

# **FRENCH MATHEMATICAL INFLUENCES IN THE FIRST BRAZILIAN GEOLOGICAL SCHOOL IN THE LATE 19<sup>TH</sup> CENTURY**

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## **ABSTRACT**

The aim of this paper is to present some French influences in Brazil at the end of the 19<sup>th</sup> century specially concerning the mathematics at the mineralogy and geology school: Escola de Minas de Ouro Preto (EMOP). We discuss about the Brazilian context in which this institution was created as well as his founder, the French geologist Claude-Henry Gorceix. We also compare entrance exams and preparatory courses with French schools. Finally, it will be presented the difficulties of the adoption of the metric system in Brazilian schools. In mathematics Gorceix implemented a study of higher mathematics content such as Calculus of Derivatives before entering higher education with a teaching that did not resort to memory but the reasoning.

## ***1 Introduction***

The aim of this paper is to present some French influences in Brazilian teaching and research at the end of the 19<sup>th</sup> century in mathematics at the Mining School of Ouro Preto (EMOP – Escola de Minas de Ouro Preto). Brazil was a Portuguese colony until 1822. The status changed, especially in science, with the arrival of the Portuguese royal family in 1808 when Portugal was about to be invaded by Napoleon Bonaparte's troops. The intention of coming to Brazil, supported by the British, was to ensure Portugal's independence (Schwarcz & Starling, 2015). Before that time, books, in general, could not be printed in Brazil, it could circulate in the colony, as long as it was produced abroad and were approved by a censorship screening, in order to keep Portugal's control over the colony. After the independence (1822), the Emperor was Dom Pedro I (1798-1834) until 1831, when he renounced the throne and returned to Portugal. His son, Dom Pedro II (1825-1891), was only six years old and could not be the Emperor. In 1840, after his emancipation at the age of 15, he became Emperor and ruled Brazil until 1889, when the Republic was declared.

Between 1864 and 1870, the hardest war took place in South America: the "Guerra da Tríplice Aliança", in which Brazil, Argentina and Uruguay fought against Paraguay, killing a large part of that country's population (Schwarcz & Starling, 2015). At that time, according to Schwarcz & Starling (2015, p. 303) "It is certain that in 1871, in the midst of a political crisis, the emperor, who seemed bored in his own country, prepared to travel around the world, the emperor, who seemed bored in his own country, was preparing to travel around the world which he knew only from books"(translated by the author). This is how the history of the creation of the School of Mines of Ouro Preto – Escola de Minas de Ouro Preto (EMOP) begins.

The table below presents a summary of the main historical and scientific events that will be discussed throughout this paper. It is intended to be a panoramic view to direct the reader chronologically.

Historical Events	Scientific Events
1808 – Royal Family came to Brazil	
1822 – Brazilian Independence	
1831 – Dom Pedro I return to Portugal	
	1832 – Creation of a School of Mines
	1862 – Prohibition of Metric System
1864-1870 - War of Triple Alliance	
1871 – Dom Pedro II goes to Europe	
1874 – Gorceix comes to Brazil	
	1876 – Beginnig of the EMOP
	1877 – Preparatory Course
	1880 – Changing in the Preparatory Coure
	1885 – Most important changing in the Preparatory Course
	1889 – Brazilian becomes a Republic
1891- Gorceix goes back to France Death of Dom Pedro II	
1919 – Death of Gorceix in France	

## 2.5 Creation of a mineralogy and geology school

In 1823, the Constituent Assembly discussed the opening of schools of mineralogy in Brazil. In 1832, a project was approved and transformed into law by the General Legislative Assembly concerning the creation of a

School of Mines in the province of Minas Gerais. Only in 1875 there was the approval of the Laws and Regulations of one institution, the EMOP, with the start of the activities on October 12<sup>th</sup> 1876.

The creator was the french geologist Claude-Henry Gorceix (1849-1919), invited by Dom Pedro II during his travel (his escape from the country because of his low popularity after the war against Paraguay, according to Schwarcz and Starling, 2015) to Europe in 1871. The french teacher studied at the Lycée de Limoges and at the École Normale Supérieure in Paris (1863-1866). Later, he was sent on a scientific mission to the French school in Athens. According to the organization report available at the Brazilian National Archive (Brasil, 1875), the EMOP was destined to provide managers for the exploitation of mines, for the metallurgical establishments and engineers employed by the State in the provincial Mines of the Empire.

The regulation, created by Gorceix, represented a revolution in Brazilian schools (Carvalho, 2002; Silva, Thiengo, 2003) especially when considering the inclusion of an entrance exam, full-time work for teachers and students, a ten-month school year followed by two months of practical work, good pay for teachers, free education, scholarships and even prizes of trips abroad for the best students.

The regulation required entrance examinations (oral and written) for access to the institution, a practice that was usual in France, but not in Brazil (Silva & Thiengo, 2003). In this respect, the politician José Maria da Silva Paranhos, known as Visconde de Rio Branco, acting director of the Polytechnic School of Rio de Janeiro and one of the responsible for analyzing the Regulation proposed by Gorceix, spoke out against the entrance exams. According to him, admission should be made as in other Brazilian higher education institutions and accept all candidates approved in the secondary school concluding examinations, called at that time preparatory examinations.

The tests included elementary geometry, analytical geometry (of lines, circumference, 2<sup>nd</sup> degree curves); algebra up to 2<sup>nd</sup> degree equations, use of logarithm tables; rectilinear trigonometry; descriptive geometry of lines and planes; elementary physics; notions of chemistry concerning metals; notions of botany and zoology; straight and imitation drawing; the French or English or German language (Brasil, 1875).

The first written exam of Trigonometry required of the candidates to determine  $\tan(98^\circ)$  in the first question. And, in the second one, was given one

side of the triangle and one angle and asked to find the other two sides and the angle formed by them. This questions where similar to the questions presented in Lacroix's book (1863, p. 47).

After the results, Gorceix sent a letter to the Brazilian Emperor Dom Pedro II, with complaints about the mistakes the students committed, "the trigonometric calculation, numerical resolution of one triangle, left much to be desired" (Gorceix, 1876). He also highlighted the necessity of introducing better methods into secondary and higher education in Brazil and suggested the usefulness of a preparatory course, similar to those that existed in Paris institutions.

## 2.6 Preparatory Course

Gorceix decided to set up a one-year preparatory course, but not to exclude entrance examinations, as suggested by teachers from Polytechnique School of Rio de Janeiro [Escola Politécnica do Rio de Janeiro]. It is worth clarifying that in the documents one can find other names such as preparatory, annex and provisional course. This is due to the fact that the course was preparatory for the entrance exam and, initially, was thought of as provisional. The adjective annex is due to the fact that it was taught by EMOP's own professors and was considered to be part of EMOP.

The Decree-law of 1832 that created a School of Mines in Brazil, which nevertheless was not implemented, had a similar course (Brasil, 1832). The one that Gorceix created was based not only on the 1832 course, but also on the Preparatory course of the École des Mines de Paris (Oliveira, 2020).

This one-year preparatory course started in 1877 (Brasil, 1877) with three subjects, most of which had a strong mathematical component. Despite this course, Gorceix was still not satisfied and decided to extend it for another year in 1880 (Brasil, 1880). Another more important change was made in 1885, with implementation of the two-year preparatory course (Brasil. 1885).

As far as we find evidence, the first Preparatory Course was created due to the mistakes made by the candidates in the entrance examinations, especially in the questions of trigonometry, the logarithm table, calculus and descriptive geometry. The aim was to complete the scientific education of candidates wishing to enroll at the École des Mines, being, at the beginning, a provisory course.

The Decree-law of 1880 stipulated that there would be a professor of mathematics and mechanics; then, the Brazilian Professor Archias Medrado was hired. Although we have not yet analyzed his proof, he might have done tests of trigonometric calculation, solve a transcendental equation or other practical calculations in two hours, according the Brasil (1880).

This Decree-law increases also the Preparatory Course by one year with three subjects, one in the first year and two in the second. It is important to emphasize the amount of content concerning mathematics and to highlight the calculation of derivatives. There was, at the entrance examinations from 1879 to 1882, questions about finding the minimum or maximum value of an algebraic fraction. The content of the mathematics and derivative calculation must be taken into consideration in all the exams and preparatory courses.

The preparatory course was extinguished in 1897, when the capital was transferred from Ouro Preto to Belo Horizonte, although the school remained in town with less students. Four years later Brazil became a Republic and Gorceix did not have the same support he had from Dom Pedro II for the conduction of the institution. So he decided to left the direction of the school and went back to France, Bujaleuf, until his death in 1919.

## 2.7 Teachers

For the selection of teachers, Gorceix preferred those who were French (Armand de Bovet, Arthur Thiré, Paul Ferrand – all of them ex-students from École Polytechnique and École de Mines from Paris), because, in his opinion, there were no people in Brazil with the required level, although he has hired Mr. Medrado. For the selection examinations, he abolished the writing and defense of a thesis, unlike in France. According to him, it would require time which the candidates could no longer afford, cost money, and prove little from the point of view of teaching. Meanwhile, he kept a lesson after 4 hours of preparation without books or handwritten notes, as was the practice in his country (Carvalho, 2002).

It is also important to point out Gorceix's opinion on Brazilian secondary education: deplorable, according him. He was especially critical of the mistakes made by the teachers who passed them on to the students. Some teachers made up the students say that the logarithm of 0 is -1, or writes that the square of  $a - b$  is  $a^2 - b^2$  (Lima, 1977). That was why he thought it was necessary to teach basic mathematics and also differential calculus before entering at the

school of mines, a practice that was not common in other countries at that time such as, for instance, Germany.

## 2.8 Metric System

Another French influence in Brazil was the adoption of the metric system. There was a law in Brazil, dating from 1862, saying that in 10 years the use of any other metric system would be forbidden. Those who used any other metric system would have to pay a fine or even go to jail. However, in the following is an excerpt from a proof dated 1888 in which the student Belarmino Martins de Menezes did not use the French system, but the traditional Brazilian system.

*“To get the surface area of a triangle expressed in **square arms** it would be enough to divide the number of square meters by 4.84, which is the number of meters a square arm has, but there is no time”*

Gorceix was worried about the implementation of the French metric system in Brazil. He went to Paris in 1882, due to personal reasons, and bought there a small box containing the various measures of the metric system and send then to the Brazilian Ministry. In his opinion, it would be useful if every school had one of these boxes in order to show students how to use it (Lima, 1977, p.194-195).

In this regard, Zuin (2017) points out that system for weights and measures are cultural products and the breaking of cultural codes and traditions does not happen without conflicts at the social level. In the 1870s there was an increase in taxes, the increase in products, economic issues, allied to the military recruitment that was imposed, erupted, in several locations in Brazil so the population was dissatisfied. At the same time, many suspicions revolved around the new standards proposed by the law, French metric system there were then groups rebelling, leading to a movement, especially in the north of the country, aimed at destroying the decimal standards, triggering a movement that became known as Revolta dos Quebra-Quilos (Revolt of the kilo-breakers), between 1872 and 1877. There were those who condemned the French metric system for its attachment to tradition; others renounced it for associating it with the French Revolution and Enlightenment ideals that could compromise the monarchical regime in Brazil (Zuin, 2017). Besides that, until the middle of the 20<sup>th</sup> century, the Brazilian system was used in school books.

## ***Final Considerations***

Gorceix implanted in Brazil a different education both in content, methods, and spirit. In mathematics one can perceive a study of calculus of derivatives before entering higher education with a teaching that did not resort to memory but the reasoning. Besides that, he brought French scholars (such as Armand de Bovet, Arthur Thiré, Paul Ferrand) and teaching methodologies to the country in order to develop Brazil education, and also spread French culture.

The French influence also occurred in other institutions and scientific knowledge in Brazilian territory, specially at the end of 19<sup>th</sup> century and beginning of 20<sup>th</sup>. Although, the teaching of calculus in secondary schools and also the use of metric system demanded more effort in EMOP than in other places. Besides that, the preparatory courses started in São Paulo in 1892, probably influenced by Gorceix.

## **REFERENCES**

- Brasil (1832). Decreto de 3 de outubro de 1832 – Crêa um Curso de Estudos Mineralógicos na Província de Minas Geraes. Coleção de Leis do Império do Brasil de 1832. Rio de Janeiro. V.1. parte 1. p.98.
- Brasil. (1875). Decreto 6 026 de 6 e novembro de 1875. Cria uma Escola de Minas a Província de Minas Gerais e dá-lhe *Regulamento*. Coleção de Leis do Império do Brasil de 1875. Rio de Janeiro, v.2, parte 2, p.701.
- Brasil (1877). Portaria número 372 de 12 de setembro de 1877. Coleção de Leis do Império do Brasil de 1877. Rio de Janeiro, v. 3. p.304.
- Brasil (1880). Decreto 7628 de 14 de fevereiro de 1880 – Altera diversas disposições relativas à escola de Minas de Ouro Preto. Coleção de Leis do Império do Brasil de 1880. Rio de Janeiro. v.2. p. 61.
- Brasil (1885). *Decreto 9448 de 27 de junho de 1885. Dá novo Regulamento à Escola de Minas*. Coleção de Leis do Império do Brasil de 1885. Rio de Janeiro. v.2. p.484.
- Carvalho, J. M. (2002). *A Escola de Minas de Ouro Preto: o peso da glória*. 2 ed. Editora UFMG.
- Gorceix, C. H. (1876). *Letter to Dom Pedro II on September 14<sup>th</sup>*: Museu Imperial/Ibram/MinC/nº785/2017 maço186, doc 8455
- Lacroix, S. (1863). *Traité Élémentaire de Trigonométrie Rectiligne et Sphérique, et D'Application de L'Algèbre a la Géométrie*.
- Lima, M. R. (1977). *D. Pedro II e Gorceix: a fundação da Escola de Minas de Ouro Preto*.

Fundação Gorceix.

Oliveira, D. P. A. (2020). Um estudo de avaliações de matemática na Escola de Minas de Ouro Preto de 1876 a 1891. Tese de Doutorado. Unesp – Rio Claro.

Schwarcz, M. L. & Starling, M. H. (2015). *Brasil: Uma biografia*. Companhia das Letras.

Silva, C. M. S. & Thiengo, E. R. (2003). *Claude-Henri Gorceix: Trabalho e Competência na criação de uma escola e na formação de discípulos*. Episteme.

Zuin, E. de S. L. (2017). *Sistema Métrico Decimal como um saber escolar no Brasil: alteração das práticas escolares na segunda metade do Oitocentos*. Revista De História Da Educação Matemática, v.3. n.2. p. 169-194.