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## **The women who defended a thesis in mathematics in France during the interwar period**

### **(1) Introduction**

Between the two world wars, 242 students of all the French universities have defended a thesis in mathematical sciences. Only five of them were women: Marie Charpentier (from Poitiers), Marie-Louise Dubreil Jacotin and Jacqueline Ferrand (two students of the E.N.S. of Paris), add two astronomers: Edmée Chandon and Rose Bonnet. The problem is that there aren't a lot of sources giving information about all these women, and more precisely about Edmée Chandon and Rose Bonnet. The only fact we can mention about them is their official appointment as astronomer at the Paris observatory and Edmée Chandon is the first woman in France to be appointed to this. When we study the career and the life of those women, we are forced to be interested in the education of girls in France in their opportunities for education and in its evolution during the interwar.

### **(2) Situation for women education**

During the interwar period, the opportunities for education were different for the girls in comparison with the boys. Each of them had their own Lycee and their own teachers: only women could teach to girls. And then since 1880 and the law of Camille See, the Ecole Normale Supérieure of Sevres had been created to train women students to become teachers, and a female "aggregation" had been created. But "Lycees" for women and the exam at the end of the studies did not allow continuing at the University. Very few girls went to secondary school and still less tackled the baccalaureate in elementary mathematics or wanted to undertake scientific studies. It concerned only elite. Nevertheless, it has been the case at least for Marie-Louise Dubreil Jacotin,<sup>1</sup> Marie Charpentier and Jacqueline Ferrand. The schooling was rather strictly separated and different even if there were sometimes exceptions.

Nevertheless, the status of women education has being improved during this period. Women became officially allowed to attend final classes of men Lycee in 1922, which prepared more easily to the baccalaureate. The Bérard's reform in 1924 wanted to make the schooling for women and men similar to succeed the baccalaureate examination. But after this diploma, there were almost no choice for women, who wanted to continue the study of mathematics. Without any particular chances, the only way to undertake further studies was to enter the Ecole Normale Supérieure de Sevres or to take the examination of female certificate of "aptitude" or agrégation to become teacher for girls. But some exception exists: one example is the case of ML Dubreil Jacotin.

She was not attracted by the Ecole at Sevres. According to her, the studies were too far removed from real science. By good luck, one of her friend (Denise Coulom) was the daughter of the head of the college of Chaptal and accepted Marie-Louise into the special mathematics classes reserved for male students and to which girls were not allowed entry but which allowed preparing the university entrance examinations.

We can remark how limited or narrow were the women's opportunities for a mathematical education and for advanced studies in mathematics. The official way did not allow women to integrate the mathematics community and to become part of it because they could not graduate the necessary certificates asked if they followed the traditional curriculum. The women had to manage themselves and to benefit special conditions and lucky conditions if they wanted to persevere, to pursue a career in mathematics. They had to face some barriers, some obstacles even when they had gained admission

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<sup>1</sup> Her teacher in 1922–23 had only nine "little girls" as pupils in her class.

to entrance examination normally, usually reserved for men. For instance Marie Louise Jacotin has been admitted to the Ecole Normale Supérieure but she has had to struggle to gain the right of attending classes in it. Before her, only the physician Marguerite Rouvière in 1910 and Georgette Flamant born Parize in 1917 had been passed but they had not been officially matriculated. At the entrance examination of 1926 the jury classed Marie Louise Jacotin second. The ranking was published with the official note "The nomination of the students to the Ecole Normale Supérieure will be by order of rank". But the decree of the ministry published afterwards in the official journal named twenty male students at the top and then Marie Louise at the head of the "Boursiers de licence". This decree had moved her down to 21<sup>st</sup> place. She expressed her "sad disappointment" to the Minister of Public Instruction and Fine Arts, Edouard Herriot. She asked to be allowed to attend the ENS as an extra day pupil or, if that were possible, to attend classes at the school so as not to lose "the minimum benefit of her rank of admission." Her friend Simone Hauser alerted her father to Marie-Louise's difficulties. He was a member of staff of Journal of ENS from which readers learned these events. This caused some stir in the press and in the administration of Third Republic. Finally, Edouard Herriot transformed her "Bourse de licence" which would have only enabled her to study in the provinces into a "Bourse près de l'université de Paris". When the academic year began again, miss Jacotin started her higher education but she did not officially matriculate until the following February 1927. 34 women came after her between the interwar period and not only in mathematics but in other domains of science, in humanities or in arts. Three of them became professors in provincial universities, four in Paris and one at the Collège de France.

Their examples proved that male and female students could study together in Paris. The time came when those women cloistered in the suburbs at Sèvres could study at the Sorbonne. This encouraged the emancipation of the students of Sèvres helped by the energy of its new Director at the end of the 30's, Eugenie Cotton, who wanted to promote a better education and a better schooling for her pupils. In 1939 she asked Jacqueline Ferrand, one other woman who integrated the ENS in mathematics, to become professor assistant and to provide better mathematics teaching than before to prepare the women to agrégation.

To sum-up, between 1914 and 1945, an increasing number of women asked for more interactive mathematics and sat entrance examinations like the "agrégation" normally reserved for men. To answer this situation a lot of discussions took place at different Councils of Higher Education or between different members of the mathematics community to facilitate the studies of mathematics for women. This pressure ends up in an attempt to make the schooling similar for men and women. At this moment these women were in fact pioneers not really by choice but by necessity. The period between the two wars looms importantly as a transition period during which barriers hitherto thought of as natural began to disappear.

### **(3) The five women who defended a thesis in mathematics during the interwar period**

First, we have to mention that the five ones are fully integrated in the mathematical community. Even if I haven't found a lot of pieces of information about Rose Bonnet and Edmée Chandon, we can say that they belong to the community of French astronomers and it is with this appointment that they are quoted in books like *World directory of mathematicians*. Both have them have defended a thesis in astronomy, one in 1930 ("Research into the tides of the Red Sea and in the Gulf of Suez") and the other in 1945 ("Spectrums, periods and eccentricity of binaries"). But the astronomers have a peculiar position in the French mathematical community. If astronomy is one part of mathematical sciences at this period, it is not promoted by the traditional members of this community.

The three other women are more representative of excellence in mathematics and of the French mathematical trends. They defended a thesis in the different domains of mathematics (in mechanic of fluid and in analysis) the most productive in France in the interwar period. Moreover they distinguished them selves by their high abilities in mathematics and by their future career in higher education and research.

The first one has been Marie Charpentier. She defended a thesis in analysis "About the Peano's points of a differential equation of order one" in which she studies the dependence between the origine of the equation and its integral, inspired by previous results of Paul Montel and René Baire. Her work

has been defended at the University of Poitiers in province but has been remarked by Emile Picard and Paul Montel, ones of the most influent French mathematicians at the beginning of the 1930's. Paul Montel has even presided over the jury of the thesis in Poitiers, whereas he was professor at the University of Paris, "la Sorbonne". After her thesis she gained a Rockefeller fellow to study one year with Birkhoff at Harvard University in 1931/32 and at the end of the 30's she became a professor in the University of Rennes.

The second one is Marie-Louise Jacotin. After a male "agrégation" in mathematics where she had been ranked third in 1929, she defended in 1934 a thesis in mechanic of fluids, "About the rigorous determination of the permanent periodic waves of finite scale". She has worked with the Norwegian mathematician Bjorknès and with the French one, Henri Villat, who reported on this thesis with great enthusiasm. This work testifies of some dynamism of this mathematic discipline, which is often ignored by the current historiography about the interwar period but which is representative of some trends in the French mathematical research of the time. After this first work, she dealt with algebra and with the modern algebra which was at the core of the German mathematics between the two wars. She benefited a Rockefeller fellow to study in Germany as some other young mathematicians in France before her, member of a new generation with André Weil and Henri Cartan which used scholarships to discover the mathematics research of other countries. After her thesis up to 1945, Marie-Louise Jacotin became successively research lecturer (1934–1938), assistant lecturer in Rennes (1938–1943), assistant professor in Lyon (1939–1943) and professor at the University of Poitiers in 1943.

The third one is Jacqueline Ferrand. After a male "agrégation" in mathematics where she had been ranked first in 1939, she defended in 1942 a thesis in analysis in the domain of functions of complex variables and about the theory of conformal mapping. For her too, Paul Montel presided over the jury but in Paris as he presided almost every jury of theses related to this specific domain of mathematics, one of the main trend of French mathematical research in the thirties. At the end of the war, she has been appointed professor at the University of Bordeaux, then very soon after her thesis which proves the high quality of her previous works.

To conclude, the interwar period can be regarded as a period of transition and of evolution for the place of women in science. Even if the number of women who defended a thesis is weak in comparison with the total number of state theses defended in France at the same time (242), each of them is one proof of the ability of women to be integrated in the mathematical community and they appear as pioneers. This evolution can be illustrated by the differences between two statements. In 1927, Maurice d'Ocagne (engineer in the elite Ponts et Chaussées corps of the French State and prominent figure in the development of the Parisian *grandes écoles* between the two wars) wrote in the conclusion of his report *A Study of Women in Science and Women Mathematician*, "women in general are devoid of an inventive mind and uninhabited by a creative muse", as if it was a generally state of mind in engineering circles among the elite State grands corps. In 1948, Marie-Louise Dubreil-Jacotin in contribution of a chapter to the "*Principal Developments in Mathematical Thought*" of François le Lionnais, (published as part of the "Scientific Humanism of tomorrow"), answered him in a chapter devoted to "Women Mathematicians":

The growth of female schooling, the combat against prejudice and preconceptions, the profound changes in ways of life, and the role assigned to women in recent years all will undoubtedly bring about a rethinking of the place of women in science. Time will tell to what extent women escape the role of excellent student and impeachable assistant to join — as men's equal — the ranks of the learned.

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