with the manager, an energetic and intelligent but uneducated man, who, after working successively as shop boy, factory hand, and foreman, had been promoted to his responsible post over the heads of the chemists. Samter heard of many similar cases. He ascribes them to the very high value put upon administrative talents, especially the ability to increase the output, largely because of the high price of labor and its poor quality, most of the workers in Eastern factories being Italian and other immigrants.

He found the condition of the working classes not quite as favorable as he had expected. He quotes the following daily wages in Eastern manufacturing districts: laborers, \$1.25 to \$1.50; non-union mechanics, \$2.50 to \$3.33; union mechanics, \$4.00 and over. The workman is more independent and more prosperous here than in Europe, but he enjoys less protection against accident and less benefit from benevolence. If injured at work, he can obtain damages only by proving the negligence of his employer by means of a long and costly lawsuit. Hence he usually compromises for a small sum. Samter cannot understand why American workmen do not exert their great influence on law makers to improve these conditions.

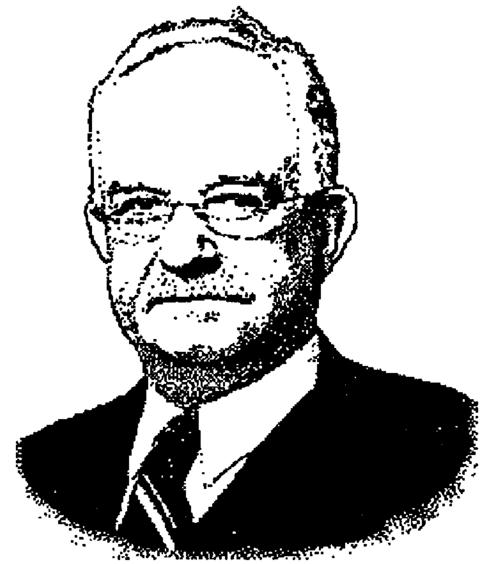
He concludes with the diverting story of a sulphuric acid manufacturer who visited a tannery to investigate a complaint about the strength of the acid he had furnished, and asked the manager to produce the aerometer for comparison with his own. The tanner, who had never heard of an aerometer, bared his left arm and said: "See those blisters? They were raised by the old strong acid. Your acid is so weak that it only makes red marks like this." *Scientific American*, **1907**, *97*, 203.

Regrettably the anonymous reporter who summarized Samter's talk failed to give Samter's first name. Readers interested in learning more about the trials and tribulations of early industrial chemists should consult Edward H. Beardsley, "The Rise of the American Chemical Profession, 1850-1900", University of Florida, Gainesville, FL, 1964 and Otto Eisenschiml, "Without Fame: The Romance of a Profession", Alliance, New York, NY, 1942.

CHEMICAL ARTIFACTS

The University of New Hampshire

When Charles Lathrop Parsons resigned as Professor and Head of Chemistry at New Hampshire State College in 1911 to become chief mineral chemist at the U.S. Bureau of Mines in Washington, he was succeeded by his colleague Charles James. James, a student of William Ramsay at University College, London, continued to head the



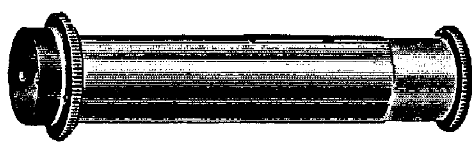
Charles Lathrop Parsons

Chemistry Department at Durham from 1912 until his untimely death in 1928. During James' period at New Hampshire, research on the chemistry of rare earths was actively pursued. Under his tutelage, B.S. and M.S. students purified salts of many of the rare earths by laborious fractionation procedures, some of which had been worked out by James. The raw materials came from James' personal collection of rare earth ores and minerals, said to be the most extensive in existence at that time.

Charles James

Among artifacts from Charles James' research endeavors are dozens of large evaporating dishes, hand-numbered and imported from Germany. These were, after all, the major need, along with strong gas burners and mortars and pestles, for the fractionation procedure. Depending on emission spectra to identify and determine the purity of his rare earth samples, James typically kept his prized hand spectroscope (made by A. Hilger of London) nearby, which, through its donation by the widow of Heman C. Fogg, a student and colleague of James, is part of our collection. In the official photograph of James as Head of Chemistry, he can be seen with the spectroscope in his hand.

A limited number of small samples of purified rare earth compounds remained in the possession of the Department on James' death. The major collection of samples, many stored in large jars or bottles, was sold by his wife to the National Bureau of Standards, presumably

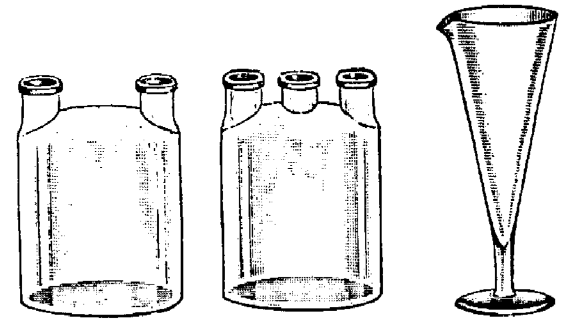


A pocket spectroscope. Circa 1925.

about 1930. In 1981 - 50 years later - an official at NBS, having read a biographical sketch of James in the January, 1981, issue of *Hexagon*, offered to return the samples to the University of New Hampshire Chemistry Department so that they could become a part of our permanent collection. Over 250 samples, packed in 18 cartons, were shipped back to Durham; they appear to have been untouched in the interim period. A large hand-crafted periodic table, about 6' x 10', constructed by New Hampshire chemistry students under the direction of Professor A. F. Daggett, hangs in the lobby of Iddles Auditorium. It includes many samples of elements or compounds, among which are oxides and chlorides of Pr, Nd, Sm, Eu, Gd, and Er - all prepared in Durham under James' supervision.

As a student in Ramsay's laboratory, James had been engaged in research in the inert gases discovered there. He had in his possession six Plücker tubes containing neon, argon, krypton, helium, and hydrogen, which had been filled by Ramsay, James, or N. Collis in London. These have remained as part of our permanent, prized possessions. James' Nichols medal, awarded to him in 1911, is among the collection of his daughter, Professor Marion E. James of Durham.

Based on the rare earth separation work, James, Cork and Fogg published a paper in the *Proceedings of the National Academy of Sciences* in 1926 in which they claimed to have isolated element 61. Also among the

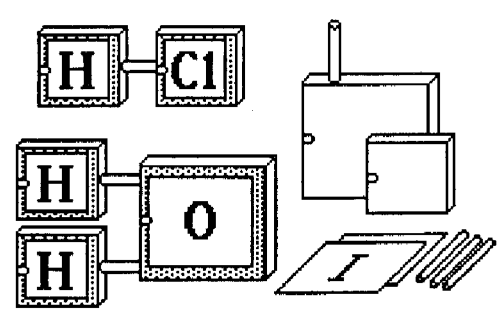


Woulff bottles and a conical test glass.

Department's possessions is the emission spectrum plate (1.5" x 1.5") which first led James to conclude that he had isolated the missing element.

Charles L. Parsons went on to become the first full-time executive secretary of the American Chemical Society, a position he held until 1946. He was the recipient of several medals, which were donated by his heirs to the Chemistry Department. These include the Nichols Medal (1905); SCI Medal (1931); Priestley Medal (1932); Charles Lathrop Parsons Medal (1952); and medals from the French Legion of Honor and the Order of the Crown of Italy. An oil painting, about 26" x 30", commissioned by his family on the occasion of the dedication of Parsons Hall in 1966, hangs in our Conference Room. Parsons' former private home, prominently located on Main Street in Durham, has been for many years the residence of Alpha Tau Omega fraternity.

Various glassware used over the years in lecture demonstrations has been preserved. Included are Woulff bottles (4" diam. x 7.5"; 5" diam. x 9.5"); and glass cylinders (3" diam. x 10"; 5.5" diam. x 12"). Test or "precipitation" glasses seem to be in abundance: about a dozen conical glasses of varying diameter (3.25" - 5.5") and



A valence block set.

height (4.5" - 8"); and one test glass in cylindrical form, (2.5" x 10"). A molecular model kit in a wooden box, with elemental balls of varying size and color and flexible metal connecting bonds, dates from about the period of World War I. Of particular interest is a box of "graphic symbols", consisting of wooden blocks with varying numbers of holes drilled in their edges. Metal clips on the faces of the blocks allow one to attach cardboard labels bearing the symbols of various elements. The blocks can then be connected together with short sections of dowel in order to illustrate the concept of valency (oxidation number). Regrettably both kits are missing the manufacturer's name and patent dates.

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WHATEVER HAPPENED TO THE GROTTA DEL CANE ?

In a recent study Furio Mas *et. al.* found that more than 50% of all 18 year old students think that gases naturally "rise" and that they lack weight or mass, opinions which the authors characterize as "Aristotelian" and as strikingly similar to those held by some chemists prior to the chemical revolution (1). Given this "common sense" view of the behavior of gases, the impact of classic lecture demonstrations in which carbon dioxide is poured "down hill" is understandable, as well as the desirability of continuing to do them in the modern classroom. However, older textbooks not only demonstrated these facts in the classroom and the laboratory, but provided practical everyday examples as well, usually involving the accumulation of carbon dioxide in poorly ventilated mines and caves and its subsequent suffocating action on unsuspecting animals and men.

Perhaps the favorite example of this was the famous *Grotta del Cane*, located at Pozzuoli, near Naples, Italy. Though mentioned in traveler's accounts of the Naples area for centuries, the cave did not find its way into the chemical literature until the end of the 18th century, when carbon dioxide (or fixed air, as it was then called) was finally recognized as a distinct chemical species, largely through the work of Cavendish, Black and Priestley (2). One of the earliest chemical writers to mention the cave was Tiberius Cavello, who described it in some detail in the 1781 edition of his *Treatise on the Nature and Properties of Air* (3):

> In the kingdom of Naples, and not more than six or seven miles from the capital of that kingdom, is a famous cave, near the foot of a hill, called in the Italian Language *grotta del cane*. This grotto is about fourteen feet long, and near seven feet high at the entrance. On the floor of it, there is always a stratum of that elastic fluid, which constitutes the choke damp. It is continually emitted from the earth, through fissures that may be seen on the ground. The experiments usually shown to the curious, who visit this grotto, are, first, that of bringing a lighted candle or piece of paper near the floor, which is put out as soon as it comes within about 14 inches of the ground, and, secondly, that of keeping a dog with its head near the ground, for about a minute, so as to oblige him to breathe the noxious fluid, which will soon affect his respiration, deprive him of his strength, and would soon kill him, if he was not immediately brought out into the open air, where, if he is not too far gone, he will gradually recover his strength and freedom of respiration. (From this experiment of the dog, the cave derives its name of *grotta del cane*; the Italian word for dog being *cane*.) There is a small lake near this grotto, the water of which is considered as a specific against the effects of the noxious fluid of the grotto, so that the animals apparently killed, or too much affected by that fluid, may be soon recovered by being bathed in that water; but if it is true that those waters at all contribute to restore the animals thus affected, it seems to be merely by the shock they give with the sensation of cold.

Apparently several generations of Italian guides and dogs earned their living by repeating this demonstration for visitors, as Worthington Hooker, writing almost 90 years

Illustrating the mass of carbon dioxide by pouring it downhill (11)

after Cavello, again mentions the guide and his unhappy canine companion in terms which suggest he had visited the cave himself, the only alterations being the use of a pail of water rather than the nearby lake to revive the dog. Describing the scene in the 1870 edition of his *First Book*