. Adam later applied the name *gregorite* to an impure bismuth carbonate *agnesite*, from St. Agnes, Cornwall, which had been analysed by Gregor (*Tableau Minéralogique*. Paris, 1869, p. 27). M. H. Klaproth, R. P. Greg and W. G. Lettsom, E. S. Dana, and others give Gregor's name as *Macgregor* in error. Gregor contributed many specimens to the John Hawkins collection and to that of Philip Rashleigh, amongst others *stannite* from Stenna Gwyn mine in 1800, and *wavellite* from the same locality in 1804, both of which are now in my collection.

The history of the exceedingly rare mineral *fluellite* is interesting, and may perhaps find a place here. Armand Lévy, while cataloguing the collection of Charles Hampden Turner, observed small crystals of an unknown mineral on a specimen of *wavellite* labelled 'Cornwall', but obviously from Stenna Gwyn mine, St. Stephen-in-Brannel, Cornwall. These crystals were examined by Dr. William Hyde Wollaston, who measured them, determined their refractive index, and found them to consist of alumina and fluoric acid, and he proposed the name *fluellite* for the mineral. These results were published by Lévy in 1824 (*Ann. Phil.*, ser. 2, vol. 8, pp. 242-243) and thus to Lévy is usually ascribed the honour of first describing the species. James Sowerby, however, in his 'British Mineralogy', 1809, vol. 3, pp. 85-86, plate 243, gives an illustration, dated 1807, of a specimen of this mineral under the name of *argilla hydrata*, or *hydrargillite*, which had been obtained by Gregor from Stenna Gwyn mine. The *fluellite* crystals on this specimen are accompanied by *wavellite*, quartz, fluorite, and *autunite*. There are also given two quite accurate drawings of *fluellite* crystals. In determining the angles, which he gives roughly, of these minute crystals, Sowerby's son employed a microscope, and by holding a sheet of paper

¹ J. A. Paris, *Trans. Roy. Geol. Soc. Cornwall*, 1818, vol. 1, p. 226. [*Min. Mag.* 29-983.] It is interesting to note that according to a deed preserved in the Cornwall County Record Office, Truro, the grant of a sett, dated October 16, 1795, was given by Francis Gregor (elder brother of William) to Robert Were Fox and Andrew Fenton Ellis to work tin, copper, and *menaccanite*, in Penpol estate, St. Anthony in Meneage. This will have included the Tregonwell stream.

below, and on one side of the crystal, was able to draw on a large scale, angles, until one most closely approximating to that of the actual crystal was found. In the text Sowerby gives the results of Gregor's chemical examination of the mineral. This showed the presence of alumina, fluoric acid, and water, with traces of lime and silica. Both Gregor and Sowerby appear, however, to have confused the fluellite with the associated wavellite, although Gregor pointed out that the mineral in question seemed to differ from common hydrargillite (wavellite) in that it contained a larger proportion of fluoric acid, for he had in 1804-1805 examined chemically the wavellite from Stenna Gwyn mine. In 1847 Richard Talling, the mineral dealer of Lostwithiel, Cornwall, succeeded in rediscovering the mineral (letter dated March 24, 1847, in the Mineral Department, British Museum) of which previously only two or three specimens were known, at the original locality, Stenna Gwyn mine, at that time abandoned. In order to obtain the fluellite he evidently succeeded in entering the old adit, which then, as now, is flooded by a watercourse which passes its mouth. The specimens he collected in the summer of that year were all apparently broken from a single mass of vein-stuff, and though he made other attempts in succeeding years, he was unsuccessful in finding more (see R. P. Greg and W. G. Lettsom, 'Manual of the Mineralogy of Great Britain and Ireland', 1858, pp. 25-26). Many years ago the writer of these notes attempted to enter the adit, but found it impossible unless the water be diverted. However, in the summer of 1948, while we were showing a party of the International Geological Congress the Stenna Gwyn mine, my friend and colleague Mr. Arthur Kingsbury had the good fortune to find a specimen showing several well-defined crystals of fluellite in a block of vein-stuff built into the wall of a small ruined building on the mine.

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2. Sur le menakanite, espèce de sable attirable par l'aimant, trouvé dans la province de Cornouilles. *Observations et Mémoires sur la Physique, &c.*, Paris, 1791, vol. 39, pp. 72-78, 152-160.
3. Analysis of a variety of corundum. *Nicholson's Journ.*, 1803, vol. 4, pp. 209-214.

[Detailed account of the analysis of a specimen of lilac-coloured corundum from Tibet, given to Gregor by Philip Rashleigh.]

4. On the production of sulphate of magnesia from the ashes of pit-coal, with remarks on the efflorescence of the same salt, observed by Dr. Bostock. *Ibid.*, 1803, vol. 5, pp. 225–227.
5. Experiments on a mineral substance formerly supposed to be zeolite; with some remarks on the species of uran-glimmer. *Phil. Trans.* 1805, vol. 95, pp. 331–348. Reprinted in *Nicholson's Journ.*, 1806, ser. 2, vol. 13, p. 247.

[Experiments on wavellite, torbernite, and autunite from Stenna Gwyn mine.]

6. On a native arseniate of lead. *Phil. Trans.*, 1809, vol. 99, pp. 195–211; and *Phil. Mag.*, 1810, vol. 35, pp. 87–94.

[Description with analysis of mimetite from Wheal Unity, Gwennap, Cornwall. Gregor had in 1808 presented James Sowerby with a specimen of the Wheal Unity mimetite which had then only recently been found and of which an excellent plate is given in the latter's 'British Mineralogy', 1809, vol. 3, plate 295, pp. 187–190. Along with this is a full account of Gregor's analysis.]

7. Analysis of a soil containing free muriatic acid, and muriates of soda, lime, alumine, magnesia, and manganese. *Nicholson's Journ.*, 1811, vol. 28, pp. 180–184.
8. Experiments upon green uran mica with a view to its chemical analysis. *Ann. Phil.*, 1815, vol. 5, pp. 281–284.

[Torbernite (meta-torbernite) from Old Gunnislake mine, Calstock, Cornwall. A partial analysis is given.]

9. On the tremolite of Cornwall. *Trans. Geol. Soc. London*, 1816, vol. 3, pp. 399–403. Also as a pamphlet with a title-page dated 1816.

[An obscure mineral, not asbestos, from the picrite of Clicker Tor, Menheniot, Cornwall.]

10. Experiments on topaz, and carbonate of bismuth, with some observations relative to Smithson Tennant, Esq. *Ann. Phil.*, 1816, vol. 8, pp. 276–279.

[He ascertained the presence of potash in topaz from St. Michael's Mount, Cornwall, and in that from Scotland and Brazil. A mineral, possibly bismutite, from Wheal Coates, St. Agnes, Cornwall, he determined as being a mixed bismuth carbonate and oxide. James Sowerby in his 'British Mineralogy', 1811, vol. 4, p. 77, figures (the figure was drawn in 1809) and describes under the heading of 'Bismutum carbonatum' a specimen from St. Agnes, Cornwall, which had been sent to him by Gregor. This specimen found its way into the collection of Thomas Allan and later to the Allan-Greg collection, for in R. P. Greg and W. G. Lettsom's 'Manual of the Mineralogy of Great Britain and Ireland', 1858, p. 379, it is specifically mentioned as having passed under the name of carbonate of bismuth or agnesite, the latter so named by H. J. Brooke and W. H. Miller ('An elementary introduction to Mineralogy', by the late William Phillips, 1852, p. 591). On searching the Allan-Greg catalogue in the British Museum in 1935 it was found that this specimen had been given in exchange to Columbia

University, New York, but on Dr. W. Campbell Smith asking for the loan of it on behalf of the writer, the Columbia University authorities most graciously gave back the specimen to the British Museum. An examination of it showed that it is undoubtedly the actual specimen figured by Sowerby, but that it contains no bismuth, and is merely a mixture of a lithomarge-like mineral, quartz, and a little limonite. It is probable therefore that when Gregor presented the specimen to Sowerby he assumed it to be similar to the one which he had analysed.]

11. Observations on a remarkable change which metallic tin undergoes, under peculiar circumstances, and on its partial conversion into a muriate of tin. *Trans. Roy. Geol. Soc. Cornwall*, 1818, vol. 1, pp. 51-59.

[Describes the occurrence of tin chloride in masses of 'Jew's House Tin', anciently smelted tin found in boggy ground in Cornwall.]

12. On Kupfer-Nickel. *Trans. Roy. Geol. Soc. Cornwall*, 1818, vol. 1, pp. 224-225.

[Describes the occurrence and gives analyses of niccolite, and a mineral possibly gersdorffite, which had recently been found at Pengelly mine, St. Ewe, Cornwall.]

13. Formation of prussic acid by the ignition of a carbonaceous substance with nitrate of barytes. *Phil. Mag.*, 1823, vol. 62, pp. 234-235.

14. Notice of the analysis of zinc ore from Huel Ann. *Trans. Roy. Geol. Soc. Cornwall*, 1827, vol. 3, p. 338.

[Analysis of blende from Wheal Ann, Phillack, Cornwall.]

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ANON., Biographical notice of the Rev. William Gregor. *Ann. Phil.*, 1818, vol. 11, pp. 112-114. (The information contained in this notice was furnished by Gregor's intimate friend and neighbour the Rev. Jeremiah Trist, Vicar of Veryan, Cornwall.)

Western Morning News newspaper, October 3, 1952.
