Rediscovery of the Elements:

Europium—Eugène Demarçay

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During our "Rediscovery" pursuits, one of the most difficult chemists to track down has been Eugène Demarçay (1852–1903) (Note 1), the discoverer of europium (Figure 1). Since Demarçay had no official status in a University, there is little in the historical records[1-3]; essentially all that exists is a brief biography[1] by A. Étard (Note 2).

Demarçay was an unusual scientist. He had given up the academic life in his early 20s to broaden his experience; he made a tour through Algeria, Egypt, and India to observe firsthand the geology and culture of different lands. Returning to Paris, his first researches (in 1876, when he was 24) were on acetylacetonates, performed in the laboratory of Cahours (Note 3). From organic chemistry he moved on to organometallics, then inorganic chemistry (nitrogen sulfides). At this point, he suffered a tragic accident when one of the nitrogen sulfides exploded, rendering him sightless in one eye (Note 4). After recovery, he constructed his famous vacuum system (1881–1882) in an independent laboratory on Blvd. Berthier, and he conducted his researches of the low-temperature volatility of zinc, cadmium, and gold. He then built a spark spectrum instrument, which he used to help him follow the separation of rare earths.

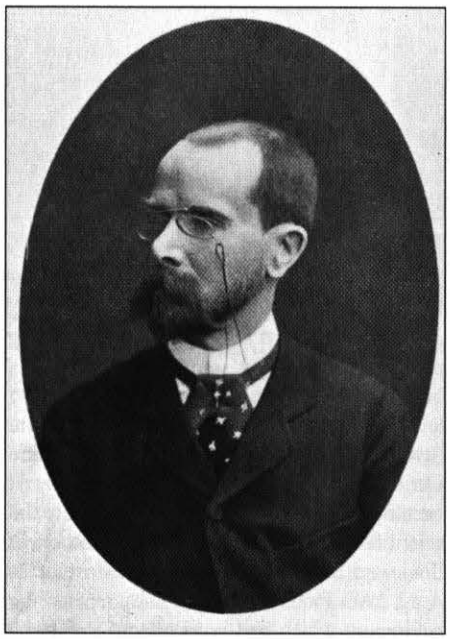

Figure 1. Eugène Demarçay (1852–1903), discoverer of europium.

According to Étard, the skill of Demarçay of interpreting spectra was legendary—he could read the spectrum of a substance like "the score of an opera."[1] Demarçay used this skill to the fullest to understand the nature of the rare earth samples that came into his possession. In 1892, Boisbaudran had noticed a faint line in samarium,[4] and after extensive study of samarium and gadolinium samples Demarçay proposed in 1896 that an element lay intermediate between the two elements.[5] The key to his success was not only his spectral prowess, but also a new separation technique he developed involving the crystallization of double magnesium nitrate salts.[6] By spectral monitoring, he was able to determine that he was preparing samples enriched in the new element, and in 1901 he announced discovery of "europium."[7] Another of Demarçay's important contributions using spectroscopy involved radium in collaboration with the Curies. After spectral analysis of the Curies' purified sample from pitchblende, Demarçay could state that the material was "fairly pure" and uncontaminated with the barium carrier.[8]

Étard briefly referred to the "famous laboratory" of Demarçay on Boulevard Berthier,[1] a 2-kilometer boulevard that arcs the northern perimeter of Paris (Figure 2), but there is no hint exactly where the laboratory was located. The notable historian Dr. Alan Rocke, an expert of 19th century French chemistry,[9] confessed to us that he had no idea where to start for the search of the laboratory and that probably "nobody had ever asked that question." Undaunted, we made a visit to the Bibliotheque National site Richelieu to verify from archival maps that at the turn of the century (ca. 1900) the location and length of the thoroughfare was essentially the same as today, and then we spent an afternoon strolling the length of the Boulevard, looking for plaques, signs, streets, any hints whatsoever... but without success. Finally, we followed our remaining lead:[1] for a couple of years, starting at the age of 18, Demarçay was at the École Polytechnique, first as a student and then as assistant (with Cahours). Accordingly, we contacted the library at École Polytechnique, who had helped us in the past with other chemists at their institution.

We were delighted to receive a letter a few weeks later from the head librarian at the École,

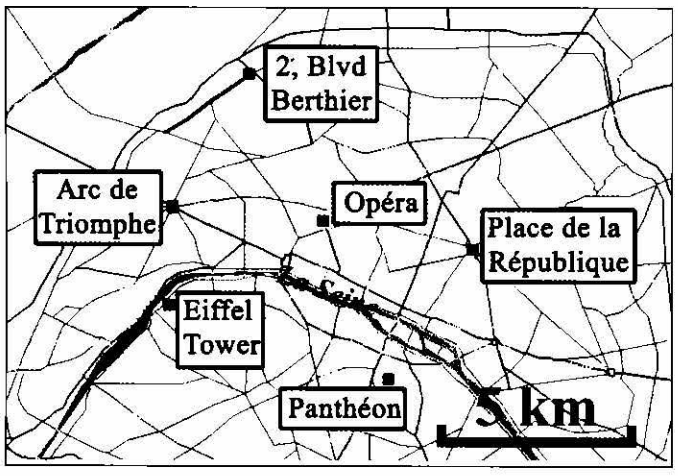

Figure 2. At the time of Demarçay, the Boulevard Berthier was just inside the city limits of Paris, marked by a railroad encircling the perimeter of the city. It was at 2, Boulevard Berthier (N 48° 53.67, E 02° 18.78) that Demarçay built his independent laboratory where he conducted a number of researches including the discovery of europium and his spectral analysis of radium (in collaboration with the Curies).

who informed us that she had a record of the granddaughter of Eugène Demarçay, Mme. Joseph de Carayon Talpayrac. Mme Talpayrac herself had corresponded with the École in an attempt to learn more about the scientific achievements of her grandfather. We immediately made contact with her, and an appointment was made for the following summer to visit her family.

The Talpayracs lived in the fashionable 16th C. arondissement of Paris, foretelling a gentility with important information. The day of the rendezvous, we were graciously invited in and spent a full morning with M. and Mme Talpayrac (Figure 3). Due to a tragic misfortune, one of the relatives had mistakenly discarded a great deal of the biographical information, and Mme. Talpayrac was keen on learning more of the scientific contributions of her grandfather. We were happy to tell her about the achievements of Eugène that we had learned from his publications. In return, she showed us what she had and opened a small packet of papers.

First, she showed us her pedigree, where she could trace her ancestry back six generations to Pierre Demarçay (1714–1788). A great-great grand father, Général Marc-Jean Demarçay (1772–1839), had fought in Napoleon's army and was involved in the successful Battle of Austerlitz in 1805.

Then Mme. Talpayrac showed us documents regarding the demise of her grandfather. We learned two key pieces of information: First, the death certificate made it clear that the published date of his death[3] was incorrect (Note 1). Second, a listing of his estate was present, which included the exact address of the property on 2, Boulevard Berthier!

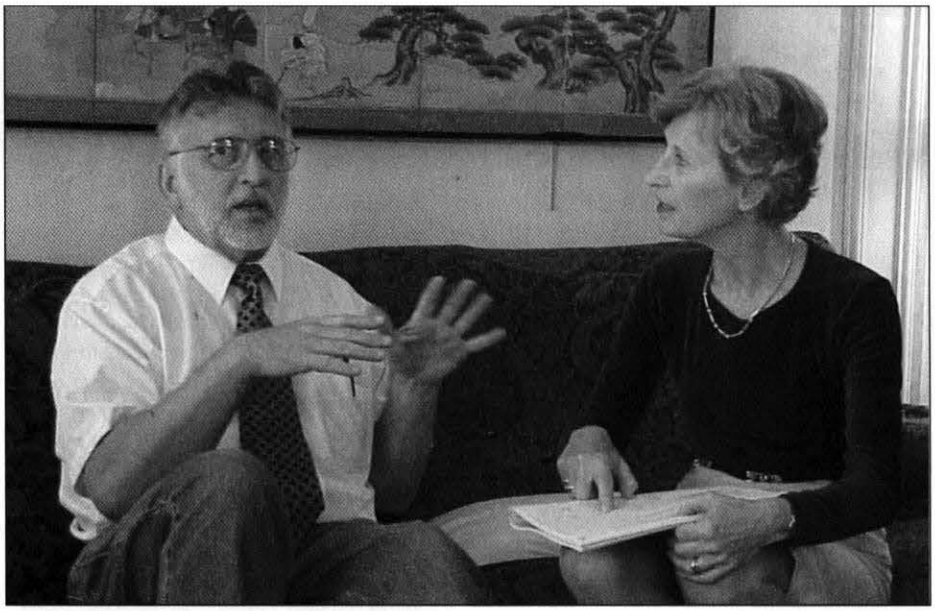

Figure 3. Inside the household of the Camille Demarçay de Carayon Talpayrac (right), J. Marshall (left) is verifying the exact translation of a passage from one of Pierre Curie's old letters.

Finally, there was correspondence, including personal notes with emotional exchanges between Eugène and his father. There were also letters between the executor of Eugène's estate (Jean, Eugène's brother) and the famous Pierre Curie. After studying these letters closely, it became clear exactly what had happened to the scientific equipment of the laboratory of Boulevard Berthier. In a correspondence of 21 April, 1903, Pierre Curie graciously refused the equipment which had been offered to him by the executor of the estate; Curie suggested instead that a capable scientist should be found who would give justice to the state-of-the-art equipment. Curie was concerned that with the passing of Demarçay, "France may be abandoning its claim to first-rate spectroscopic research;" he intended to ask M. Moisson (the discoverer of elemental fluorine) for any suggestions how to dispose productively of the equipment.

In a subsequent letter of 4 May 1904, apparently Pierre Curie had accepted the equipment which was now in his laboratory and working well; he had found a solution to his dilemma: he had discovered "M. Urbain" (Georg Urbain), a long time researcher in the rare earths, who had even "prepared several grams of europium salts in the pure state." In this second letter, Curie attested to the strength of Urbain's character and recommended him to inherit the spectral equipment. Hence, it appears from Curie's correspondence that the equipment of Demarçay was transported to the laboratory of Urbain, who eventually used it in his discovery of lutetium in 1907 (Note 5).

After our farewells with the Talpayracs, we were eager to strike out for 2, Boulevard Berthier. A Metro ride and a short walk took us to the address, which disappointingly had been "improved" and now sported a modern hotel (Figure 4). Across the boulevard, however, the buildings are the same as they were a century ago (Figure 5) and give an idea of the probable appearance of the dwellings where Demarçay performed his famous experiments (Note 6).

Our conversation with the Talpayracs had given us an idea of why so little of Demarçay's life and work has appeared in the French literature. Eugène—a Protestant gentleman, reserved and discreet—always gave credit to others. His training had been quite unconventional—he dropped out of the classical acade-

Figure 4. The Demarçay laboratory was once here on the north side of Boulevard Berthier, now occupied by a modern hotel.

mic curriculum and pursued a life of self-education, wandering from topic to topic just as he had passed from country to country in his previous world travels (Note 7). His professional station was unorthodox, as he pursued his independent researches in his private laboratory without becoming involved in the usual academic politics. He was a true Renaissance Man: free in spirit and following his curiosity wherever it took him. He was wonderful in character and rich in his contribution to his family, to France, and to the scientific world.

Acknowledgments.

In addition to the gracious hospitality and help of the Talpayracs, we are indebted to Jill Daniels, a professional Parisian guide who accompanied us on our visit to the Talpayracs. Ms. Daniels has developed historical "Walking Tours" about Paris, and she helps us from time to time when we need to make sure we fully appreciate the nuances of Parisia+n conversations during our interviews.

Literature cited.

1. *A. Bull. Soc. Chim. Fr.*, **1904** [3], *32*, 1–10. Reprinted as *A. Étard*, "Notice sur la vie et les travaux de Eugène Demarçay," **1904**, Masson et Cie, Paris, 1–10.

2 A. Étard, "*The Life and Work of Eugène Demarçay*" (an imprecise English translation of ref 1), *Chem. News J. Ind. Sci.*, **1904** (March 18), 137–138.

3. M. Weeks, *Discovery of the Elements*, 7th ed., **1968**, *Journal of Chemical Education*, pp 689–692.

4. L. de Boisbaudran, *Compt. rend.*, **1892**, 115, 575–578. Also see J. L. and V. R. Marshall, *The Hexagon of Alpha Chi Sigma*, "Rediscovery of the Elements: Boisbaudran," **2003**.

5. E. Demarçay, *Compt. rend.*, **1896**, *122*, 728–730.

6. E. Demarçay, *Compt. rend.*, **1900**, *130*, 1019–1022.

7. E. Demarçay, *Compt. rend.*, **1901**, *132*, 1484–1486.

8. E. Demarçay, *Compt. rend.*, **1898**, *127*, **1218**; **1900**, *131*, 258–259.

9. A. J. Rocke, *Nationalizing Science*. Adolfe Wurtz and the Battle for French Chemistry, **2001**, MIT Press, Cambridge, MS.

Notes.

Note 1. The literature is either silent[1,2] or is incorrect[3] (1904) regarding the year of death of Eugène Demarçay. The true vital dates, which came to light during this research, are 1852–1903 (born 1 January 1852, Paris; died 5 March 1903, at 80, Boulevard Malesherbes, Paris).

+Figure 5. Across the boulevard from the hotel, the buildings still date from Demarçay's time and most probably reflect the outside appearance of Demarçay's original laboratory.

Note 2. Alexandre Étard (1852–1910) was "Examiner of Students at the École Polytechnique" (A. Étard, *Les Nouvelles Théories Chimiques*, Gauthier-Villars, Paris, 1897) and occasionally published with Demarçay and Cahours. Étard's legacy is the eponymous reaction whereby toluene is oxidized to benzaldehyde with chromyl chloride, CrO_2Cl_2 (*Compt. rend.*, **1880**, *90*, 534).

Note 3. August André Thomas Cahours (1813–1891), professor at École Polytechnique from 1871, discovered amyl alcohol, methyl salicylate, and other organic compounds (J. R. Partington, *A History of Chemistry*, **1964**, Vol. 4, Macmillan, 429–431).

Note 4. Demarçay was dealing with such risky compounds as SN_3Cl and S_4N_3Cl (E. Demarçay, *Compt. rend.*, **1880**, *91*, 1066–68; **1881**, *92*, 726–728; **1881**, *92*, 726–728). As a harbinger of his horrible accident, he had noted in his publications that at ordinary temperatures these compounds appeared stable but could explode violently when heated. In his third and final publication on the subject, he mentioned nothing of the accident, only declaring that he was relinquishing study of these compounds because they had "inconsistent and irreproducible compositions."

Note 5. The world now recognizes that honors of the discovery of the lutetium should be shared with Auer von Welsbach and Charles James (Abstracts, 223rd ACS National Meeting, Orlando, April 9, 2002, HIST 26, J. L. Marshall and G. R. Dobson, "*Charles James, Pioneer in Rare Earths*"; "*Rediscovery of the Elements: Althofen, Austria and Auer von Welsbach*," J. L. Marshall and V. R. Marshall, *The Hexagon of Alpha Chi Sigma*, **2002**, *93*, No. 1, Spring, 9–11).

Note 6. The Talpayracs also gave us addresses of the old home of the Demarçays (152 Haussman, where Eugène's parents lived and where he was born) and the older home of Eugène (80, Malesherbes) where he died. We briefly visited these sites as well.

Note 7. However, Demarçay did work in Cahours' Laboratory for several years, where he carried out his research in organic chemistry. Here Demarçay carried out research that led to his dissertation ("Sur les acides tetrique et oxytetrique et leurs homologues," Gauthier-Villars, 1880). Upon the death of Henri Victor Regnault (1810–1878; Regnault had succeeded Gay-Lussac at the École Polytechnique; his researches dealt mostly with the physical properties of solids and gases), a vacancy developed in the Académie des sciences, and Demarçay presented his application (*Compt. rend., 1878*, 86, 1511), but, was not accepted. However, soon afterwards la Section de Chimie de l'Académie des sciences presented the Jecker Prix to Demarçay for his contributions to organic chemistry (*Compt. rend.*, **1881**, *92*, 566–568). On November 14, 1889 Eugène Demarçay married Mlle. Jeanne Berard (1865–1933) at the Temple du St. Esprit, Paris, a Protestant church near their home (5, rue Roquépine, N 48° 52.41, E 02° 19.15).