

Rediscovery of the Elements

Bromine—Montpellier, France

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In the Golfe du Lion coastal bend of the Western Mediterranean, Montpellier stands as the capital of the Languedoc region, the great southern province incorporated into the French royal domain 800 years ago (Figure 1). Lying in the estuary of the Rhône River, numerous étangs (salty lagoons) dot the region¹ and serve as a haven for wildlife. Historically this region has supported a thriving commerce in salt production, notably around Aigue Mortes ("dead water" in the local Occitan language). Here salt is harvested from numerous lagoons on an annual cycle—dammed in the spring, allowed to evaporate in the summer, and collected in the fall (Figure 2). Further east, in the marshy delta of the Camargue Region, the world famous *Parc ornithologique de Pont de Gau*

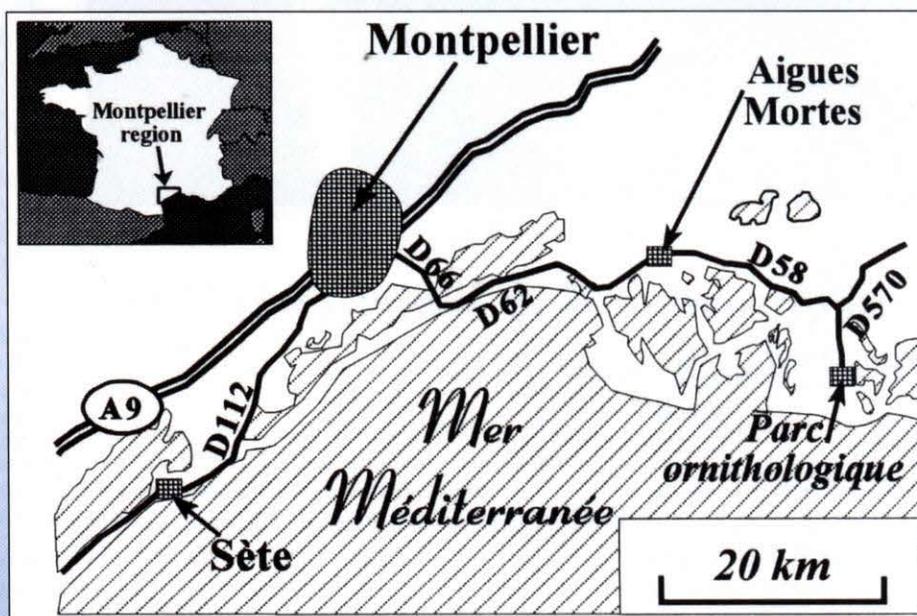


Figure 1. Montpellier resides near the Golfe du Lion coastal bend in the Western Mediterranean Sea. The seacoast near Montpellier is well known for its étangs (salty lagoons) and its natural haven for wildlife.

(Figure 2) attracts thousands of wildfowl (and visitors) annually (Note 1). As one drives across the grassland prairies of the Camargue, white

horses and black bulls are herded by gaudians (French cowboys) (Note 2).

It was in the ancient salt lagoons of Sète (Figure 3) that Antoine-Jérôme Balard discovered bromine.² Balard was known for his dedication and hard work—he hiked the 25 km to Montpellier, sleeping in a ditch during the evening, and arriving fresh the next day at the École de Pharmacie to deliver his lectures. Interested in the vegetation of the region, he was studying *Fucus* (rock algae) to see if Mediterranean plants were identical with Atlantic plants. He noticed that a brown color was produced when the algae was mixed with elemental chlorine (Note 3). He then conducted more elaborate experiments back at the university.

At the present Musée de la pharmacie at the Faculté de pharmacie in Montpellier (Figure 4), a "montage" has been constructed which is a replica of the apparatus Balard used to isolate bromine in 1826 (Note 4). Balard passed a stream of elemental chlorine through the mother liquor from salt production and separated into ether a brown substance, which he isolated by distilling by a retort into a receiver

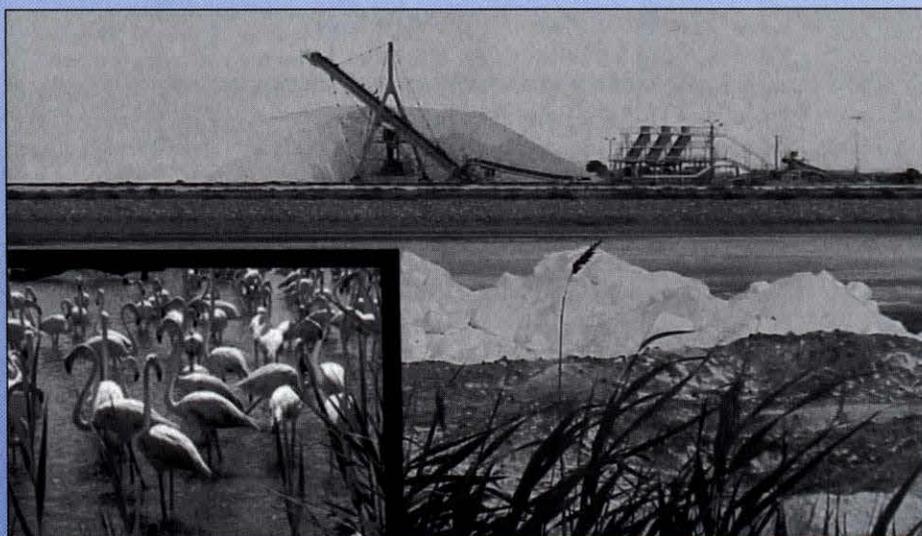


Figure 2. At Aigue Mortes a thriving enterprise in salt production is evident from the mounds of salt. This particular site was purchased by Morton International, Inc., in 1998. In the summer the water in the lagoons acquire a strong rose-colored hue from *Dunaliella saline*, a harmless microscopic algae. Inset: Flamingos teem by the thousands in the étangs of coastal France.



Figure 3. From Le Site des Pierres Blanches, the highest point in Sète (N 43° 24.24', E 3° 40.24'), the ancient salt lagoons may be seen in the distance. The production of salt from this particular sites was terminated in 1961. Twenty kilometers away, on the horizon, is Volcan d'Agde, an ancient extinct volcano.

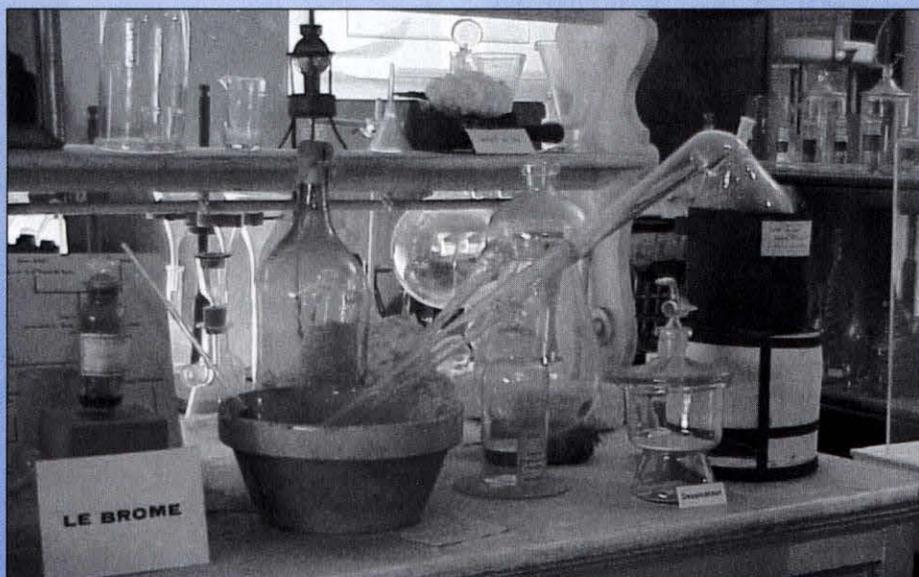


Figure 5. This "montage" is a replica of the apparatus used by Balard to isolate bromine, and resides in le Musée de la pharmacie in Montpellier.

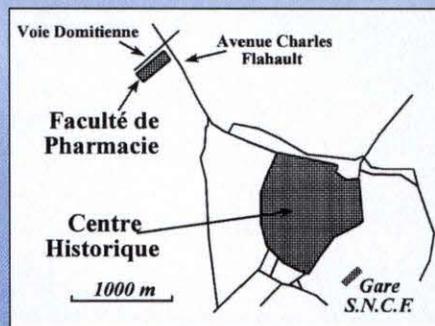


Figure 4. The present Faculté de pharmacie (N 43° 37.38', E 3° 51.74') resides about two kilometers to the northwest of the Centre historique of Montpellier, at 15 Avenue Charles Flahault. Although it appears to be a straightforward procedure to drive from downtown to the École, the peculiar layout of one-way streets and traffic signs restricting left- and right-hand turns dictates a sinuous route, counterclockwise around the Historic Center, then northwest to Voie Domitienne, then right and south onto Avenue Charles Flahault. Until one becomes familiar with the route, the trip is best negotiated by a taxicab driver. The "Gare S.N.C.F." is the train station.

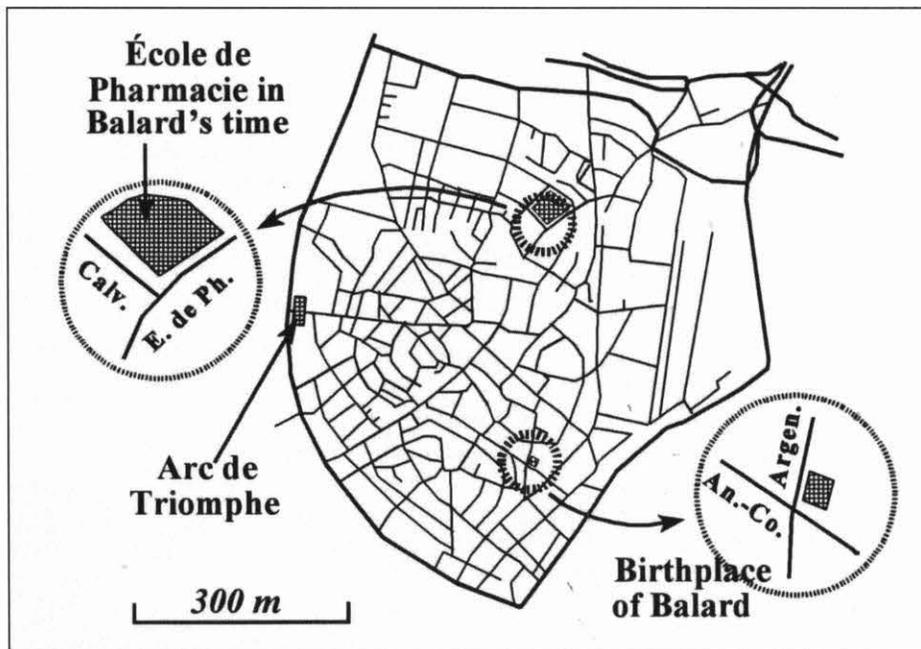


Figure 6. In the "Centre historique" of Montpellier, the old College is at the corner of rue la l'École de Pharmacie and rue Calvaire. Balard's birthplace is at 25 rue de l'Argenterie (corner of rue de l'Ancien-Courrier).



Figure 7. One passes by the Arc de Triomphe while entering the historic center of Montpellier. Inset: Equestrian statue of Louis XIV, in the Promenade du Peyrou (in the direction opposite from the historic center).

cooled in a salt-ice bath (Figure 5). He wanted to call the new liquid "rutilé" (French for "red"); Professor Joseph Anglada, who had been Balard's professor at Montpellier, preferred "muride" ("la mer") (Note 5). Later Gay-Lussac in Paris named the substance "le brôme" (*mauvais odeur*, "bad odor"). By reacting bromine with caustic potash, Balard produced potassium bromide crystals. Before long, potassium bromide was being utilized as a medicine for epilepsy—hence, the source of the term "bro-

mide" as a general sedative. Balard had beaten out several other chemists in the discovery of bromine (Note 6).

When Balard conducted his research, the École Supérieure de Pharmacie was in the center of Montpellier (Figure 6), whose history can be traced to the 12th century.³ Entering the historic center via the Arc de Triomphe (erected in 1691 to honor Louis XIV), one passes into a Medieval setting of ancient buildings (Figure 7). Negotiating the narrow streets, one can locate



the original university (Figure 8). This is the medical school for which Montpellier was famous in the middle ages, the home of the French pharmacy. Further down the hill, Balard's birthplace can be found (Figure 9).

Balard left Montpellier to become a professor at the Sorbonne (1842) and the College de France (1851) and left Montpellier permanently in 1860 for Paris, but he never forgot his roots in Montpellier: "Surtout n'oubliez-pas de dire que j'ai été élève in pharmacie [above all never forget that I was raised up through pharmacy]." In the grande salle of the Faculté de pharmacie, a large portrait hangs of this venerated professor (Figure 10). ○



Figure 9. The birthplace of Balard, in the historic center of Montpellier (N 43° 36.52', E 3° 52.69'). The extensively weathered marble plaque above the door reads: "Ici est né [here was born] le Pharmacien-Chemiste Antoine-Jérôme Balard 30 September 1802."

Acknowledgments

Gratitude is extended to Madame Collette Charlot, Conservateur de Musée de la pharmacie at the Faculté de pharmacie, 15 Avenue Charles Flahault, 34060 Montpellier, who not only guided us through the museum but also through the Centre Historique, locating and identifying historical sites. Mme. Charlot also



Figure 8. The original University in the historic center of Montpellier (N 43° 36.77', E 3° 52.72'). At this medical school, Nostradamus qualified as a "médecin" ("doctor"). This building now houses the National Health Laboratories. The plaque reads: "Ancien Collège Royal Ouvert des le Moyen Age a l'Enseignement Médical et Siège de l'Université de Médecine de 1498 a 1792 [Ancient Royal College opened in the Middle Ages for the instruction of medicine and the seat of the university of medicine from 1498 to 1792]".

shared a great deal of additional important information regarding Balard in the museum archives. Also helpful were Gérard Cros, Professeur et Docteur en Pharmacie, and Jacqueline Azay, who aided with some of the translations of documents and other archives.

Notes

1. When the authors visited this ornithological park (headquarters and entrance: N 43° 29.32', E 4° 24.24'), they viewed the rare sacred ibis (*Threskiornis aethiopicus*, the revered bird portrayed on Egyptian tombs and obelisks)—an accidental visitor from Africa.
2. Napoleon III's Spanish wife Empress Eugénie popularized the tradition of the fighting bull in France.
3. Balard produced elemental chlorine as did Scheele in the latter's original discovery in 1774, by reacting manganese dioxide with hydrochloric acid.
4. This exhibit was constructed for the 150th anniversary (in 1976) of the discovery of bromine by Paul Jaulmes, Professor of toxicology and analytical chemistry at the University. The Faculté de pharmacie moved to this present site in 1962.
5. Anglada wanted to avoid confusion with the mineral rutile (TiO_2), whose crystals are typical-

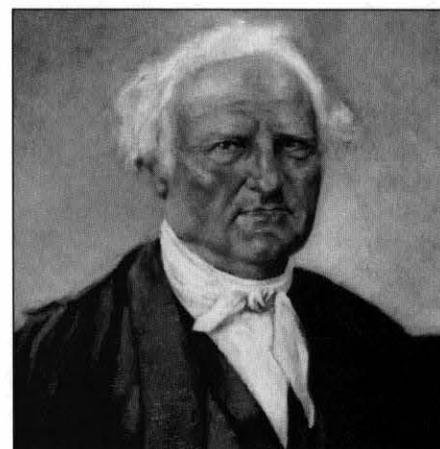


Figure 10. Portrait of Antoine-Jérôme Balard, which hangs in the grand salle of the present Faculté de pharmacie, 15 Avenue Charles Flahault, Montpellier, France.

ly red in nature, and which had been named in 1803.⁴

6. Notably, Justus von Liebig had misidentified a bottle of bromine as "iodine chloride."² After Balard's announcement, he ruefully placed the bottle in his "cupboard of mistakes." Balard's original sample of bromine is stored in the Imperial College of Science, Technology & Medicine Archives, Imperial College, South Kensington Campus, London (N 51° 29.91', W 00° 10.68').

Literature Cited

- ¹ Botting, B. *Wild France*, Sierra Club Books, San Francisco, 1994.
- ² Weeks, M. E., *Discovery of the Elements*, 7th ed., *Journal of Chemical Education*, 1968.
- ³ Dulieu, L. *Le Musée de la Pharmacie de Montpellier*, Languedoc-Roussillon.
- ⁴ Dana's *New Mineralogy*, 8th Ed., John Wiley & Sons, N.Y. 1997.