

Chemical Landmark 2011 – Designation of the Laboratory of Jean-Charles Galissard de Marignac in GenevaBarbara Winter-Werner^{*a} and Didier Perret^{*b}^{*}Correspondence: Dr. B. Winter-Werner^a, Dr. D. Perret^b^aSwiss Academy of Sciences (SCNAT), Platform Chemistry, Schwarztorstrasse 9, CH-3007 Bern, E-mail: winter@scnat.ch^bSection de chimie et biochimie, Université de Genève, Sciences II, 30, quai Ernest-Ansermet, CH-1211 Genève 4, E-mail: didier.perret@unige.ch

The third award of a «Chemical Landmark» in Switzerland goes to Geneva: The building *Uni Bastions* of the University of Geneva was awarded this designation in honor of the chemist *Jean-Charles Galissard de Marignac* (1817–1894) – his laboratory was located in this building.

Jean-Charles Galissard de Marignac originated from a noble family of protestants from Languedoc, who in 1733 took refuge in Geneva. He studied at the Academy of Geneva (University of Geneva from 1873) and held there a chair from 1841 until his resignation for health reasons in 1878.

This famous scholar owes his fame to the two elements ytterbium (Yb) and gadolinium (Gd), which he discovered in the years 1878 and 1880. Between 1842 and 1883 he also determined with the highest precision the atomic weights of 29 elements, *i.e.* of more than a third of the known elements at that time. His balance is still preserved at the *Musée d'Histoire des Sciences* in Geneva. He conducted his research at both the University and in the laboratory in his private apartment on the Rue Sénebier (more about Marignac and his life see below).



Fig. 1. Clockwise: Prof. Dr. E. Peter Kündig, Gérard de Marignac, Prof. Dr. Claude Piguet, Prof. Dr. Jean-Dominique Vassalli (Source: www.mayenfisch.com).



Fig. 2. Uni Bastions at 5, rue de Candolle (Source: Centre d'iconographie genevoise)

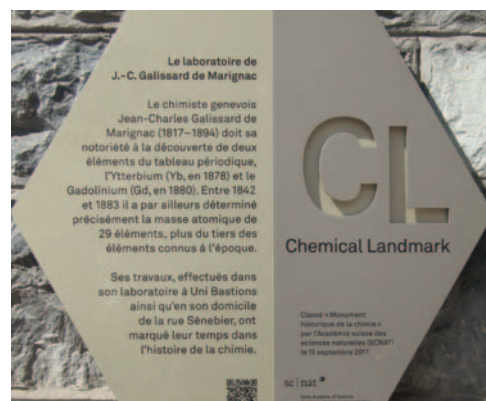


Fig. 3. Commemorative plaque (Photo: B. Winter)

The «Chemical Landmark» designation ceremony took place on September 13, 2011 in the *Uni Bastions* (Fig. 2). Over 80 people followed the invitation, among them many past and present professors, students and collaborators of the School of Chemistry and Biochemistry of the University of Geneva, as well as personalities from politics and economy of the metropolitan area of Geneva, and numerous guests of the de Marignac family.

Prof. Dr. **Thierry J.-L. Courvoisier**, President Elect of SCNAT, warmly welcomed the attendees. Afterwards, Prof. Dr. **E. Peter Kündig**, member of the Board of the «Platform Chemistry» gave a brief introduction to the program «Chemical Landmarks». In his laudatio – which, as well as all other presentations, may be found at www.chemicallandmarks.ch/2011 – he acknowledged the lifework and the person of Jean-Charles Galissard de Marignac and the significance of his work for the sciences at that time but also ongoing to the present. The following presentations deepened this image: **Gérard de Marignac**, historian and direct descendant of J.-C. Galissard de Marignac, explained the historical perspective and gave a closer view of the honored man from a more family-internal perspective. He showed a variety of images and works from the estate of J.-C. Galissard de Marignac. Prof. Dr. **Claude Piguet** from the Department of Inorganic and Analytical Chemistry at the University of Geneva showed in his presentation the chemical background of the work of Marignac from the 19th Century to the present day. After the unveiling of the commemorative plaque (Fig. 3), Prof. Dr. **Jean-Dominique Vassalli**, Rector of the University of Geneva, thanked the SCNAT

on behalf of the university for the designation and emphasized the importance and tradition of chemistry in Geneva.

More information about the program «Chemical Landmarks» may be found at www.chemicallandmarks.ch.

Jean-Charles Galissard de Marignac: A Man, a Laboratory – or two – and many Chemical Elements

The Swiss chemist *Jean-Charles Galissard de Marignac*, born in 1817 in Geneva, was without doubt an exceptional and erudite figure:

After having completed very early his studies at the *Académie de Genève*, he graduated at the age of 18 as Major from the *Ecole Polytechnique* (Paris), then as Major from the *Ecole des Mines* (Paris), two famous institutions of the time.

Afterwards, de Marignac made several scientific journeys to Scandinavia and Germany (including interactions with Liebig, Wöhler and in particular Berzelius) and two post-doctoral stays in organic chemistry (laboratory of Prof. Liebig in Giessen; 1838–1839) and in inorganic chemistry (laboratory of Prof. Brogniart in Sèvres; 1839–1840).

He was then offered a chair in chemistry in 1841 to replace Benjamin De la Planche and a chair in mineralogy in 1845, by the *Académie de Genève* which became *Université de Genève* in 1873, one year after the relocation of the laboratories of chemistry and physics from the former *Hôtel du Résident de France* to the brand new building *Uni Bastions*, in the basements of which the chemistry laboratories were located.

Jean-Charles Galissard de Marignac could have foreseen a brilliant career in the French administration, but he preferred to take the positions offered in Geneva, although the allotted wages were quite low.

De Marignac thus spent some 37 years working relentlessly and reclusively in his laboratory, without assistant or collaborator and investing some of his personal assets to buy his glassware and instrumentation. His colleagues considered him fierce, yet patient and modest, wasting no time on social activities within the academy and giving priority to his laboratory work over lunchtime. He accepted the position as Dean of the faculty of science but, as he feared that an honorary position would expose him to public gaze, he rejected the offer to become Rector of the university, and he prevented the efforts of his friends to have him awarded the French *Légion d'Honneur*. Despite this, he received many honors and distinctions, including the Grand Davy Medal

(awarded by the Royal Society of London in 1886) and the *Ordre du Mérite* (awarded by the Emperor of Prussia in 1888).

In 1878, tired and ill, he decided to stop his teaching and research work at the *Université de Genève*, but his scientific career was far from over. Ironically, the new *Ecole de Chimie* (*boulevard des Philosophes*) was inaugurated only one year after de Marignac's retirement, just in front of his private domicile (*rue Sénebier*), but he did not have the opportunity to use these modern premises. Nevertheless de Marignac had a small private laboratory at home, and this is where he continued the scientific investigations that were of the utmost importance to him and his correspondence with other chemists in Europe.

Although Jean-Charles Galissard de Marignac is usually depicted in the literature (including the complete biography of the man published in 1894 by Emile Ador) as austere and strict, his private correspondence with his wife and with relatives throws a much more romantic and empathetic light on his character. This different picture is exemplified with the comparison between the official photography (Fig. 4, left) and alternate images (Fig. 4, center and right) of the chemist.


During his later years he was much diminished by illness and he died in Geneva on the 15th April, 1894. Jean-Charles Galissard de Marignac rests in peace in the *Cimetière des Rois*, not very far from the grave of another famous chemist, Sir Humphry Davy, who died in Geneva in 1829.

The scientific achievements of de Marignac during the XIXth century are huge, but the heritage he left is equally extensive. Nowadays, he is well-known – according to the general standards of the population, which are usually based more on spectacular results than on seminal inputs – because he was the discoverer of the two 'Swiss' elements, ytterbium (Yb) in 1878 and gadolinium (Gd) in 1880. It must indeed be pointed out that part of these discoveries was the result of the tenacious work that he performed in his private laboratory of *rue Sénebier*, while already retired from his official functions at the university.

In 1869, the periodic classification of the elements proposed by Dmitri Mendeleev contained gaps, which issued a call for frenetic element hunters all over the world (Fig. 5). At that time, the only five rare earths known were yttrium (Y; discovered in 1794 by Johan Gadolin, which is named after Ytterby, Sweden, where its host mineral ytterbite – now named gadolinite – was discovered in 1787 by Carl Axel Arrhenius), lanthanum (La; discovered in 1839 by Carl Gustaf Mosander), cerium (Ce; discovered in 1803 by Jöns Jakob Berzelius and Wilhelm Hisinger, and independently



Fig. 4. Jean-Charles Galissard de Marignac (Source: Centre d'iconographie genevoise)



H																			He
Li	Be											B	C	N	O	F		Ne	
Na	Mg											Al	Si	P	S	Cl		Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br		Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I		Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At		Rn	
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Uuq	Uup	Uuh	Uus		Uuo	
		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu				
		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr				

Fig. 5. Periodic table of the elements (modern presentation, including elements up to 118, Uuo) showing the elements known in 1842 (yellow boxes), year of the first determination of atomic weight by de Marignac, the elements known in 1883 (orange boxes), year of the determination of the 29th atomic weight by de Marignac, the two elements (red boxes) discovered by de Marignac in 1878 (Yb) and 1880 (Gd), and the 29 elements (red symbols) for which de Marignac determined the accurate atomic weight.

by Martin Heinrich Klaproth), terbium and erbium (Tb and Er; both discovered in 1843 by Mosander). The missing elements were formally discovered and confirmed between 1878 (Yb; de Marignac, Ho; Per Teodor Cleve and Jacques-Louis Soret) and 1945 (Pm, Jacob A. Marinsky, Charles D. Coryell and Lawrence E. Glendenin).

However, for modern chemists, the most influential (and probably most obsessive), yet less spectacular, work of de Marignac is undoubtedly the critical determination of the atomic weight of 29 elements with an accuracy never attained up to that time.

In 1842, when de Marignac started his quest for accurate atomic weights, there were only 55 elements known; in 1883, when he ultimately published the atomic weight of his 29th element, the periodic table of the elements was rich with 69 elements. Alone, Jean-Charles Galissard de Marignac thus determined with the highest and most rigorous accuracy available, and using a simple balance (Fig. 6), the atomic weights of 42% of all elements known at that time.



Fig. 6. The balance used by Jean-Charles Galissard de Marignac (Source: Musée d'histoire des sciences de Genève)