Discovering the Noble Gases: a story of a chemistry superhero

“Krypton is a fictional planet in the DC Comics universe, and the native world of the superheroes Superman and, in some tellings, Supergirl and Krypto the Superdog. Krypton has been portrayed consistently as having been destroyed just after Superman's flight from the planet, with exact details of its destruction varying by time period, writers and franchise.”

So much for trying to do a “wikipedia” search for this “hidden” element!

The story of its discovery along with the other noble gases, however, reveals a Victorian man of Science who, in his own way, qualifies as a superhero. Born in Glasgow in 1852, William Ramsay was already established as one of the foremost chemists of his day when he took up his appointment at University College London in 1887. The chair to which he succeeded had been occupied by leaders of scientific progress and, almost immediately after entering on his new duties, he was elected as a Fellow of The Royal Society. Great things were therefore believed of him, but nobody could have foreseen the discoveries that came so rapidly.

Ramsay's colleagues of this period describe him as “charming, witty, and generous” - traits which no doubt made him an easy man with whom to collaborate. Lord Rayleigh, himself an eminent physicist, was therefore lucky in more ways than one that Ramsay responded to his letter to Nature in September 1892. In it, Lord Rayleigh had expressed puzzlement as to why atmospheric nitrogen was of greater density than nitrogen derived from chemical sources, and wondered if any chemist would like to turn his mind to this anomaly. It does not appear that anyone except Professor Ramsay attempted to attack the question experimentally. What followed was a story of rich success, an early interdisciplinary collaboration that broke the barriers between chemistry and physics.

Correspondence between the two men reveals the enthusiasm with which Ramsay set to the task and details painstaking and meticulous work first to isolate sufficient atmospheric nitrogen and then to test it, using fractional distillation, for impurities, – anything, basically, that wasn't nitrogen. In this
In this way, Ramsay wrote to Rayleigh: “We may discover a new element”. In fact, they discovered Argon, and Ramsay went on to discover an entirely new class of gases. In 1904, he was awarded the Nobel Prize for Chemistry for the discovery of argon, neon, xenon and, of course, krypton.

Forming the final column in the periodic table of the elements, the discovery of the noble gases has played an important role in the understanding of atomic structure. Seemingly oblivious to their surroundings, the lack of reactivity of the noble gases is attributed to their 'complete octet' of electrons, a concept still essential in chemistry today for understanding which elements will form compounds with each other. Aside from aiding theoretical understanding, the noble gases also play a role in exploring the frontiers of modern science: first isolated on Earth in 1895 by Ramsay, helium is used in large quantities at CERN to keep the Large Hadron Collider at a rather cool -271.3°C, enabling scientists to recreate conditions of the Big Bang.

But the potential applications and practical uses of the noble gases are perhaps irrelevant in the story of its discovery. The point of Ramsay’s work was not to put his knowledge to some utilitarian purpose – the point was to discover. Scientific endeavour is perhaps too often judged by whether or not its results are “useful”. But discovery and knowledge are sometimes an end in themselves. The purist knows the joy of discovering that which was hitherto unknown.

Sir William Ramsay was a purist – a man with an insatiable appetite to better understand the world. He travelled to Canada, the United States, Finland, India, and Turkey with his wife Lady Ramsay. He was a man open to new ideas, always endeavouring on his travels to learn local languages and customs and always alive to new experiences. One anecdote, related by a travelling companion to Iceland, describes him standing on the site of a geyser with a small glass jar, capturing gases as they erupted from underfoot. The image is unmistakably one of a childlike fascination with nature, in a man whose dedication to research knew no limits.

In his 1918 biography of Ramsay, Sir William Tilden describes him as a man
“ever filled with that divine curiosity which impels the discoverer forward” who enjoyed the satisfaction of knowing that he was achieving something. Indeed, in a memorial lecture, for his late friend Henri Moissan in 1912, Ramsay quoted the following words:

“But what I cannot convey in the following pages is the keen pleasure I have experienced in the pursuit of these discoveries. To plough a new furrow; to have full scope to follow my own inclination; to see on all sides new subjects of study bursting upon me, that awakens a true joy which only those can experience who have themselves tasted the delights of research”

What’s left, then, is the joy, of finding what is hidden, a fact reflected in the very name of the element, Krypton, taken from “krypto”, greek for hidden. And nothing to do with a SuperDog.

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