

Rediscovery of the Elements

Titanium-Manaccan, Cornwall, England

James L. Marshall, *Beta Eta '71* and
Virginia R. Marshall, Department of
Chemistry, University of North Texas,
Denton, TX 76203-5070; jimm@unt.edu

About 500 B.C., according to legend the seafaring Phoenicians of Carthage traveled as far west and north as the Cassiterides, the present Isles of Scilly, beyond the southwestern tip of Cornwall, to obtain tin¹. Certainly by half a millennium later, tin mining by the Romans was commonplace throughout Cornwall (Figure 1), and tin was extracted in prodigious quantities through the eighteenth century. The tin was obtained from "cassiterite," tin dioxide (SnO_2), still today the most common ore for this element.² It was in this region two hundred years ago that a new element "titanium" was discovered by a parson in a stream by his church.

Our guide to this region was Dr. Simon Camm, of the Camborne School of Mines, University of Exeter in Redruth, Cornwall. An hour automobile ride from Redruth through rolling hills brought us to the Goonhilly region of Lizard Peninsula (Figure 2). Situated in the center of Manaccan (from the Cornish word for "monk") was the church (Figure 3). Inside the church were neat wooden pews nestled beneath Gothic arches and beautiful stained glass windows. On the wall hung a copy of the Lord's Prayer (in Cornish) and in the corner of one window lay a plaque dedicated to Reverend William Gregor, the "Scientific Parson." Gregor had excelled at a young age in painting, music, and science, and at Cambridge he had won academic honors in classics and mathematics. He took holy orders but was also keenly interested in chemistry and mineralogy. During walks by the nearby Gillan Creek (Figure 4) he discovered in 1790 a black powder which he thought appeared like gunpowder but which "followed the compass," that is, was magnetic. He took the substance home and analyzed it, deciding that it held a new "earth." He named the new mineral "menachanite"—now known as ilmenite, FeTiO_3 .³

"Menachanite" washes down from the west, originating from gabbro (Note 1). This black sand was well known by Victorian gold miners, because it would collect and mix with the precious metals during panning of the streams (Note 2). Dr. Camm illustrated this panning



Figure 5. Dr. Simon Camm of the Camborne School of Mines, University of Exeter, illustrates how to obtain the black ilmenite sand by a classic panning procedure. The ancient Victorian miners used this same procedure for gold in this region. The ilmenite, being magnetic, can be lifted easily from the grit at the bottom of the pan.⁵

process in Gillan creek (Figure 5). This black material is not as strongly magnetic as iron, but can be easily identified by its magnetism using a neodymium-iron-boron magnet.⁵

Reverend Gregor's laboratory contained such chemicals as "phlogistic alkali," "gall-nut tincture" and "microcosmic salt" (probably potassium ferrocyanide, tannic acid, and sodium ammonium hydrogen phosphate, respectively).³ He did not have the sophisticated facilities of some chemists on the continent, but through his skills and persistent labors he was recognized by scientists there, including Berzelius in Sweden. By a complex series of experiments he was able to recognize and characterize a new earth. Mixing the black menachanite with spiritus salus (hydrochloric acid), he dissolved the "marital portion" and destroyed its black color, leaving a reddish-brown calx, previously unknown. After over 100 experiments, including melting a particle in borax that rendered the flux greenish,

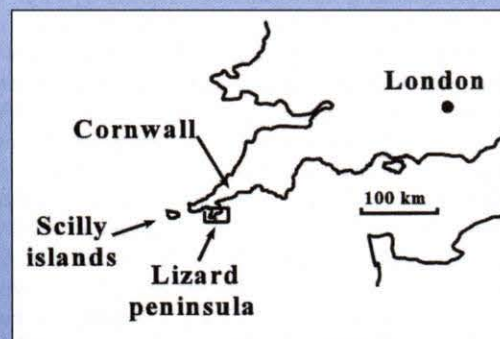


Figure 1. Cornwall is the extreme southwest portion of England. This region has been actively mined for tin for more than two millennia.

it was clear that he had something new, and he presented his findings in 1791.⁶

It remained for Martin Klaproth, the famous Berlin chemist who discovered uranium and zirconium, to establish unequivocally the elemental nature of Gregor's new earth (in 1794). Even though Klaproth performed the definitive work and gave the modern name of "titanium"

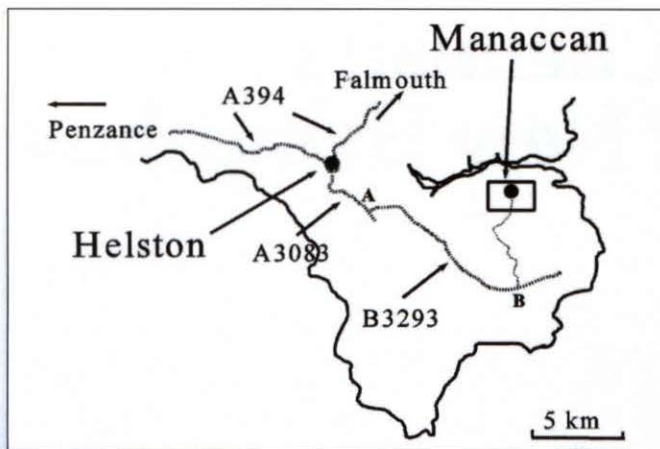


Figure 2. Lizard Peninsula of Cornwall. This region is sometimes called "Meneage" - Monkish Land. The village of Manaccan, where titanium was discovered, may be reached by traveling to Helston on A394 (west from Falmouth or east from Penzance); intersecting A3083 ($50^{\circ} 05.51' N$, $05^{\circ} 15.85' W$); proceeding 3.5 km and then turning left on B3293 ($50^{\circ} 04.39' N$, $05^{\circ} 14.41'$, identified by "A"). From B3293 there are a multitude of narrow, winding roads which can reach Manaccan, and exact, detailed instructions are laborious to delineate and probably even more difficult to follow—but if one turns left at the intersection identified by "B" ($50^{\circ} 02.19' N$, $05^{\circ} 07.57' W$, which is 10 km from "A") and proceeds generally northward 7 km further, one will reach Manaccan and the church ($50^{\circ} 05.01' N$, $05^{\circ} 07.63' W$).

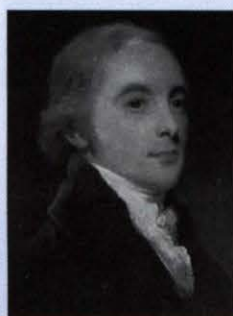
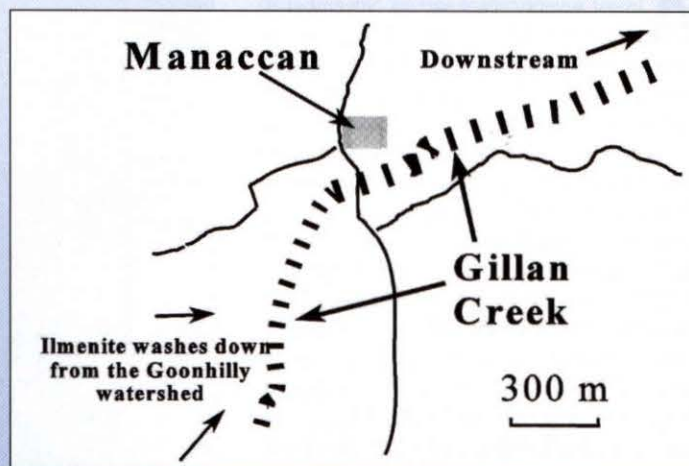


Figure 4. The Manaccan region. The Manaccan church is in the center of the village, and the "black sand" can be procured by spading up sediments from the muddy lowlands of Gillan Creek, either upstream or downstream from the church.

Figure 6. Portrait of William Gregor, by John Hoppner, which hangs in Huntsman Tioxide of London. (John Hoppner was appointed portrait painter of the Prince of Wales, later King George IV).



to the element, he graciously extended to Gregor the credit of the original discovery. It is to be recalled from the previous issue of *The HEXAGON* that Klapproth likewise gave the credit of the discovery of tellurium to Müller von Reichenstein of Romania. (The story of Klapproth "undoubtedly the greatest German analytical chemist of the day, but modest and benevolent" is a story that must wait until a future issue of *The HEXAGON*).

Truly a Renaissance man, Gregor's passions encompassed many arenas, particularly affairs of the British Navy and science. Self-taught, his "love of science was voted a great nuisance in his youth by the females of the establishment who were bothered by Master William's messes," notably one Madam who washed her "fine laces in what she conceived to be fair water, but which alas contained unseen qualities very detrimental to the precious net work. . . ." In later years Reverend Gregor was remembered as "kind and gentle, brave as a lion, truly religious by nature and zealous in everything he undertook." His portrait, by John Hoppner (Figure 6), is proudly exhibited by Huntsman Tioxide of London (Note 3).

Acknowledgments

Gratitude is extended to Dr. Simon Camm of the University of Exeter of Redruth, Cornwall, who furnished transportation to Manaccan and much geological and historical information; and to Harry Cowling of Huntsman Tioxide of London (Note 3), who shared Gregor family information and the portrait of Gregor.

Notes

1. Gabbro is a dark igneous rock related to granite, but richer in calcium and lacking quartz. This particular formation was formed during the Devonian era, about 400 million years ago. The ilmenite crystallized out in the gabbro in microcrystalline form, and as the gabbro eroded, the ilmenite "sand" was released.

2. Samples of ilmenite sand from Manaccan are exhibited at the element/mineral collection of the author at University of North Texas.⁵ Photographs are available in *Walking Tour of the Elements*, J. L. and V. R. Marshall, JMC Services, Denton, TX 76207.

3. *Huntsman Tioxide*, Lincoln House, 137-143 Hammersmith Road, London W14 0QJ ($51^{\circ} 29.64' N$, $00^{\circ} 12.83' W$). No portrait of Gregor was available for Weeks' classic, definitive work on the elements.⁸

Literature Cited

1. H. G. Wells, *The Outline of History*, Vol. 1, p 155, Doubleday & Company, New York, 1920.
2. *Dana's New Mineralogy*, 8th Ed., John Wiley & Sons, N.Y. 1997.
3. Victor Gordon, "The Titanic Parson," *Review Magazine*, 1999, No. 50 (June), pp 17-19, Rio Tinto Publications, London.
4. Rev. H. H. Dixon, "The Story of the Parish Church of Manaccan," printed by the Brewers of Helston, 1964, and available from the Manaccan Church.
5. Marshall, J. L., *J. Chem. Educ.*, 2000, 77, 979-983.
6. *Creel's Annalen*, 1791, I, 55.
7. L. S. Gregor, "Francis Gregor M.P. and the Rev. William Gregor M.A. Notes by Mrs. L. S. Gregor in her Recollections, 1853," letter dated October, 1853. Available at Huntsman Tioxide, London.
8. Weeks, M. E., *Discovery of the Elements*, 7th ed., *Journal of Chemical Education*, 1968.

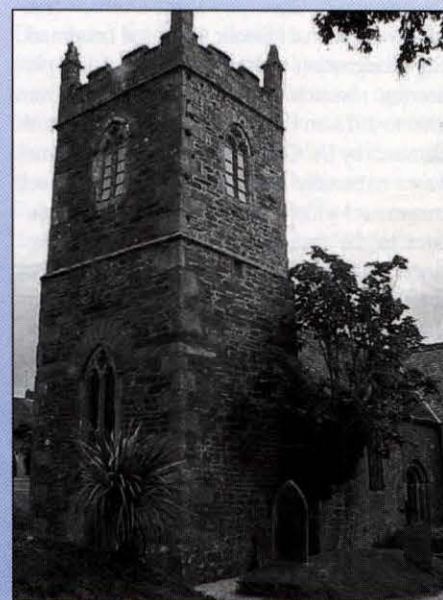


Figure 3. Manaccan Church, Lizard Peninsula, Cornwall. This is originally a twelfth-century Norman church, and much of the original remains today. The first mention of Manaccan occurs in a charter of King Eadgar, dated 967, where it was called "Lesmanoc—Place of the Monks."⁴