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Willi H. Hager, Kolumban Hutter and Oscar Castro-Orgaz

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Correspondence between de Saint-Venant and Boussinesq 2: Boussinesq's professional and private life up to 1886

Willi H. Hager^{*}, ^a, Kolumban Hutter^b and Oscar Castro-Orgaz^c

^a VAW, ETH Zurich, CH-8093 Zürich, Switzerland

^b c/o VAW, ETH Zurich, CH-8093 Zürich, Switzerland

^c University of Cordoba, Campus Rabanales, E-14071 Cordoba, Spain.

E-mails: hager@vaw.baug.ethz.ch (W. H. Hager), hutter@vaw.baug.ethz.ch (K. Hutter), ag2caoro@uco.es (O. Castro-Orgaz).

Abstract. Joseph Boussinesq is among the great physicists of the late 19th and the early 20th centuries, mainly due to his novel techniques to mathematically solve complicated equations by an adopted method of approximations. He has scientifically worked in all fields of physics, except for electro-dynamics. His writings are difficult to read due to overlong sentences and complicated formulations. He therefore does not count to the readers' favorite author.

Boussinesq's work can, alternatively, be approached by a correspondence between two 19th century scientists, de Saint-Venant and Boussinesq. Their well-known papers are thus commented from the point of development of their theories; the input of both scientists is evidenced by their writings, and comments of both to each other. The age difference of the two was 45 years, the experienced engineer de Saint-Venant, and the mathematician Boussinesq, two eminent researchers, met to discuss not only problems in hydraulics, but in physics generally. In addition, their correspondence embraced questions in ethics, religion, history of sciences, and personal news.

The life of Boussinesq is poorly documented, given his shyness and his privacy. The letters of the Correspondence reveal many details, however, that this venue was selected as the basis of this paper, ending with Saint-Venant's death in 1886. The topics discussed include Boussinesq's early career until Saint-Venant became part of his life, by asking questions on one of his first papers. They felt attached to each other, so that numerous letters were exchanged. Although others are missing in the Correspondence, the entire collection allows for an almost complete view on the life and career of Boussinesq. His years at the College of Gap and at the University of Lille are considered. The last days of Saint-Venant are commented then both in terms of the master of mechanics, and his great steps made for Boussinesq to enter the Sorbonne University in Paris. The present work is concluded with a hardly known obituary of more private than professional origin, by which the many facts are evidenced by one of his friends.

Keywords. Biography, Fluid mechanics, History, Institut de France.

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* Corresponding author.



Joseph Boussinesq in 1894 (*Le Monde illustré*, 38 (16^{ème} Juin), p. 384)

1. Introduction

Joseph Boussinesq (JB) is a scientist having greatly added to almost all topics of physics in the late 19th, and early 20th centuries. Of particular relevance are his studies in hydrodynamics, featuring among others the solitary wave theory, the stability analysis of open channel flows, or the first turbulence model for simplified two-dimensional pressurized flows. He is also known for the Boussinesq equations dealing with curved [Sic.: Non-hydrostatic] free surface flows by which the common assumptions of the Shallow Water Equations (SWEs) are overcome by a one-dimensional approach, thereby including the effects of streamline curvature on the velocity and pressure distributions. Despite these exceptional achievements, JB was hardly known to people in his environment, mainly because of his privacy and his reserve, his silence and his shyness. As a consequence, few details on his life are known.

A unique possibility in exploring these details offers the large Correspondence available at the *Académie des sciences*, Paris, France, where hundreds of letters are kept, having been written between JB and his Master Adhémar Barré de Saint-Venant (dSV). The background of this Correspondence is presented by Hager *et al.* [1], so that here it is only stated that these letters cover almost all aspects of their human and scientific lives, starting from purely professional aspects mainly in mathematics and physics, advancing to aspects of philosophy and ethics, and finally touching human aspects of the two scientists and their families. The purpose of this second work on the Correspondence is to focus mainly on JB and his background.

It should be noted here that dSV was 45 years elder than JB, who could have been his grandson in terms of age. dSV, then a worldwide known scientist and engineer in the elasticity theory and in hydraulics, was confronted with a young person whose talent was mainly in mathematical physics, who was neither engineer nor mathematician, but whose knowledge was encyclopedic

surpassing that of most of his fellowmen. The elder, dSV, was persistently asking JB for still more advanced insights in this or that problem, whereas JB largely profited from the many relations of his master, as he addressed him in all letters. Accordingly, dSV was largely responsible for the integration of JB in the University of Lille from 1872 to 1886, and then into a position at Sorbonne University, the so-called *Institut*, then the top academic location in France in terms of a scientific career. Note that dSV headed the Section of Mechanics at the *Institut* from 1868 up to his death in 1886, whereas JB eventually became president of the *Institut*, based on the principle of *anciennité*. JB did not at all look for such a position, given his modesty and his shyness. It should also be mentioned here that the output of JB's scientific work abruptly diminished once his mentor had passed away.

A complete translation from French to English of all letters available at the *Académie* is out of scope. Given the many topics addressed, only these relating to the career of JB are considered in this second part of the Correspondence. An important restriction on its publication is imposed by the *Académie*. Once WHH had received access to its Library, he was asked to sign a document in which strict personal use of the letters was requested, so that none of these letters can be published. The only way to diffuse their contents thus was to transcribe them first into French, from where the English version was gained. The effort to obtain these transcriptions was heavy, but given their historical significance, the authors feel convinced to add to this relevant topic of science.

The contents of this paper is subdivided into the start of the correspondence between dSV and JB, followed by a description of JB's professional career until 1872. The third portion deals with his years at Lille University. Given that the Correspondence ended in late 1885 because of the passing of dSV, the last more than 40 years of JB's life are summarized in an obituary written by one of his close friends. The many names of colleagues both from France and Europe mentioned in the Correspondence are highlighted in the Appendix of Hager *et al.* [1].

2. Correspondence

The Correspondence between dSV and JB was founded in 1929, as stated by Hager *et al.* [1]. The total number of letters kept at the Library of the *Institut de France* of the *Académie des sciences* is 600. Except for isolated documents, the entire Correspondence has never been viewed. Given its importance, the authors decided to publish the major findings in paper form. This restriction allows for a first insight into the world of 19th century imminent scientists, who were in personal contact between 1868 and 1885.

2.1. Start of the Correspondence

Letter 4, dated May 7, 1868: dSV thanks JB for his kind words relating to dSV's appointment as president of the Mechanics Section of the *Académie des Sciences*, namely: "I thank you, dear Sir, for your support leading to my appointment; therefore, you are a Christian, you are a Catholic, for it is only these today who fear God who deals with the affairs of this world; those who reject revelation no longer concern themselves with writings, as in the last century, with the mask of a certain vague Deism. Yet, we mathematicians are dedicated to logic, if we believe, and when we practice; what is more reasonable and gentle? God, no doubt, asks us for our heart, and he deserves more than just one title; however, he is certainly utmost undemanding, and what he demands from the organ of his church is rooted in goodness and love to do so; we wouldn't be scientists if we would refuse it." This statement reveals the two scientists as dedicated Catholics, forming between them a common base all through the Correspondence. Logically, the two not only discussed questions of science, but expressed also their hopes and sorrows that constitute an excellent foundation in the common religion. Such statements may be found in many of

the letters. In addition, a number of letters are dedicated to questions of ethics and human coexistence, yet these are not considered here.

The answer of JB follows in Letter 5, dated May 10, 1868. dSV suggests to JB the following advice relating to his professional career: “I cannot express to you how happy I am that in my last letter the word God came spontaneously to my mind, since it expresses to me happiness to know you better, and to see that I am united with you, not only by sympathy, but even more so by a complete unity of moral conviction and religious life. Oh, you have a reason (if you allow me with my juvenile experience to use this word) to judge that nowadays, at least in France, it is impossible to believe in a living God without being Catholic. Indeed, an induction, which is not as absolute as a syllogism, but whose force is irresistible to every mutilated ground soul that, if God notices this world, the Catholic Church is his work, as being the most central, the greatest and the most divine on this earth. A certain feeling, deposited by grace in the depths of the souls, and even a natural meaning, proves this in an experimental way. The misfortune is that this feeling is very delicate, and quickly fades in contact with evil passions: This is the source that one believes less in Him than in the bodily senses.”

Letter 6, dated May 22, 1868, discloses dSV’s opinion on the comments made in JB’s papers. He writes: “I could assure myself next month, whether your memoir seemed good and important; not that your views would be approved by everyone, which would be difficult because everybody has his own way of looking at the issue, but at least in a way that the continued publication of your research is considered interesting, so that Mr. Liouville is willing to include it in his *Journal*. Without waiting for this judgment, which may not be supported by many (because everyone has his own opinion, and attentive readers of the works of others are few) you could always send new memoirs to Mr. Liouville, by thanking him for having published the first, so that there is some reason to hope that he welcomes further research. However, he may leave in mid-June for Lorraine, where he would stay until after the holidays, and this circumstance often prolongs the printings because, before his departure, he usually classifies the subjects to compose several issues.” It becomes obvious that dSV has wide relations with the French publishers, he knows them mostly due to his visits at the printing houses. JB may thus also profit from this unique circumstance in his future career.

In Letter 8, dated June 13, 1868), dSV sketches to JB the professional future that might lead to the latter’s success, stating: “It is extremely rare for a professor, even one having obtained the title ‘Dr. of sciences’, received from a communal College to a Faculty. If he is in competition with others, who have passed through High Schools, they will have every chance of winning. There is no exception for the ‘Rollin College’ which is by no means a free school as Stanislav College, whose professors are only approved and not selected by the university. Therefore, you should prepare for the aggregation tests, in which your Doctor title will give you a marked advantage; if you want to join a Faculty, first ask for a chair in a High School.

As for me, dear Sir, I only advise you. If you opt for a Faculty chair or apply almost everywhere in order to identify resources of your work and studies in some important scientific center, it is clear that there is nothing better than Paris. Stanislav College will have the same effect, and even more than a city with a Faculty in the province. It is said, moreover, that the teachers are well housed and well paid, so that if the recommendation of the Bishop of Gap is admitted, it is possible that this will support you. I find it hard to believe that you have to feel it, because after a year, for example, for lack of the Faculty chair, you have to take a chair of a Provincial High School. However, if you can use it for your prompt advancement at the university, you’d better ask for a high school, namely Stanislav in Paris.”

JB’s answer to dSV’s comments is expressed in Letter 9, dated July 1, 1868: “Receive my best thanks for the steps you have taken on my behalf at the Ministry of Public Instruction. I was expecting what you have written to me. However, I still have some hope. Mr. Danton, the Director

of Personnel, told me last year during a talk which I had asked for, that with submissions approved by the Institute, I could arrive at a Faculty. In the absence of the Institute's approval, I think that from my publications on light or other subjects, scholars expressed that my request could not be rejected. I know professors, in both the Faculties of Letters or of Sciences, who have been appointed at lower costs. It is true that I am young, and that I have not had, before you, a man who has deigned me; but I will wait for my time with patience."

JB continues: "The reservation I feel in asking for a high school position originates mainly from the fact that I have a small strength, getting quickly tired, and that a large class would stress me much, even more perhaps than I think; while at the small college in Gap, I can manage myself despite the inconvenience for my students. That's why, before I ask for a high school appointment, I'd wait a year and maybe more. However, if a chair at Stanislas College were available to me, I would accept because it seems that there are not many classes, and it seems to me that the environment I would find there would be nice for me. You see that I am asking for a Faculty chair, to have a position that allows me for both, to occupy myself in freedom of hope and to set my path. The aggregation of high schools would not, I think, be entirely difficult. Yet, I would have to prepare for the experimental expertise beforehand, an ungrateful work when you do not have a laboratory. A laboratory is all the more necessary for this preparation since the reason involves a practical test of physics and chemistry. However, if I see next year that my business is not moving forward, I will do my job." Note that JB here plans to work in future not only analytically, but also experimentally, to double-check the results before being published. However, with his mainly analytical background, he would hardly be able to compete with the top experimenters of his era, such as Henry Bazin (1829–1927). Fortunately, the two collaborated from the early 1880s mainly on weir flow, finding outstanding results for curved streamline flow. These results are considered accurate even today.

JB returns to this topic in [Letter 1](#), dated Feb. 3, 1869, writing to dSV: "I gratefully accept the two observations that you offer me, and I would use them for all the submissions that I may publish in the future. Besides, I almost always followed your first advice, which is to return, after several months of rest, on what I composed, before submitting it to print: but my unfortunate spirit is never satisfied. As for the stay, I have so far hardly been able to recall my memories; perhaps, at best, a historical record containing the presentation of previous works and relating to the same subjects, for I have rarely had the original memoirs at my disposal; and I have not dared to venture into a field of which I don't know much about. I hope that in future I will have more elements to fathom your advice to depth, because I also feel that it is important." JB, aged only 27 years, thanks dSV for his excellent comments, and admits his limitations in the knowledge of research results because he simply does not have the chance at Gap to get acquainted with all original writings addressed by dSV.

JB continuous: "Since your kindness allows to warn me, and since you will talk with Mr. Danton again, tell him that, if I still stay at Gap, it is first because of the smallness of my salary, that would perhaps force me to abandon teaching in a high school; that is in order to be better able to complete some scientific work and to have more time to prepare the physical license necessary for the promotion. It seems to me, however, that my publications and my title as a doctor would give me sufficient rights to be called to such a Faculty. How will I, Sir and Dear Master, pay you for all the debts? The helplessness, which I feel to do so, suggests no other than my absolute devotion. I pray and would always pray to God of all good things to acquit me, giving you and your beloved every day his presents."

In [Letter 6](#), dated June 5, 1869, dSV states: "I wrote today a letter to Mr. Danton asking him to have you being appointed as Lecturer at the first opportunity, telling him that I am not the only person who thinks that your real place is higher education, that it would be regretful to make you follow rigorously the most ordinary way of advance, that is to use beforehand your talents,

to avoid a tiring high school class. With your highly conscientious character, one should profit from your expertise as a professor. You should soon acquire, with the scientific reforms offered by an urban Faculty, the rank of associate that will give you one more title to pass the border.” The present authors think that the support of dSV would have been and still is of relevance for many working in the sciences. At the end, only few have the chance of being appointed to a qualified excellent position within the system of higher education. The question remains what would have been the fate of JB without the continuous help and active support of his mentor?

In the Annex to Letter 7, dated June 16, 1869, JB has other news for his colleague: “You must have had the answer from the parish priest of Gap to your letter on marriage plans concerning me. If I had been free, I would have accepted a position, due to your kindness, your exceptional interest that you wish me well, and certainly the most advantageous I can expect. However, my heart is no longer free. Some time ago, on my way, I found a person who became attached to me, and whom I also love. She is of a character, of a spirit and habits that suit me, of a very honorable family, finally in a position quite well but much inferior to that of the young person to whom you must be kind to think for me. I do not find in her disadvantages: although she was married two years to an honorable man and she is without children, she is nevertheless a widow and there is a considerable age difference between us. However, this last drawback does not influence me much. Having unfortunately abused the light, and made my mind too serious before time, I will fear not to suit enough to a young person of the world. I feel that my soul will be better understood by a company matured in tears, raised in the school of work and even that of misfortune. Moreover, it seems to me that with her, completely free of the material worries of housework, I could better devote the most active part of my life to science, to the truth, which has always been, and which will, I hope, be the only issue.” JB here talks of his love, *Jeanne-Constance-Anastasia Giscard de la Roque*, born in 1819 at Mende (Lozère) and passing away in 1894. He continues: “You are, Sir and Dear Benefactor, the first to whom I reveal these things, which one feels, that one should not say. I’d rather tell you everything than just give you pretexts. I recognize the important and delicate process you offered yourself, to make for me all the gratitude and strength of interest that you and Madame de Saint-Venant have given me. So, the memory will be serious in the depths of my heart. I ask Madame de Saint-Venant to accept, as well as you, the feelings of deep gratitude and respectful devotion with which I have the honor of being your humble and obedient servant.” It is in this Letter that JB first also mentions dSV’s wife, thereby aiming not only at a professional relation between the two scientists, but in addition also in a human relationship between the two couples. It is almost certain that this expansion on the human level was proposed by Mrs. Boussinesq, as will be seen also below.

In Letter 9, dated Sept. 10, 1869, JB writes: “Finally, the big deal of my marriage to Madame Van de Velde, née Giscard de la Roque, will be performed next week, Wednesday or Thursday. One of my letters had made you aware of my friendship for this person and the pros and cons of our union. I hope that this marriage will offer for her and for me the elements of a solid happiness, accommodated to our tastes and our minds, as stable as are the good things of this world. The bright, outer side, which has never deduced me, is missing alone, not because of the fortune of my future, which, however small, is equivalent to good ease for us, but because of her age, significantly greater than mine. Alas [Sic.: Oh, I see], I believe that I am actually as old as she is, yet without being as old as she is. Moreover, this difference may be, in some respects, very real, an advantage because, leaving you little hope for the posterity, it will protect me from embarrassment and worries entrained by paternity, and will allow me to devote all my care to the study of truth, for which I feel a true vocation.” The letter continues as: “Since Madame de Saint-Venant is good enough to be interested in me, I ask you to convey my marriage plans to her and to join her so that God may have for a long time the one I love, and separates us, if possible, only at the end of our long pilgrimage, when it is so painful to feel alone. We will ask Him, in

turn, to give you both long and serene days, full of fruit for heaven. If you had to write to me, for comments on my paper on liquid waves or other subjects, please be kind enough to send your letters to Father Giscard de la Roque, referent in letters, Place St. Arnoux, Gap. This gentleman is going to be my father in law. He and his sister constitute the whole family which I'm going to get into."

Letter 10, dated Sept. 22, 1869, gives impressions of dSV to JB relating to his marriage as follows: "I didn't forget you in my morning prayer last Wednesday. I hope that God will have blessed you as well as your union contracted by Christians and great motives in a family that unites intelligence with piety and good traditions; no doubt Madame Boussinesq and her brother have found in you a religious man no less than a scholar. Such a union gives tranquility and support at the same time as contentment to the heart and provides relief in the work, which retains all its ardor, and to which a possible increase of family does not harm. I hope that your ardent study of the truth will, without confining you, as done unfortunately by so many scholars in a specialty by rejecting everything else, produce in you not an isolated satisfaction that will be a kind of selfishness, but rather fruits which others will benefit from. Nobility of intelligence and heart obliges as much and more than any other gentility. Especially in times like ours, when the best gifted minds are perhaps these who make most mistakes, as in selfishness where they are and where they persist in performing the highest and most essential truths, so that it appears as a duty for them to whom God disputed their feelings and love not to leave them under the bushel. Your main occupation, other than that of the homework of your teaching, will be, I imagine, the mathematical (or physical-mathematical) research, which you have started so well and whose publication will provide you, in addition to an improvement in position, the right to better be listened-to when you talk about truths of another order. Moreover, on the confinements of mathematics and philosophy, are there not many mysteries, or aren't our attempts to penetrate, or to bring out impenetrable mysteries here on earth, trials to give more evidence of the need to admit, elsewhere, mysterious things? Thus, from elementary geometry, and even from arithmetics (for example in periodic fractions and in usable moments), infinity makes it inevitable despite all the artifices in the ancient and modern times have made use to try to evade it. It is not the true infinity, but it is in what reminds me that we can hardly name otherwise. So, there is mystery in mathematics, and if I had long years to live and less occupation, I think I would make some publication under this title. But you can do better. I take, you probably find it, singularly my moment to make you keep to the imaginations and my dreams!"

"I understand that you don't have to leave Gap yet. If, as I hope, you go from here to take time in an urban Faculty, and if the Abbé de Roque is a professor at the College, it would probably be easy to get his change at the same time, in case he wishes not to leave you. Present him, I beg you, as well as Mrs. Boussinesq, my respectful tributes and the compliments of Madame de St. Venant and note for you the new expression of my very affectionate feelings, dSV." From the present time, these words of dSV are difficult to understand, it is another language by which he wished his colleague all the best for the future. Note that it was already mentioned previously that dSV was a kind of mental father, even grandfather to JB, who enjoyed the professional successes of his scholar, as well as the bright future secured by a wife who was mainly supporting her young husband.

In Letter 11, dated October 6, 1869, Mrs. Boussinesq wrote to dSV the words: "Allow me to join my husband in expressing my gratitude for all the kindness and encouragement you have given him for so long. If he is happy to have met such a master and such a friend, I dare to say that his devotion to you, Sir, is very great. I share it with happiness and I would like a circumstance to allow us to meet you and Madame de Saint-Venant, to whom I beg you to offer my respectful compliments. We will not forget you in our prayers, and we will ask the Lord to also repeat his blessings on your children. My brother instructs me to offer you and Madame respectful tributes.

Please accept the assurance of distinguished and grateful consideration with which I am happy to say to myself, Sir, Your all devoted

C. Boussinesq born Giscard de la Roque.”

It was indeed Catherine Boussinesq who started the social connection with the family of dSV. She was certainly overwhelmed by the professional exchanges between the two colleagues, but as a woman she was also interested in getting the other family known. The wife of dSV was equally interested in the background of JB and his wife, so that she also supported the plan to meet JB and his wife, as will be described below.

In Letter 16, dated Dec. 12, 1869, JB has the following surprise: “My wife had the happy idea, which I fully support, to send you for Christmas the only things, special to our mountains that we can offer you, that is, two regional breads and twelve alpine sausages. We will be happy to see a remembrance of you and your family on Christmas Day. This gift left tonight Grenoble in a basket, and will arrive, I think, in Vendome almost at the same time as this letter, if not earlier. If there is a train station closer to St. Ouen than Vendome, that’s where you find it. We hope that this small shipment, due to our gratitude, will be pleasant to you and to Madame de Saint-Venant.”

The answer of dSV to Mrs. Boussinesq reads as follows in Letter 18, dated Dec. 20, 1869: “We are very touched, Mrs. de St. Venant and I, to the kind of attention that you have exercised to contribute in this way to the amenity and cheerfulness of our family and friendly meeting of the New Year. The charming products of your mountains were admired by connoisseurs before being tasted. However, what we were learning above all is the graceful place that you give in your thinking to me and I have done only my duty in what the interior conscience commanded to me, in the small surrounding of my power, to assert the remarkable work of Mr. Boussinesq, and to encourage him in the noble path which he has chosen and where I am convinced that he will move forward more and more without ever saying that it is enough. And, let me, Madam, congratulate him on having in you a careful and prudent collaborator who will ensure that health never suffers from his labor. Please present him, Madam, my compliments and those of Madame de St. Venant by accepting those whom she also asks you to accept with the expression of my most respectful feelings, C^{de} de St. Venant.” It is noted here that the relation between the two scientists was much more than of purely professional background. It was certainly the idea of Mrs. Boussinesq to present dSV and his family a special gift for the Christmas dinner. The answer of dSV is charming and thankful, and the reader may feel the warmth of thinking for a common future. Note also that dSV in this letter uses the abridged form of his first name ‘Claude’, which he never did in any of the other letters.

2.2. *Professional career of JB*

In Letter 3, dated Feb. 16, 1870, dSV asks JB to write a letter to the Minister of Education: “The Report on your Memoir, which has been with Mr. Delauney for a long time, was finally returned to me, and I intend to read it on Monday, 21. When he took it last night to Mr. Jamin, another Commissioner, he told me: Are you saying good things about Mr. Boussinesq? Yes - then I sign the two manuscripts without reading: if you say evil it would be different; for a long time I put aside his writings, which I noticed, in order to study them well when I had the time. He added: «Write to him to make to the Minister a request to become Lecturer in a Faculty; that he includes, with the title and date of these writings, a few copies, especially one (if he has kept one) of your Report from last year. Send him all this, or give it to me, I will do it, and will inform Dumesnil (the head of higher education who, in the new organization, replaces Mr. Danton).» I think you’ve already made such a request. So, would you like to make a new request, or just send me a copy of the one you made previously?” The above demonstrates again the immense support of dSV for

his colleague JB to bring him into a better professional position, where he could really work in science, as compared to the position at Gap, where he was mainly teaching at a gymnasium. Let's see how the story continues, once dSV has used all his possibilities with the French Ministry of Education.

In Letter 4, dated April 7, 1870, dSV writes to Mrs. Boussinesq as follows: "What you are telling me about Mr. Boussinesq's health is very distressing to me, although there are many examples of similar diseases in the country, in which I live at the moment that are not serious. My wishes, and also my prayers, are for his fast recovery. When his health returns, he will probably not be able to avoid completing his teaching year in Gap until the holidays. Yet, will you, Madam, tell him that he will do well to rest, and to postpone work to another time, when his conditions will be less severe, so the execution of scientific ideas that have come to him or that will come to him again. It is useless for the good that we want to achieve, that he seeks to increase during some time the number of his titles as a scholar; they are already numerous enough to entitle him for a position as Lecturer of a Faculty, especially since his latest work, which he will publish, will honor him; and I think, it's already, simply, a matter of possibility and vacancy to place him."

"However, it seems to me that it would be as durable if he did not resume his course at the Gap College again next year that would be so difficult to combine without fatigue with his mathematical research. I would therefore like to ask you, Madam, whether, in the event that he could not give a Faculty course, he would be willing to take a leave or be available with half the Faculty's duty. If, however, I do not know, what is done in the University to professors whose health needs rest, or who require to carry out the continuation of scientific research that has been conducted? Would you, Madam, if you like, ask Mr. Boussinesq this when he feels better. So, during my stay in Paris, which will take place from the 22nd to 30th, I would try to get it. Madam, please agree with the compliments of Mrs. de St. Venant sensitive to your memory, the expression of my feelings of respectful devotion, dSV." These words from dSV to the wife of JB clearly express that dSV searched for any means to advance the position of JB, even by the help of his wife. Despite the position of dSV in France, things were not so easy, as may be noted from the letters below.

In Letter 5, dated May 8, 1870, dSV again writes to Mrs. Boussinesq as follows: "I was able to talk a lot about Mr. Boussinesq during my nine-day trip to Paris. Please be hopeful, but also patient. There are only 17 or 18 chairs of mathematics in the faculties, so vacancies are rare. The division of secondary education tends to promote special teachers with long and distinguished services, paired with fine work, and the Division of Higher Education is quite extensive and sometimes hesitates to accept them, although Mr. Dumesnil, its leader, is an intelligent man with broad views, who, in no way wants to look at these pulpits as retreats and who is willing to appoint in the future a young man of brilliant evidence. The few words I have tried to say about Mr. Boussinesq's health are that the annoyances of ungrateful service can contribute to altering (as your letter marked) and have not succeeded at all. I was forced to add that Mr. Boussinesq had had a serious illness like so many others this winter, but that he maintained all the appearance of a well-made man, fit to do good service. We appreciate the strength, especially now that (owing to the departure of Mr. Dumesnil) the university will have to support the letter in favor of free education; and we also appreciate the willingness despite of our disgust of the above service that one would have been able."

"I found a young friend of my family in the Ministry (Mr. de Resbecq, head of primary education, was his father, a close friend of Mr. Dumesnil). He promised to remind him several times of your request, and he advised me to send to the Department the letter of which I am sending you a copy, signed as you see, by a number of academicians. This letter, in which much is said of Mr. Boussinesq, shows how I think; it must certainly give you hope, but whether without generating in you an impatience that would be a torment, I am sure you will not indulge in it, nor

will it in any way alter his modesty. The true scholars are indeed like the saints: after intensive work they always convince themselves that they have done nothing yet, and seek with calm adoration something that satisfies them even more, but as much as the madness and time allow. It should not be concealed as the mathematics of a certain elevation, for in France few readers, I doubt even that Mr. Boussinesq's memoirs had so far had someone other than me, who read only a small part of it. I do not know when Jamin will take the time to read and study what is related to light, or whether he will report something he calls discovery. Let us hope that in Germany it will be studied carefully and that soon it will be mentioned. Take perseverance and patience."

"I have before me the letter of the late Mr. Danton, dated June 16, 1869, saying, «In the very interest of his candidacy, Mr. Boussinesq must have aimed at the aggregation. As soon as he was promoted to the title of associate professor, and had produced real and accepted results, he will always be accompanied by many evidences and difficulties. However, with perseverance and the sacred fire of zeal, one always ends up by overcoming them». One essential thing that I forgot and which proves Mr. Dumesnil's good disposition is that he tells me to advise you to renew your application often. In this way you will be thought of when the opportunities arise. This should be done at the time of the holidays, as a work of mutation. This is what I learned in the Paris offices. I was hoping for better news, but I still hope."

"P.S. Would Mr. Boussinesq know any faculty professor, willing to rest and well-off to have a substitute? Substitute, it's better than lecturer and it's a good way to get a foothold. I will try to get Mr. de Resbecq to write me the opportunities. One reason that still makes me desire that Mr. Boussinesq has the aggregation, that is to say first, he is licensed in physics as a mathematician, i.e., that his work is mathematical physics. Yet, that he thinks over his time and his strengths, that he avoids the chances of failure which perhaps harmed him, that he sees this, so as not to give up his researches, which it appears to me, that he still has beautiful programs. Please Madam, kiss him for me, tell him to take good care of himself, and give me news." Again, as previously, the words of dSV to Catherine Boussinesq are these of a close friend, almost as these of a family member. dSV thus not only was attached to JB, but also to his wife, and he sought to improve the conditions of JB by supporting also his wife.

In Letter 6, dated May 2, 1870, dSV sends a note to the French Minister of Instruction, reading: "Minister, among the scholars who present their work to the Academy, I, like a number of my colleagues, have had the opportunity to keep Mr. Boussinesq, Dr. of Sciences, currently professor of mathematics at the Community College of Gap, a modest position that so far he has desired to keep preferably to a better of secondary education, to have more time for zealous scientific research. The already numerous list of his works until last March (and there have been some remarkable articles since) is attached to the request he then had the honor of addressing Your Excellency to be in charge of a mathematics course in a Faculty. Those of his memoirs by which a report was made received the high approval of the Academy which proposed its insertion to the *Savants Etrangers* [Sic.: Its memoirs were at the time considered among the top French publications, issued irregularly, but used previously by most of the great French mathematicians and physicists]. The other papers published are by no means inferior to them by the spirit of initiative, to the depth combined with analytical skill. Others were started and it would be desirable if he could soon produce them."

"Mr. Boussinesq is young, but his character, highly moral and conscientious, is of an early maturity. I was told that his teaching was persistently lucid, even attractive, so that it would seem clear by all reports, to render services to the higher courses that seem to be his true destination. To get there by the long and tiring way of high school classes, would, in my conviction, be a detriment of science. I have regarded it as my duty, Minister, to call on the attention of His Excellency, and to submit these documents to an informal assessment. I have the honor of being with a high and respectful consideration, dSV."

To support this initiative, dSV added short comments and the signatures of several well-known colleagues of the *Académie*.

In the Letter 19 dated September 1, 1870, dSV announces the start of the Franco-Prussian War. His family was particularly hit by the war actions, whereas JB and his wife offered his family to come to Gap in the Savoy Alps, where these actions were hardly felt. However, dSV preferred to stay at his home, caring for his family and waiting there for the end of the war. During the following months, mainly topics in periodic waves, in elasticity, and in unsteady waves were discussed, not within the contents of this paper. In early 1871, JB makes another invitation to the dSV family, yet without success. At the end of Letter 1, dated January 23, 1871, JB states: “My wife joins me in presenting to Madame de St. Venant the deepest respect. As for you, I would repeat over and over again that you also have our most affectionate and dedicated gratitude. One of the blessings, of which I thank God most every day, is to have given me in you a master whom I can take as a model both as a scholar, as a man and as a Christian. Also I find it evident to simply call me your very humble disciple, JB.

PS. I wish that this letter would reach you. Hoping that Vendome would soon be cleared, I would postpone from one day to the next to write to you; finally I can no longer wait and I send you two copies of this letter in two different ways, so that at least one arrives at your home.”

Letter 9, written by JB on May 19, 1871, deals with hydraulics and the Shallow Water Equations first, but then ends with a completely different topic, stating: “My wife would very much like me to be introduced to the Geometry Section [Sic.: of the *Académie*], not, I admit, because of the honor we might find there, but because she thinks that this presentation could more than any other recommendation, draw the officials who govern us from their torpor towards me, and make me place in a Faculty. She finds that both class work and my personal studies tire me more and more. I know that the share for everyone is unfortunately small in this world, and I take patience, although I admit, I feel devoid of the necessary qualities and in particular of this hope of firmness, which one must have to lead a class without having too much to consume.”

The answer of dSV on this proposal is contained in Letter 13, dated June 23, 1871. It reads: “Dear Sir, I have just made a four-day trip to Paris. And it was timely for your future. Indeed, the Geometry Section had a first meeting on Monday 19th. I have given these gentlemen the analysis of your titles (so the copies will be drawn from you and distributed to the members of the Academy).”

“Here’s what an hour later Chasles came to tell me: Mr. Boussinesq is worthy, but to put him on the list of presentation would be as difficult as making $(-1)^{1/2}$ a real quantity. Indeed, he has a position in the provinces, and an academician must reside in Paris. It is because of this that we do not carry Father Aoust [Sic.: Barthélémy Aoust 1814–1885, French mathematician], professor at the Faculty of Marseille, nor Mr. Emile Mathieu, professor at that of Dijon. If you had no retirement parity and no office you would not have been elected.”

“Combes, who was next to me, didn’t think so. The Section, he told me, will not go back on its end for non-receiving, its work is wrong and it will not change it. But, propose to attach Mr. Boussinesq to the list, away from the committee; I believe it will be held on Monday, July 3, and I would support you. A commercial college chair in the Alps does not count as a position, rather an attachment. He is not an elected academic who does not recognize it, by a request for availability or leave that he was not denied, or by a resignation if he was denied against all odds.”

“Poncelet was in a similar condition. He was captain of engineering and a professor at the Metz School of Application. At the end of the non-receiving and the ill-will that was opposed to him, he responded by making a commitment to renounce his chair and to come and reside in Paris, where, in fact, the Minister immediately called him to sit at the limit of the fortifications and where he had other duties.”

“Well, dear sir, just do the same. This is safe because, apart from the fact that a member of the Institute would certainly find in Paris, in a faculty of free school, or in lessons and questions, enough to more than compensation for what your current chair is worth; your current promise is not to want to hire another candidate, or you would have another position. And, this time, it is quite certain that it will be Puiseux [Sic.: Victor Alexandre Puiseux 1820–1883, French mathematician], who will pass almost unanimously; so your name only needs to be carried on the list in order to make you first rank; this will facilitate your requests for a chair in a Faculty. And Combes tells me that in any case this circumstance will call attention on you.”

“Do you want, if it suits you, to send me (on a simple paper in 4° and not on paper ‘type minister’) a letter of about this content, which I see from your letter: To Mr. President of the Academy of Sciences, I learn that the chair I hold in a provincial town could be an impediment to what I am proposing for the currently vacant place in the Section of Geometry. Please tell the Academy that if it did me the honor of electing myself, I pledge to relinquish this chair and will come and reside in Paris.”

“Becquerel Jr., whom I had seen yesterday morning, and who is quite familiar with the practices, thinks that your automatic registration will suffer no difficulty, despite of what a member of the Section may say: what if we also took candidates in the provinces, there we would have a dozen more to add to the list. However, if, despite what I intend to say about the Parisian documentation, that we no longer want at all, I would not refuse to have you added. The current or next goal to achieve for you will not be missed. My three academic echoes of 1843, 1847, and 1864 were always followed by compensation.”

In the annex of Letter 17, dated July 5, 1871, dSV makes the following note: “I have not been able to get your name included on the Geometry list. They only want pure Geometers such as Mannheim, Darboux, Bouquet, etc., since these are no longer elected in mechanics, physics or astronomy. I have time today to talk to you about that. Do not be discouraged and always walk in the way of Euler, Daniel Bernoulli, Fish, Navier, and Lamé, because it is the best and the one that best suits your sagacity. You will find difficulties in your scientific career but they will be over one evening. Above all, produce in a positive and clear fashion. We’ll talk about it. There are other Sections, and besides, the current members of the Geometry Section will not live forever, and the spirit of this Section may change.” These words of dSV demonstrate again the eagerness with which he tries to bring JB to a better professional position. He tries all ways which he has experienced in the past, being now for more than three years president of the Mechanics Section.

In Letter 24, dated August 6, 1871, JB writes to dSV: “Sir and dear Master, I would not have waited until this day to thank you for your gracious invitation, if I had not been absorbed this week by the correction of the general works of the college, e.g., the examination of eligibility to the School of Arts and Crafts in Aix, and the patent of capacity, elementary or higher, which were presented this year, in the Hautes-Alpes, to seventy female aspirants and about thirty male aspirants. Finally, I am all the more free since I no longer have a class in the college, until the end of the school year. The holidays are given after tomorrow, Tuesday, the day of the school year is October 9, and I hastened to take the opportunity to tell you that I will come happily to Vendome, or will finally be able to see you and hear you, which I have desired more than once. I also do not refuse your offer to use your room in Paris, if that is useful, from Vendome, I will go there. I only wanted to go first to spend the second half of August in *Saint-André de Sangonis* [Sic.: the hometown of JB close to Montpellier], where I would take, in the clear waters of the *Hérault* River, baths that have always done me great enjoyment, and which would be especially necessary this year because of more frequent and sometimes rather disturbing nose bleedings.”

“Hemorrhages are the cause that Madame Boussinesq does not want to leave me alone, especially on the great journeys from Vendome and from Paris. Although, for my part, I do not want to separate myself from her, the fear of causing you too much embarrassment had made

me arrive alone at your house, without kindness that you would have also of the guest. She will be so happy to see you and Madame de Saint-Venant and your daughters! We will leave for *St. André* on Tuesday or Wednesday, August 9th. We will not arrive until Saturday, because we will spend two days in Montpellier at the home of my uncle (Mr. Cavalier) parish priest of *St. Eulalie*. We intend to go in September to see the parents of my wife, whom I do not know yet. However, it is likely that we will give up doing these two trips this year.” It is also in this letter that JB tries to inform dSV in all details, including the holidays to be spent in Southern France.

In Letter 28, dated August 17, 1871, JB announced the latest news on the trip to be made to Vendome, stating: “We hope to leave for Vendome towards the end of August. My father is in the mountains right now, fifty kilometers away. Yet, in turn, I will share with him the feelings you wish to express to him, and I am sure that he will be infinitely thankful.” The Boussinesqs indeed arrived by the end of August in Vendome, meeting for the first time the dSVs, and certainly had both private and scientific chats. dSV in Letter 30, dated Sept. 30, 1871, shortly comes back on this particular occasion with the words: “I hope, dear Sir, that your trip went well all according to your wishes. Moreover, Mrs. Boussinesq should be asked that I offer her my respects and those of my daughters, with the compliments of their mother as well as their aunt, my sister, who asks me if you could give her also your photograph.” In turn, JB sends his greetings in Letter 32, dated October 4, 1871, as: “Our travels ended without accident. We have cancelled two of the visits we had wished to make in the *Lozère* Region. It was too much for us to have to devote the proper time to them. Thank you for your excellent hospitality. I ask you to offer our respects and those of my wife to Madame de St. Venant and Madame des Mazure. I have fond memories of your children. I would like to send away this letter tonight, so that I have to finish now. Yours entirely devoted J. Boussinesq.”

In Letter 36, dated Nov. 6, 1871, JB returns again to this topic: “We often talk about the excellent hospitality you gave us during the holidays. Mr. James asked me these days again for news about you and your family. We both concluded by saying that from now on, humanity would almost be in a state of glory and happiness that we expect after this life, and it consisted so only of families like yours. This poor and excellent priest? He is not at Gap in this moment. A disease that is already old but which has unfortunately increased in severity, forced him two days ago to leave for Lyon, where he will find doctors more capable than in Gap; it looks like he has the gravel [Sic.: *Gravelle* in French; *Harngries* in German], perhaps further complicated by another disease. Sometimes I’m afraid we’ll lose him! Pray to God with us to keep him for us, JB.”

“We always say, when we have no news of *Villeporcher* [Sic.: the location of dSV’s castle in the community of Vendome], that the excellent health in which we found you all has not been altered. I hope, however, that the lack of news is due only to your overly absorbing work. Besides, I have no complaints to make about you because I already occupy you too much, and I myself, was not assiduous to write you these days. Please offer to Madame de Saint-Venant and Madame des Mazure my very humble respects and to your children our fond memories.”

In Letter 38, dated Nov. 13, 1871, dSV makes the following statements: “Dear Sir, we are very sensitive, Mrs. de St. Venant and me and our children, to your favorable letter and to the memory that Mrs. Boussinesq wishes to keep of us and which she feels also for us. We would like to deserve, for this world and for heaven, your positive opinion, in the conception of which the heart influences the judgment. However, I find that today, in general, the good ones are rather imperfect, and only beautiful far from what they should be after so many grave warnings from God, who seems, by the punishments and humiliations that continue, to address even more reproachfully the believers, the self-righteous, the unbelievers, and the nerving persons in error. And I am far from excepting the number of those for whom there is still a long way to go to be effectively building the indifferent and contributing the moral regeneration of poor France, even in its small surroundings.”

“And I would like, among other things, to have a less distracted mind and to faster complete the analysis of your work and the comparison of the devastating ways of dealing with light. I hope to reach a good point soon and to be able to support the proposal that I have promised to make of your inclusion on the list of candidates. I will write to my colleagues in the Section that I would not be available for list-making with them until January, since during the month of December, I will be busy with the marriage of my eldest son in *Saintonge*. You see that I don't have to complain too much about the plagues of heaven. We are all no less pleased than he is with this marriage to the sister of a sister-in-law of his battalion leader [Sic.: of the Department of] *Loir et Cher*. What is known of him in this part of the family, and what was said to Miss de St. Legier (who had seen him only once) of his uninterrupted practice of his religious obligations since childhood, and also of the ‘color of his flag’, that determined her and her father to accept it. He's been in their castle for 15 days, and will come back for preparations. However, we don't tell anyone yet, because the contract is not signed.”

“Going back to the Institute, I think Tresca [Sic.: Henri Tresca 1814–1885, French mechanical engineer] will be put on the front line of the list, and alone, because an *ex-aequo* [Sic.: equally placed] suggestion on the front line is a bad thing. I would like you to be put on the second line with Résal [Sic.: Aimé Henry Résal 1828–1896, French mining engineer]. Then, in 3rd grade, Bresse, Rolland, Mr. Reech, etc. However, I would finish if we only want to have him in the second row and none in the third. The only case where I might be forced to agree with you being in the third grade would be the case in which you want to put only one candidate in the second line, and I would be careful to emphasize, both in the Section and at the Academy, that your work deserves better, and that if I did not insist that you were even in the first place, it is because they are still little known.”

“Yet, don't anticipate. I'll let you know. I do not want you to have to do that because it is about getting on the list. Besides, it is not that I wish for you soon, to be admitted. I wish rather you were at a Faculty of the South, with the title of Correspondent, until you were unanimously called to Paris. And I would especially not like to see, to a certain extent, this kind of honor that you leave, after being appointed by a Faculty. That's where I'll see you really useful, and here too, I'll see you completely safe. Yours dSV.” At this point it should be noted that dSV stayed at the chair of Agricultural Engineering, Versailles, only for two years, leaving 57 years old, to become private scientist after having bought the castle at St. Ouen, Vendome. His souvenirs of Versailles appear not having been the best, so that he warned JB of the dangers to be confronted at an academic position.

dSV wrote Letter 39, dated Dec. 26, 1871, on Christmas, reviewing the past year as: “It is not, as I told you, to have you appointed to the Institute now, which would not be possible regardless of your titles, but only to have you placed in a good position on the list, to which can be added a candidate who, I believe, has good chances, namely Colonel Martin de Brettes [Sic.: Jean-Baptiste Martin de Brettes 1813–188?, ballistic engineer], representative of the new artillery.”

“Hello dear Sir, happy new year, patience and courage. I wish you success, because I think you are not one of those whose successes arrive and quickly die-off. I wish you were appreciated, but not spoiled. As for me, I do not know what I would have become if I had had successes of good hate, perhaps I would have stayed there, with persistent failures, setbacks, disappointments, even humiliations, that give me attention, courage. Whom would I have become, above all, if early, as was my wish, after having asked myself scientifically I had managed to be one of the defenders of religion by science? Perhaps my pride had been at its height, that I would be more infallible than the Pope, and that I would have finished, like Montalembert [Sic.: Charles-Forbes-René, Count de Montalembert 1810–1870, French historian and politician], with blasphemy in my mouth. Fortunately, God has been good to save me from it. My respectful tributes and my good wishes for a happy new year to Madame Boussinesq, Yours dSV.” This letter contains rare words of dSV on

his views on professional and religious feelings. He would have hardly exposed these to anybody, except JB, who was his close associate.

Letter 10, dated February 16, 1872, has news that were astonishing for JB; they read: “I don’t need to tell you how pleased we were with the four little words of your mail. Oh, thank you a thousand times. I could never have hoped for any honor, and although I have been getting used to the idea of being on such a presentation list for the past year, I may still be surprised. After God, I owe you this honor, and I will not forget it. Besides, I try (and I think I will entirely succeed) not to attach much importance to all that shines in this world. Alas!”

“If I knew that ‘to send Notices’ must have won me a few votes, at least in a first round of voting, I would not complain, although I have only a dozen or fifteen left on top of those which I will need at the next election, to distribute one to each Member of the Academy. For about three weeks, I have sent some to Mr. Dupin, Phillips, Morin, Sauret, Bertrand, Pâris, Hervé Mangon, Lacaze-Duthiers, Belgrand, Guiseux, Faye, Balard, Levchniery, and perhaps also to Bonnet and a few others. All of them had to receive one from Gauthier-Villars about a year ago.”

This discussion on membership in the Academy of Sciences, Paris, continues in Letter 11, dated March 3, 1872, as: “I’m sending you a copy of my letter of February 28th to Mr. Leverrier, Mr. Faye, Mr. Balard. I thought you would not disapprove that action. Perhaps it will make it a little easier for you to do the ungrateful task you have been willing to take on. It was in this hope that I did it. You will see the main reason why I would be a little pressured to use my position, not from a financial point of view, but from the point of view of my health, which, apparently very strong, has become delicate. However, there is another reason which I have not detailed to these gentlemen, and which would make me (at least provisionally) desire to arrive at a higher education chain as early as Easter. It is that the Academy will necessarily take care of me a little, and recommend me warmly to the Minister, by the very fact of the presentation. A few months later, the men quickly forget, especially in Paris, the advantageous results that I could derive from it might be much less. On the other hand, the financial situation of the Minister of Public Instruction will probably not be better in November than it is now, and I am concerned that all my steps will be more difficult than in a month’s time.”

“If Mr. Dumesnil can find for me, in any capacity, a salary of 2000 francs in October, it seems to me that he could do so now. I would be content with that. What I would most likely to do is to have some kind of appointment without waiting until October. Between now and then, I can be completely forgotten by departmental employees, if they are still there themselves. Thank you for saying me that I could be granted the right to be substituted for Gap. So with 2000 francs from the Ministry and four or five hundred francs that could bring me the title of professor at Gap, my wife and I could live in Paris. There, I could monitor a little better this chair of mechanics of Toulouse which can soon go away (if it is not even declared vacant next year), and which will become my goal, since I see that it will be impossible for Mr. Dumesnil to go away to settle in a somewhat stable manner in Paris, unless it was animated by a great goodwill. Could you not see, when you speak to Mr. Faye again, what he was telling you about this place in Toulouse? Yet, we should not, as you say, exhaust his favorable disposition.”

“Thank you for your letter to the Principal, which I will present to him tomorrow or the day after, by asking him for a fortnight’s leave, and which I believe will address on this side all the difficulties that might have arisen. With regard to a substitute, I decided to write to Mr. Roche, a professor at the Faculty of Science in Montpellier, who is interested, whether he would not know a young man, a bachelor of science, who consented for 1200 francs to beg me during four months or for a year to a year and a half, or to Mr. Valson of Grenoble [Sic.: Claude-Alphonse Valson 1826–1901, French mathematician], or Aoust of Marseille [Sic.: see above]. I am sure that many science graduates would be delighted to accept such a position under these conditions, which they could then become holders of. Did I not have any more than 1200 francs of salary only in 1864 and

1865 at Vigan, where life was more expensive than it was in Gap? And, however, I am licensed in mathematics since 1861. I'm the only graduate of Gap College. There is not a single licensee, not even in history."

"Yet, I would only like to write to Mr. Roche when I have a serious hope of staying in Paris until August. It is useless to have a substitute if I have to stay only a fortnight in Paris, and I will not talk to the Principal before my trip to Paris to be pretty sure to stay there until that time, because in this case, it would be pointless to tell him, perhaps even harmful. It would be difficult for me to supervise a substitute at Gap. The other teachers couldn't take care of my class, which must be done at the same times as theirs. On the other hand, I do not believe that there was an engineer of the Bridges and Roads Corps who is capable of preparing students for the Bachelor of Science and teaching (even to students of letters only) physics, chemistry, cosmography, etc. Moreover, the Principal and the Inspector would not easily accept such a substitute. We have no artillery or civil engineering in Gap. Finally, my alumni, who have become strong in science, are either doctors, students, or engineers graduated from the Central School, or located in commerce. So, I would need to bring-in a substitute from outside, but I'm sure he would come, if it were only for a year."

"I hope that Misters Faye, Leverrier, Balard, and Henri Sainte Claire-Deville will be of good help to us. Can the state, however poor, not spend some money to encourage the study of science, which has caused part of Prussia's superiority? Is the medal that Mr. Haton told us about, is it not accompanied by some money, and could it not, if I get it, also be used to wait for the Department's financiers? Take care of your health and please accept, with the feelings of deep gratitude of Mrs. Boussinesq, those of Your devoted disciple, JB." At this stage, JB analyzed all possible scenarios to be removed from Gap to a better position, suiting mainly to advance his researches. Will he finally succeed?

In Letter 12, dated February 28, 1872, written to the Inspector General, JB details his impressions based on the exchanges with dSV, as: "Mr. Inspector General, I have learned from Mr. de Saint-Venant that you are interested in me, and that you were intending to ask the Minister of Public Instruction, either my change in a Faculty of Science or the creation, at the *Collège de France* or at *Salle Gerson*, of a course dedicated to the exhibition of the results of my personal research. I feel the need to thank you for this interest which honors me, and which is a precious compensation for the pain and fatigue which I have experienced in my studies, repeatedly interspersed with painful classes. I have indeed asked to be placed in higher education, it is not so much to change against the modest position I have held since 1865 at the College of Gap, but to have the opportunity to continue my research without destroying my health. I am charged here with scientific teaching of the classes, from Latin to philosophy inclusively, and sometimes also (this year in particular), and without any increase in salary, of all the preparations for the Bachelors of Science. Having never been able to get a leave for the studies of mathematical physics for which I feel an irresistible vocation, I had to bring together these two kinds of absorbing occupations, and I feel that my health would no longer withstand such an overwork. I would therefore ask you to get me, if possible, a leave with some salary, from Easter to the end of the school year. I would spend those four months preparing my course next year, and writing a rather considerable memoir that I have to do on water flow [Sic.: JB addresses here his 1877 Memoir on Water flow]. In the event that it is not easy to get this leave, could I not be allowed to offer the course I am going to start at the beginning of the school year as early as April? I feel that the preparation of this course makes me less tired than the work at the College."

dSV thinks that it will be extremely difficult to accept the plans expressed in the above letter, given the combined problems with the courses at Gap, the financial effort and the unknown value of JB's promises relative to the scientific advances proposed. In Letter 15, dated April 6, 1872, JB

tells about his stay in Paris as follows: “Since Wednesday night, I am in Paris with my wife, and I could not find a moment to write as the activities took my time. People are well devoted towards me. On Thursday, at the Sorbonne, where the Learned Societies are chaired by the Minister, I had a triumph far greater than I could have hoped for which, I believe, is the only entry to the Institute. The next day I saw Mr. Faye, Mr. Sainte-Clair Deville, Mr. Leverrier, Mr. Balard, Mr. Quet (Inspector General of Secondary Education), and finally Mr. Jules Simon himself, who granted me on the spot a leave of absence (of an open Faculty position that he promised once the first place would be vacant); this allows me to stay in Paris and cultivate my application with a salary equal to that I have at Gap. I think this is a minimum that will be exceeded. Mr. Balard and Quet, especially, gave me hope. Everyone welcomed me with the utmost eagerness and showed a desire to be useful to me. This is what I owe you, for it is you, and you alone, who has prepared the ground.”

“I will go to the Philomathic Society, and on Monday I’m going to the Academy of Sciences. I regret that I have not yet been able to visit Mr. Morin and the other members of the Mechanical Section. Tomorrow, I may be able to see them, and I am ready to visit Mr. Haton de la Goupillièrre from that moment on, to thank him for his supporting intervention on my behalf. I stood today in the Department to see Mr. Dumesnil, who was not available there because he was summoned to the Minister’s house with other members of the Higher Education Commission for a topic related to this teaching. I think I will take care of it a little bit. I judge it by a few words that Mr. Leverrier said to me yesterday. I have seen Mr. Graziani, who has been very good to me and will do everything he can; he told me, to support me. Perhaps this time you will have succeeded with God’s help, to bring my little boat afloat.”

“Meanwhile, my wife took care of looking for accommodation, and she finally found two good little, well-exposed rooms in Hotel Denmark, at Rue Vavin, near the Luxembourg Garden and Rue d’Assas, plus a kitchen where air and light are not lacking, all furnished, for 40 francs per month. On this account, we will not bring our furniture from Gap, where it is packed and, ready to go, and we hope to stay there until the election in Mechanics that will soon take place. Then we will go to St. André (Hérault), where we will stay until some place is provided in the Faculty. Mr. Quet, Inspector General of Secondary Education, and Mr. Balard, assured me that a place would be found by then. I can’t wait to be settled down to get to work every morning. In the evening, I will make this long series of visits that will have to be made for the next presentation. Mr. Faye gives me hope and assures me that the results of the last election could have been different from what they were, if a few more words had been passed. Mr. Sainte-Claire Deville asked me to go to see him tomorrow Sunday and that he would have plenty of time to talk about my affairs and my hopes. He promised to push Mr. Dumesnil persistently.”

“Thank you for the letters you sent me to give me access to the libraries of the Institute and the Bridges and Roads. I haven’t used it yet, but I’ll have time to use it next week. Let me finish here my hastily done doodle. I want this letter to be available to you tomorrow, and I would also like to see Mr. Haton tonight. My respectful tributes to Madame de St. Venant and your whole family. Receive those of Madame Boussinesq, and please believe me, Your all respectful and grateful disciple, JB.”

JB thus prepares the next vote at the *Académie* by visiting the various members of the Mechanics Section. In the meantime, he is known in the capital both by the preceding vote, and particularly by his many papers published in the French top journals.

Letter 18, dated May 5, 1872, describes the meeting of dSV and JB as follows: “Dear Sir and friend, I have not yet sufficiently studied your manuscript so that our conversation tomorrow Monday would be impossible. I will be busy with what I have to say to the committee. So do you want to postpone the meeting to Tuesday? If you have something to say to me beforehand, I will see you at the Session which, for non-members, will end at 4 o’clock, dSV.”

“P.S. The election of Tresca will, I think, be more favorable to you as well as to Résal. We talked about you again at noon on Monday. Leverrier said that you are presenting an example of the majority of another organization of things in the department. Mr. Pasteur told me yesterday after dinner that it will be an honor for me to look for you and make you known.”

Letter 20, dated May 20, 1872, written by dSV, gives the results of the vote for the new member of the Mechanics Section as: “

Tresca	34 votes
Résal	18
Boussinesq	1 (Mr. Guiseux)
Bresse	$\frac{1}{54}$

If I had known this, dear Sir and Friend, you would have had two votes, but not being able to foresee such a success of the Section, my duty was obviously traced. And Mr. Faye was not there! However, your main issue, the one that interests you most and the future of your work, namely a leave until a course arises is most essential. We conceive this almost without a presentation so passionately delicate, the fighters had thought to abstain from your friendly person. Yours dSV.”

The response of JB on this result is expressed in Letter 21, dated May 24, 1872; it reads: “Sir and dear Master, arriving in Montpellier, where I will be until June 2 or 3, I found your good letter of May 20. My journey from Paris would not have been lost, had it only served to preserve the happiness of seeing you again, and the advantage of having acquired a friend enough motivated to vote for me in such a passionate election (I am inclined to believe it was Mr. Guiseux).”

“I am not angry at all to see Mr. Tresca at the Institute. It is certain that the research and creation of dynamic plasticity is a serious issue. I wrote to him before I left Paris to thank him for sending a copy of his Memoir on ‘Punching’, and to express my esteem for this book and the regret of not having time to go and visit him. Mr. Dumesnil, whom I saw the day before I left, gave me the most formal assurance of finding myself or making a position in a Faculty before October 1st. Perhaps you will not have been satisfied at all with my article on dynamic plasticity? However, the publication of this article could not currently cause any harm to Mr. Tresca. Let me finish my letter here because of the time to send the mail, and also that I can, before the end of the day, make some visits. Receive, with my respectful tributes for you, for Madame de St. Venant and for your daughters, the new expression of Mrs. Boussinesq’s gratitude for all that we owe you, Your devoted disciple JB.” Despite the failure of JB to be accepted by the *Académie*, he was most probably convinced, based mainly on his juvenile age, that another candidate was elected. Note that the typical age of Members of the Academy was around 60 years, so that JB with his 30 years was definitely a ‘youngster’. Later, when finally being elected Member in 1886, he still was among the young members, so that he had to preside the Membership in the 20th century due to anciennity.

Another problem of JB was the return to Gap: Should he go there or just wait for an official deliberation, as promised earlier at the Ministry of Education? In Letter 31, dated Sept. 27, 1872, JB writes at its end the following to dSV: “I am a little concerned that I have no news from the Department. My leave expires in three days, the return to Gap is on October 8, and I do not know if I am appointed without a Faculty position, or whether this is extended. I’m going to write to Mr. J. Simon.”

Letter 35, dated October 2, 1872, still deals with the above issue, stating: “I have not yet received anything from the Department about the extension of my leave or any appointment. Mr. J. Simon, Member of the Institute, Place de la Madeleine, in Paris (to whom I wrote) had likely received this letter on Sunday, September 29. In the course of my leave and finally at the

beginning of September, I had written repeatedly to Mr. Dumesnil, in accordance with the advice he himself had given me. Would I make my future in Gap or at a high school, after everything that has happened? I'm not very tranquil."

This topic was taken up again in Letter 38, dated October 9, 1872, in which dSV states: "It is possible that this indefinite extension of stay in a community so devoid of scientific resources, and which perhaps offers you more subjects of disturbance than any other, you may experience pain, despite the sweetness of the children's memories and family reunions. I will write, if you agree, to Mr. Balard, but when he does not tell me that I will not have to torment myself and others when having formally promised the leave until the holidays, with the position of availability that you have desired."

dSV comes back to the topic in Letter 39, dated October 12, 1872; he writes: "I went yesterday (after receipt of your letter of the 8th) to Mr. Balard. I told him that although the presence of your replacement at Gap makes it unlikely that you will return, but if the leave is not soon extended, the payment of this new position might be difficult. And because I am in correspondence with you, I can certainly use your time in the most active and useful way. And I told him that I have heard from various people about the probably imminent retirement of a professor in Toulouse, who asks that this position should not be given to another person."

The next message from dSV to JB was expressed in Letter 40, dated October 15, 1872, stating: "I do not think that in the letter from the administration that granted you a 6-month leave, it was said, "You will return to your post on October 3rd," and I regard it as certain that you will not receive a letter ordering you to return, nor that deprives you of your total salary. But I am writing to Mr. Faye, reminding him of his warm disposition towards you. His indignation at the thought that you may be left in a lower position or with a small grant, and I am urging him to join Mr. Balard strongly to get you a post in Besançon or another Faculty without further ado. I also write to Mr. Morin not by asking him to take steps because he does not like the Minister and he is not an inspector, but to ask Mr. Balard, Mr. Faye and Mr. Leverrier not to forget you. If the Parisian candidate won this time, and before Besançon, well, dear sir, I count on your tone afterwards to think that you will not be discouraged."

Again, in Letter 41, dated October 20, 1872, dSV cares for his colleague with the words: "Dear Sir, Mr. Faye replies that he spoke again to the Minister who told him that the work on your person was being developed at the Staff Office, but he was hesitating to place you between Marseille and Toulouse. Although Marseille is a little closer to your location than Toulouse, perhaps you would be a little more overwhelmed in this Provence and this city of commercial and maritime business, and reached to do much more astronomy there than in Toulouse. On the contrary, you may have reason to prefer Marseille, whose inhabitants, without being perfect, are religious and men of spirit."

"If, therefore, you have any reason to prefer one over the other, nothing would prevent you from writing to Mr. Dumesnil that you were probably destined for either of these two universities and explaining to him the reasons you would have to be grateful, both for your taste and for the sake of science and your research has been more in one place than in the other. Perhaps this would influence him."

The answer of JB on this proposal follows in Letter 42, dated October 30, 1872, as: "Thank you very much for the pain you have taken for me, writing to Mr. Faye and Mr. Morin. I did not feel it was appropriate to ask Marseille rather than Toulouse or Toulouse rather than Marseille, because I do not know, what would be better, and besides I asked Toulon enough on four or five different occasions, to make it clear that the Chair of Mechanics of this Faculty would tempt me much more than any chair of astronomy. If one would have respect for my wishes, one finds them quite clearly expressed in these requests. I don't think that the vacant Marseille chair is a chair of astronomy."

The response of dSV follows in Letter 45, dated Nov. 27, 1872, stating: “Dear Sir, you note that I returned to Villeporcher after 20 hours spent in Paris. Do you not think to visit us in your long journey already so expensive, and despite the true pleasure that we would have to see you as well as Madame Boussinesq? I will also return next week to Paris where I will spend Monday, Tuesday, Wednesday 2nd, 3rd, 4th December. In Lille, you will only be a few hours away from Paris and we can see each other again.”

“It’s probably hard for you to get out of the way at that level. But Lille seems to me a superb position, much better than Marseille. It’s a learned, enlightened city. It is also a good city, better in reputation than today your poor *Midi* and which, perhaps still now, is much better than it was two years ago [Sic.: During the Franco-Prussian War]. If Mr. Guiraudet, whom you may be succeeding, is not dead, and if he is still in Lille, you will find in him help and advice as to the knowledge of the locality, by telling him about me. I never had the fortune of seeing him, but I was in excellent correspondence with him on the occasion of the publication of my Notice on Du Buat in the Memoirs of the Society of Lille of which he is the Secretary, and on my appointment as Correspondent of this learned Society. You could also speak to Mr. Kuhlmann, Correspondent of the Institute, and to Mr. Violette, former Commissioner of Powders and Saltpeter, although I know them only by correspondence.”

“All right, I know that your course is that of differential and integral calculus. A course in mathematical physics would probably have been better by putting you in a way to expose your theories of optics and soon make them the subject of a book, and even allowing you to talk about hydraulics, and also rods and plates. But the course of analysis will leave you more leisure to continue the solution of problems on permanent and non-permanent water flows both in straight and curved channels, indeed useful things. You will do well to make visits with M.M. Raillard [Sic.: Charles Louis Emmanuel Raillard 1817–1900, Engineer General of Bridges and Roads], Chief Engineer, and Menche de Loisne [Sic.: Henri Marie Joseph Menche de Loisne 1824–1903, General Engineer of Bridges and Roads], who no doubt knew me. With all these I was discussing hydraulic problems.”

“There are indeed a large number of good treaties on differential and integral calculus that can be followed without much trouble. Navier’s is good and simple. Duhamel’s is also good, but in my opinion it limits too much the method, to such a kind of rigor similar to the algebra of finite quantities, although the infinite and the small infinity are avoided only by disguising them. I think that the infinite small, expressed and considered frankly, is at the same time the simplest, most easily accepted and understood by the students, despite its inevitable mystery. Besides, you probably have your opinion and your plans on all of this. I only talk to you about it in the desire that you simplify your work and save you pains and time to use them for other things.”

“I add that I have the experience that the more you simply do the things of your obligatory profession, the more you satisfy your bosses and everyone else. I found myself in a bad place in Paris as an engineer, and in Versailles as a professor to do something too good, that is to say too much confidence in what seemed to me such and did not seem to others, and which was exceptional. However, in total, I do not have to restart, and as for you, I am convinced that you can say good new things on infinitesimal metaphysics and about the knowledge of presenting things. Yours dSV.”

The year 1872 thus brought a great change in JB’s career by strange circumstances due to administrative misunderstandings and the supportive role of dSV. The step from Gap College to the University of Lille was exceptional, given that Lille counted as one of the best French academies during this era. Second, JB was much closer to Paris, and to dSV, so that organizational difficulties were also resolved by this professional change. Let’s then have a look how the story continues.

2.3. *JB's years at Lille University*

In Letter 1, dated January 19, 1873, dSV comes back to the position at the *Institut de France* as: “In the Section meeting on Saturday 11th at Mr. Dupin's office, while discussing the candidates for Correspondents in the Mechanics Section, I said that I would first ask you whether you would be a candidate for it. If that were your wish, I had not yet had time to convince myself. So, these gentlemen told me that it would be better to ask you for tenure since you have already had the chance. Well, I think, when it comes to drawing up the list of candidates to succeed Mr. Dupin, I could recall this to get you listed. I want, of course, discuss this issue with you in advance, because now having reached a good place in higher education in the provinces, you will be required to be promoted, that you formally commit to give it up and come and reside in Paris if you were appointed. This commitment will, I believe, not be dangerous, for presumably the one that will be named this time will be Résal, whose work is not superior to yours, but who is much better known. If no other candidate is opposed to his questionable election, you will probably have a few sympathetic votes that will, for another time, set a good precedent.”

“Moreover, if you are appointed, there is no doubt that the Ministry would find somewhere a position in Paris for you, unless, from an indefinite leave, you find someone in free higher education who will probably be organized soon. Tell me (taking the time for deliberation), dear professor and friend, what you think and how you resolve it. Yours dSV.” From the letters available, there is no answer of JB on this question. In any case, JB accepted the proposal of dSV and for the moment did not look for a position at the *Institut de France*.

During the following nearly two years, these topics were no longer discussed. It is only in Letter 17, dated Sept. 21, 1874, written from JB's hometown St. André de Sangonis, where it is stated: “Sir and dear Master, I preferred the *Collège de France* to the Faculty of Sciences in Paris, but there are not many attractive opportunities, and it is easier to seize them when you are already in Paris than in Lille. Make sure, whether my duties as a lecturer or substitute at the Faculty were to prevent me from continuing my research; I would find it much better to stay where I am. However, from what I've learned from the Faculty of Sciences in Paris, the disadvantages you point at are not as serious as they seem. And first of all, the baccalaureate exams should not be much more tiring in Paris than in the rest of France, despite the larger number of candidates, because the examiners are more numerous and each has a particular room where he questions afterwards all the young people to be examined, a circumstance that reduces the length of sessions by two-thirds. In addition, willing examiners should not be missed, because they are actually paid for the examinations which they do in contrast to what takes place in the province where, as a result of a common agreement, the possible total is shared equally among all professors. As to College inspections, I do not know whether, in Paris, the professors of the Faculty are doing it. It is a thing of its own, so far, in the Northern Department (except for the Douai Academy) and that does not exist in any of the other academies which I know. Finally, the question of courses to be held does not really worry me. In Paris, the professor has only one course per week, plus a lecture for the bachelor's degree; the holidays are also longer than outside Paris, where we have two courses and one lecture each week. Besides, I know how little professors are embarrassed about the subjects of their courses. Everyone brings into their frame just about anything he wants, and directs no eyes on any official program. This is what we are doing in Lille, to the extent that we think is appropriate, and it is probably also what is even more done in Paris. In summary, it seems to me that if the preparation of my lessons of a year were to absorb me a month, or two at most, then I would have time to continue the course of my researches, or the one that you would like to suggest to me, while taking into account the poor conditions of my stomach.”

“So I think you would do me a real service by writing to Mr. Faye (it is possible that I was wrong in my last letter by saying that he is from the Faculty of Boispin; he is rather Inspector General of Higher Education), Misters Balard, Leverrier and perhaps Dumas in the spirit you indicate in your letter. You could add that I would not be the youngest member of the Faculty, since Mr. Darboux, who is, I believe, one year younger than me, has already been attached to it for a full year as deputy of Mr. Liouville. Mr. Serret himself, to whom I spoke last time more than a year ago at the library of the *Institut*, told me that I would be better off thinking about Paris and that I was probably getting there quite soon. I apologize for so much trouble. But you know how many people are looking for available jobs: Maybe the place is already taken, or promised.”

This issue became more concrete in [Letter 1](#), dated January 18, 1875, in which dSV writes: “If you cannot get the Chair at *Sorbonne* (even if you tell Mr. Bouquet that you are willing to anyway accept this situation which he thinks is embarrassing for you), I will end up telling you that this is even fortunate. Are you sure that you do not experience any beginning inconveniences, which may even be deprived of it soon if you are only there on a temporary basis? It would be the *Collège de France* that you would need; it is a little bit less privileged than the *Ecole Normale* in pure analysis. Continue to produce, when you have finished your corrections, prepare good work, which will enforce the opinion to declare itself in your favor.” In summary, JB appeared to be happy with his novel position at Lille University, and he knew that Paris might be his future. He also realized that it was now time for him to advance the many research questions, particularly the Essay on water flow, a topic of another paper.

JB gives in [Letter 37](#), dated September 9, 1875, some holyday impressions of St. André, stating: “I was given yesterday your letter of September 6, when I returned from *Notre-Dame-de-Grâce*, where we had been celebrating the feast of the nativity and praying for our friends, among whom you and yours are in the front line. This sanctuary is near Gignac, only 4 kilometers from St. André, in a magnificent position from which one can contemplate all around a splendid panorama surrounded by mountains. The Church is quite beautiful, of Romanesque architecture, although it is, I believe, from the 14th century. The place has always had a religious character, probably due to its position, as the present church is on the site of a temple of Diana.”

“The huge consumption of grapes during 12 days, and the baths in the *Herault* River, have made my body well. The stomach works regularly and without laziness. So I’m starting to be in a good shape. After your tour around Paris, you could send me one of the questions you want to discuss. In the meantime, I would have sent the proofs [Sic.: for the Essay on water flow] that I have had for ten days, but which I have barely read, and then I will be able to start your work. It will be with greatest pleasure. My father and parents were sensitive to your good memory. I am responsible for conveying to you the expression of their respectful feelings. Please pay our respects to Madame de St. Venant and accept them for yourself. Your obligatory and devoted disciple, JB. P.S. My family is fighting hard over my work. I hardly have to tell you, that once we arrive, I don’t have to do much anymore. However, the reality is that I do better by working moderately than doing nothing at all.”

In [Letter 44](#), dated September 29, 1875, dSV has a completely new proposal to JB: he writes: “Well, when you have time, tell me a little history of your education and your life? What you will say, I will say only with caution to people, because what pleases some displeases others. Have you been for several years in some institution of Montpellier, either as a boarder or as an outsider, or have you had courses simply in mathematics, of the Faculty with lessons of a teacher, or at least with his advice from time to time to help you in the study of topics that you were doing from books? And, as concerns the Latin language, did you have only the lessons of your uncle, the parish priest of St. Eulalie, who perhaps simply gave you a dictionary with a grammar and texts of St. Thomas to translate? If I am talking about this to someone who is not displeased, I will add, because I am convinced that in this way you know Latin better, and especially philosophy

than those who have gone through High School and to whom one inspires the love of letters and science with sorrows and other punishments.”

“Is it the subject of philosophy or of theology that you have studied in parallel? Maybe you’ve been at the Little Seminary? I only want to know this with reluctance and perhaps not at all. Yet, in addition to my interest in what is significant to you, it may well be what I know. Besides, I do not know what you are aiming at. You have taken your bachelor of science degree, for which Latin is required. However, I know that you did not seek to take the bachelor’s degree, for fear of missing questions about ancient Greek which you penetrated less carefully. Just as you have not aimed at the Bachelor’s degree and the Science Aggregation [Sic.: degree to be elected to a higher state position] for fear of the inconvenience you might experience, being already a Doctor and author, to be adjourned for not having the knowledge of what makes these kinds of exams to be passed, or to be helpless by loss of the memory of these formulas and those words of organic chemistry that you do not intend to use in the work to which you are dedicated. It seems to me that you will have better French than many bachelors majoring in letters.” The speculations of dSV on the early career of JB were quite wrong, as follows from his answers.

Letter 51, dated November 2, 1875, deals indeed in lots of details on the biography of JB, who writes [Sic.: Note that the very start of this letter is not available]: “It [Sic.: My thesis] was on the theories of heat and light waves. At the same time, I made a submission on the theory of the laws of Poiseuille, which was treated in the same year by Mr. Mathieu. My thesis left Gap the day after I got there, around November 20, 1865. Prof. Verdet, after a long examination period, wrote to me that he approved it, but that the work corresponded to ten dissertations and that I could, in order to reduce the printing costs, take only one of the problems that were dealt with. He explained that I could meet him upon his return from the *Midi* to where he would go during the Easter holidays. Unfortunately, Mr. Verdet became ill (which I did not know) of a spinal cord disease, died within his family, after writing me a letter in which he highly appreciated the merits of my thesis. When I indirectly received the news of his death, I sent his letter to the Dean of the Faculty of Science in Paris, asking for the examination of my thesis. I was told that it was necessary to wait for the successor of Mr. Verdet. At the beginning of the 1866–67 school year, Mr. Briot was appointed. I immediately understood that my thesis might not please him, because it was on optical waves in contrast to his theory. In order not to get into troubles, because I did not know whom my other examiners were, I presented another thesis related to physics dealing with the classical theory of heat. I had found the ellipsoid of linear conductibility, which was precisely the problem whose isothermal ellipses Sénarmont [Sic.: Henri Hureau de Sénarmont 1808–1862, French physicist and geologist] had experimentally revealed to exist. I made this subject my first thesis, accepting for the second thesis the questions that the Faculty would ask me and that would relate to the calculation of simple, multiple integrals.”

“Once the examination of the doctorate was passed, I tried to see, before leaving Paris, whether Mr. Liouville accepted my great optical memoir or at least its summary. Mr. Liouville was generous, but, not knowing me from any publication, to take charge of publishing a summary as much as that of Mr. Darboux, whom I had spoken to as having been for some time my classmate in Montpellier, would like to accept the responsibility of the President himself on my part after examination. He said that I could, for that purpose, present this summary in the form of a letter written to Mr. Darboux and which he would publish in the *Journal of Mathematics*. I gave my summary and handed it over, along with my rather large manuscript, to Mr. Darboux, whom I had already seen, and who promised me to examine it within a week and then writing to me. One month, then two, then three, were running away and I didn’t receive any letter. Then I wrote to both Mr. Berger (our former professor at Montpellier) who had become a special teacher at Charlemagne High School to ask Mr. Darboux for my manuscript and to send it back to me, which he did shortly afterwards; on the other hand I asked the Perpetual Secretary of

the Academy of Sciences (who happened to be the good and welcoming Elie de Beaumont) to include in the Report my first two articles of 1867 ('Reciprocal Action of Two Molecules', and 'Theory of Poiseuille's Experiments') whose manuscripts were attached. He also inserted my two or three other articles, which followed until about November 1867, containing in summary the most essential ideas outlined in my manuscript. The happiest thing for me in all this was that you noticed these articles, contacting me about the one dealing with the distorted isotropic environments. That day, I could say that God had loved me too much, for I found in you the man, the guide and I dare to say the friend who never spared me any advice, no boring work, and who finally, despite the many obstacles, led me to the term I had been aiming for ten years, in my heart, but without daring to speak of it, as it seemed for me difficult, to a chair of higher education. Bless you, after God of whom you have been the constant envoy."

"I said everything, you know the rest. I wouldn't have gone into so much detail if you hadn't expressively asked me. Please forgive my excessive prolixity of this letter, which will tire your head a full afternoon to relax from it. I dare not asking you, when you have time, to entertain me with the story of your studies. Yet, I would desire it, and because of the deep interest, along with a respectful affection, that inspires me all that touches you, and because of the usefulness it will have, I am convinced, first for me, perhaps also later, to the extent that you would like, for others. I am your all grateful and obligatory disciple, JB."

This 'private' biography of JB until 1868 reveals many details. In particular, he did not profit from any advantages. By contrast, he had to find his way alone, and finally succeeded to publish a number of papers before becoming 25 years old. He also noted, that the sunshine in this period of his life was the letter from dSV, who became interested in his researches, and was asking him questions on various details. This letter is not included in the Correspondence, however.

Another news was received by dSV in Letter 24, dated August 22, 1876, in which JB writes: "We are in the process of buying a pavilion and a garden, located at the entrance to the village [Sic.: of St. André de Sangonis], on the road from Montpellier to Lodève, all for 11,000 francs. There is an inexhaustible well with a water table in a 10 m layer of sand and, in addition, a vast covered store 21 m long, 10 m wide and 8 m high, which we do not know how to use it. We have two entrances, one from north, the other from South. The house is in the garden, the façade of 12 m at the rising, with two windows off to the north and two to the south. There is a ground floor, a first floor, and a large attic on top, with a magnificent view on the rising sun. The entire good thing is walled, but the garden is rather a brood of 21 m of ribs, where much remains to be done. I would not bother you with those details, if some of the good opinions you gave me in your last letter would not seem to me that you would also be interested in them. All we still have to do is to make the sales contract, the day the notary is available. We have given our word and we have the word of the owner or rather the one in charge of sales, because the sale is the result of bankruptcy."

More details on this estate are given by JB in his Letter 25, dated September 29, 1876, reading: "Never before Madame Boussinesq and I have been so busy in St. André. We first got rid of 4000 francs, before having started any work, for a store and a courtyard adjacent to the main part of our acquisition. It still consists of a rectangle having its two small sides, 12.5 m each, to the north, confronting a wide private street (6.50 m, which belongs to us and four other owners); the other at the South is on the road from Montpellier to Clermont and Lodève. The two large sides are each 44 m long being walled like the others. There is a large wooden entrance gate (4 m wide by 4 m high) from the road, and a gate on the north street. The rectangle is divided, parallel to the small sides, into three strips, the northern, 8 m wide, is a small garden and contains an excellent well adjacent to the next strip. This, 10.5 m wide, is a vast, almost square and 7 m high store where, while leaving plenty of room available, we have installed a pump, a washhouse, a cellar, a chicken coop. The south strip, 28 m by 12.5 m, is a courtyard of which we will make part of a garden (there is already a beautiful tree). The 12 m-fronted house, overlooking the east, is in

the southwest corner of this strip. On the ground floor, it has a large kitchen, a living room to the north, vestibule and staircase, and two bedrooms (the most beautiful to the south is for you, when you come to spend the months of August and September in St. André) and a workroom with beautiful view on the country. In the second, there are two bedrooms (we just built them), one on the East with splendid views of the road of Montpellier, that of Larzac, the valley of Herault River, the mountains of Ariane, and the Paillarde Region. The other on the north, with magnificent views of the Montpeyroux Mountains, on the side of the Larzac road that border on this side a horizon whose radius, both on this side and on the east side, is 15 to 20 km. The front door is in the garden. It's the big gate that closes everything. The house is the first of St. André (a village of 2800 souls) when you come from Montpellier. It's on the right, on the north side. A large spinning site is on the other side of the road, to the left. Since we have received the house key, we have not been able to find a moment of rest: carpenters, masons, locksmiths, zincers, upholsterers, we have set everything in motion. We changed the frame of the store, demolished a staircase to put another in hard slabs, originating from pretty marble, made two chimneys, two bedrooms, a window on the canopy, plastered the house, part to the lime, part cement, what do I know? We will leave for Montpellier, in order to buy the furniture that we were missing and also the wallpaper that we will have to try to stick on the walls before we leave, if possible. It is a madness that I had to reproach myself. However, as much is worth this one as another, if it is absolutely necessary to make one. I hope that the ordeal will disgust us for the life of the owner's profession. It will not be a small benefit that we will have reaped from our misfortune. However, I would not complain if, on the holidays of 1877, you agreed to come and give up your knowledge of the South, of which you were so happy as you walked through the valleys around the Vigan and you explored the ladies cave. We can still next year, please God, give you strength grapes! They do so much good, especially to the scientists! Later, I am not sure if we could promise you, although we are determined to plant a lattice that runs the full round of our courses, defending it, if necessary, by the remedies of Mr. Dumas. The enemy, the phylloxera, invades here. Already this year, it has significantly reduced the grape harvest. Its invasion line, which is from the north to the south of the mountains to the sea describing deep sinuousness, and which moves, in our regions, from east to west, has exceeded us by about fifteen km. Although on the plains, we are not far from the mountains, and there are beautiful places to explore, even more picturesque than in Uzès, yet not as green. And I would have the pleasure of resuming with you some of these conversations of Vendome, as I keep a precious memory. We will need a priest, at our purchase price which is only 7000 francs (11000–4000), about 600 francs in fees and nearly 3000 francs for the expenses we have made or we will make, including the addition of furniture. All to spend in a few months of the year? Yet, I feel that Madame Boussinesq must be impatient with my delays in coming to relieve her of her duty as a supervisor to our workers. In fact, there is work for two, and I could not find the time to make the plan you will ask me to do. I preferred to use the moments I could have to make the note you will receive, one day before this letter. So, despite my regret at leaving you, I end this already long letter, and pray to you. Sir and dear Master, I am always your all devoted and grateful disciple, JB.”

It was obviously Mrs. Boussinesq who could persuade JB to acquaint the house in his hometown. Suddenly, it seems, that JB took even a more important interest into this project than doing his researches. As stated in the letter, it was, at least during this era, quite adventurous to have a house next to that in which people lived during the rest of the year. JB had thus earned sufficient money to satisfy the wishes of his wife, and he also enjoyed this jewel in the South of France.

Over the next four years, nothing exceptional can be reported about JB. He continued his researches, published widely, starting now also with works in the field of the researches of dSV, namely the elasticity theory. In addition, after his failure to be accepted as member of the *Institut de France* in 1873, he initiated a second trial in 1880. His Letter 1, dated February 27, 1880, reads:

“I don’t know what the Section, of which you are the respected dean, intends to do for me. However, it seems to me that, in fairness, logically, it could, and should, place me alone on the front line [Sic.: of the List for the vote of a new member], preferably in front of Mr. Bresse. Indeed, the Commission put us both, tied, in second place, in 1873, proof that it was assumed at the time that our titles were roughly equivalent. However, since that time, Mr. Bresse, whom I value and appreciate, has not added any new titles (or so) to his previous titles. It is true that Mr. Bresse is older than me, but I had the Poncelet Prize four years before him, and there are so young, perhaps even younger men than me at the Academy: Mr. Cornu, Mr. Tisserand who seems to be as young as, maybe, even younger than me. In turn, I have published the Essay on water flow, the memoir of Belgium [Sic.: On the distribution of pressures in sand upon the placement of a foundation], the one where I gave the reason and the general demonstration of your two simple laws on the living resistance of solids, the memoir on the principles of mechanics, articles on the resistance and deformations of an elastic soil, then on how to present the potential theory in the discontinuity hypothesis of matter, and my general formula for expressing hydraulic losses. My new memoir on stems and plates, the discussion I supported with Mr. Levy on the conditions around the plates, and which, I believe, has fully shed light on this issue, the discovery of the property of the ellipsoid of revolution whose polar vertical axis is half of the equatorial axis, to be a surface on which a heavy point describes small fixed ellipses, while these ellipses would be mobile on any other surface. I am not talking about my work on the philosophy of science, because they have been controversial, and although I have no doubt that my idea of guiding principles alone is worth more than anything else. It would seem difficult to me that by bringing this out to the other members of the Section, they would not understand it. I hope that Mr. Tresca will be in my favor. I have given, I believe, the real reason for his punching formulas to the extent that they may be true. On the other hand, I received, eighty days ago, a very nice letter from Mr. Résal. I had written to him that you had given me a point of the difficulties caused by my long memoir, but that I was not in a good hurry to see it published and that, provided that some of it was published in 1880, I would gladly wait for 1881 for the rest. He replied that my little eight-page paper (on potential theory, and probably also the other on the problem of twisting dealt with curved coordinates, because the two manuscripts are joined), and that, as for the big one, I had to do myself what I had indicated on a square of paper attached to the manuscript, that is to cut it into three or four parts. And that’s what I executed from point to point. He gave me the reason that a general regulation had been made about the maximum length of the memoirs inserted in the *Journal de Mathématiques*, and that the 50-page limit had been set. I conclude his letter: “I do not forget that, together with Mr. Faye, I helped you out of a modest provincial college, and as a result my sympathies have been for you over for a long time.” (I don’t know the circumstances he’s talking about this issue).”

“These words are certainly good. Moreover, given the circumstance that it was on February 7 that they were being said, at the time I became a candidate, perhaps they should be heard in the sense that it would not be unfavorable to me in the election. Now, with Mr. Tresca and Résal, both of whom owe you their success to the Academy, who have for you the deepest esteem and well-motivated feelings of deference, you form the majority of the Section. I do not know Mr. Rolland’s way of thinking and I do not know whether Mr. Phillips will support Mr. Bresse with the same insistence he did for Mr. Tresca and Mr. Résal. However, it seems to me that my titles, compared to those of our competitors, and despite Mr. Bertrand’s [Sic.: then the Secretary of the *Académie*] alleged opposition, would stand out enough and could hold the influence of the coterie, if the Section were to argue them in all cases, you know that I will have you the greatest gratitude for what you will do for your devoted disciple, who I believe may, if he served you, continue your thought and your work here on earth. And this gratitude will be the same whether we are victorious or defeated. In the meantime, don’t get too tired, not even to defend me on the

occasion, because one of my most precious good is your health; accept the new expression of my deep and respectful affection, JB.”

The vote for the new member of the Mechanics Section is described by dSV in [Letter 17](#), dated June 2, 1880, as: “Dear Sir, I am only receiving news today of the election on Monday 31, and I will not wait for the count. The result is:

Bresse 32
Lévy 22
Boussinesq 2

I had assumed that Lévy would win by one or two votes over Bresse, given what had not been said, in view of the absence of several members.”

“My vote for you was prepared, and I had, in the course of the week, written three letters in your favor, namely to Mr. Berthelot (who was for Lévy), Villarceau (*idem*) and Pâris, in order to tell them that I was by no means formalized from your letter of his expression on me (which so scandalized and almost outraged Fizeau and, also a tiny bit a person living here, though he loves you very much but fears that I will spoil you) and that I found your free request very natural and not hurtful to me. However, upon my entry into the room, Tresca was watching me, who was so admirable to you, since it is because of him that you have been carried on the list after Lévy, and also due to him, the attentive presentation of my Report, wonderfully read and accentuated by him on the 17th. Well, Tresca tells me: I urge you to rename a vote of pure sympathy, because several members assure me that the situation is very tense, and that nothing can be answered if there is a second round of voting. I had to follow an advice and had the pain of not voting for you with my great regret. Tresca was convinced that Bresse prevailed over Lévy with only one or two votes, and was not without fear. Besides, don't be too surprised that you only had 2 votes (likely from Faye and Abbadie). Already on the eve of the presentation session on the 17th, several of those who had given you hope with their votes had formally said that they would vote for Bresse. Probably because of the same apprehension that determined to lead me to what I did.”

“I am sending you my speech of May 17, because you asked for it. I understand that you should explain to your Rector, who has given you time off, why you do not have more votes. You can quote the words as if they were taught to you by a letter. Yet, I think it would not be appropriate to send him a copy of this communication, because what is said in a secret committee is supposed to be kept secret. And then, I noticed that the praises, the assurances of being looked at as superior, the successes even when I had them (and here I did not) breaking my arms and legs make me fall into presumption and slackening, while disgraces, humiliations are giving me tone and courage. Is it the same for you? I don't think so. However, it is obvious to me that the good God, in this circumstance, wanted to humiliate me, and you maybe too. I believe that in the present time he is very mediocly happy with his most faithful servants, who are called his most self-righteous people, and gives them to draw his lessons. Yours dSV.”

This is the second time that JB was not successful, as was more or less foreseen by his mentor. Despite the excellent research results, the good exchanges with his colleagues, the Committee preferred the much elder Joseph Bresse (1822–1883), who was particularly known for his book ‘Hydraulics’, first published in 1860. It was clear to JB that he had to wait, to become a little bit elder, to enter into this particular ‘club’ of the most important scientists in France.

Later this year, JB and his wife were again on holidays. [Letter 32](#), dated October 23, 1880, reports the following: “Sir and dear Master, I will leave to *les Vans*, with Madame Boussinesq, on next Wednesday morning 27, returning to Paris next Thursday, and to Lille on the 30th or 31st at the latest. The weather has become a bit rainy, but it keeps mild; I hope it won't be too bad for our trip. We hope that autumn will not bring you any indisposition. This requires not to wait in putting on winter clothes and making fire as soon as one feels the slightest need.”

“I rested a little during the month of October, mainly reading things of literature or correcting my proofs in Lille. However, I am still only on page 84 of my little lithographed course at the Industrial Institute of the North (dealing with the theory of maxima and minima). But the sleep and my stomach still leave something to be desired. Mr. Danel’s workers [Sic.: of the printing house] are so unaccustomed to mathematical work that three proofs are needed before I can give my ok. And again, it’s far from perfect.” It is obvious that JB thought of his future, he looked for a new research agenda, after having published during the past decade mainly in hydraulics. His new directions were the elasticity theory, the theory of vibrations, and pure mathematics.

In Letter 13, dated November 24, 1881, JB writes to Mrs. dSV: “What you have written to me, Madam, of the state of fatigue in which you are currently finding him [Sic.: dSV], and of the leg aches that have occurred to him and which are, I suppose, the same as those which he had a few years ago, that, I say, has pained us very much. However, it is to be hoped that they will heal a second time as they did earlier, and that he will be able to peacefully and happily complete the great work of his life, by publishing at leisure the unfinished handwritten works that remain to him. The last letter he wrote to me, of a character as perfectly firm and clear as the oldest ones which I have of him, does not suggest any state of fatigue. Please accept, Madam, for you and for all your excellent family, with the best memories of Madame Boussinesq, the tribute of my respectful and devoted feelings, JB.”

In Letter 6, dated April 12, 1882, JB gives insight to his visits at colleagues in and around Paris. This particular technique was originally proposed by dSV more than a decade ago, to open JB the way to the most important and influencing French top scientists and engineers. The letter reads: “Sir and dear Master, I saw yesterday, at great length, Mr. Tresca, Mr. Bresse and Mr. Hermite. I found an excellent reception everywhere, especially from Mr. Tresca and Mr. Hermite. I explained to them my integrals

$$\int_0^{\infty} f(\alpha^2/2) \times \psi(x^2/2\alpha^2) d\alpha$$

that Mr. Hermite had already noticed, and also the application to the transverse shock. They found the thing as simple as it was interesting. Mr. Tresca told me that, if necessary, he would be all the more likely to prefer me to other candidates, since Mr. Lévy seemed to him to be embarking on my scoured path, dealing with the issue of electric motors, and that there had already been much more than dubious progress.”

“I have also seen, at some length, Mr. Bresse, and he seemed to be interested not only in the results of my longitudinal impact analysis, but also in the defined integrals used to treat the former and which he told me he understood very well. I showed him the calculations on a sheet of paper, which I had made on a blackboard to Mr. Tresca, whom I had seen at the Conservatory [Sic.: *des Arts et Métiers*]. I could not reach Mr. Résal, who was absent, but whom I hope to see before I leave, nor Mr. Jordan, who is absent for a fortnight, as I told you in my last letter. However, I have spoken at length, perhaps more than an hour, with Mr. Hermite, about an infinite number of things, and I believe, said between us, that I will have finally conquered him, as much as I could hope. We talked on my integrals, and I noted his interest even though he declared himself incompetent, and the integral asymptotes that he finds to be one of the most beautiful questions that could be posed, and continuous functions devoid of derivative, about which, it seemed, he had not yet thought, and continuity, and discontinuity and gradual variation. This made him available, no doubt, because his daughter, Mrs. Picart, just had a happy birth. However, the last time I saw him, he had also welcomed me with great kindness. Yet this time, I hope to have conquered him, as I told him, as much as possible. He asked me how you were doing and, on my affirmative answer, accompanied by the observation he had seen, no doubt, in the last Report, an article of you, which would be followed by others. He told me that he had indeed gone through

it, and that he admired your tireless activity. He instructed me to present to you, with the best memories, the wishes for a long time to come, you will send articles to the Report in which it is no longer necessary to admire the perfect lucidity of ideas and expression or the prodigious amount of work and calculations they assume.” These visits of JB served two main purposes: (1) He was indeed interested in these colleagues, because of their similar works in the past, and (2) he knew that the next vote would come, and that these colleagues would be able to support his final entry into the *Institut de France*.

The year 1885 was excellent for JB. He initiated first works on the outflow from tanks, he also got into contact with Henry Bazin (1829–1917), the great hydraulic experimenter of the 19th century, and he published his book on mathematical physics. Letter 23, dated July 15, 1885, was written by dSV to Mrs. Boussinesq, reading: “Madam and friend, I have not yet received my newspaper today. But one of my daughters, who read another last night in Vendome, told me the excellent news of the appointment to the Legion of Honor, who deserved it for a long time, which nevertheless cared less than you, but who must see there the prognosis of justice soon complete, which he receives with the same modesty and the same renewed ardor to continue his work as if he had not yet done any, while probably experiencing a great contentment to be more and more rid of these sad and agitating concerns about themselves that are inherent in the state of votes. Offer him, Madam, my friendship and congratulations and please accept for you the tribute of the respectful affection of my son and me, dSV.”

The answer of Mrs. Boussinesq, as expressed in Letter 24, dated July 17, 1885, reads: “Sir and venerated friend, I was, indeed, very happy and pleasantly surprised, on last Saturday morning, when my brother had just said his mass, told us that one of our vicars had come to read in the newspaper: «The real France that Mr. Boussinesq has decorated!» He was as surprised as I was, for he only hoped to have been honored next year by the learned societies. It was to this committee that you were willing to recommend it, and we have no doubt that by your kind approach to Mr. Liard, you are a venerated friend, the expression of my gratitude and dedication, C. Boussinesq, born Giscard de la Roque.”

Next, dSV prepared the next vote to complete the Mechanics Section of the *Académie*. Letter 30, dated October 23, 1885, gives details as: “Dear Sir and friend, the time is approaching. I intend, towards the beginning of next month, to convene the Section and read my Report done without having them deliberate beforehand on the order of classification that I would present to them everything established as well. After you, of course, alone in the first line, I take first, put in line 2. Sarrau, 3. Leauté, 4. Deprez, Kretz, Ledieu. Yet, as Phillips is strongly for Leauté who has, since 1883, made a new memoir on which his report has determined the insertion to the *Mémoires des Savants étrangers*, I hope to be able to improve this letter by putting 2. Léauté and Sarrau tied, which will bring out the unity of your ranking. But for the last two days, I’ve been thinking to propose 1. Boussinesq, 2. alphabetical tie Deprez, Kretz, Léauté, Ledieu, Sarrau. This, it seems to me, will further highlight the Section’s intention to get you elected, if it follows this simplified ranking. It will also have the advantage of having me read the report on Deprez immediately after the report on you, after which my colleagues will read the rest which will be, this time, irrelevant. Inequality will be restored at the election. Yours dSV.”

In Letter 47, dated November 7, 1885, the strategy for the election of a new member of the Section of Mechanics is discussed. dSV states: “Well dear Sir, your letter yesterday contains many indisputable truths, for example, that we will not succeed in the term this time since even Daubrée and others are seduced by Bertrand [Sic.: the perpetual secretary of the *Académie*, offending persistently JB]. But this letter dictates to me what I would have to do, namely:

1° In my report, longer than I had counted, your greatest and most emphasized praise, would better be said within the Section than in the committee.

2° Fought in the Section, but without putting off my colleagues by overly insisting, which Résal emphasizes too much to the advantage of Deprez, a fact he does not like, believing that this praise of Mr. Deprez is a necessity of the moment, since he wishes him to be infallibly elected.

3° However, in the committee, do not say a single word against Deprez; it is important not to make an enemy because the Section would, even after putting you first on the front line, be able to put down, this second time, Sarrau or Leauté, who are the favorites of Résal and Phillips.

4° Finally, if we do not succeed either of the two times, think that God also wanted to humiliate us in our true surrounding, and to make us better thinking and better focused for a more valuable zeal for his service and glory. So, I'm going to work on my report, which is difficult. If I want to put almost all the arguments successively into writing, there would be a hundred written small papers of all ideas that came to my mind. Pray for me, so that I may do this hard work without laziness. Your all loving, dSV."

It was evident to dSV that the next election was of great importance to JB. dSV also felt that his life was coming to an end, and that without his support, JB would have a difficult future. Accordingly, all possibilities were explored, and discussed with JB, so that he knew what might be coming next in his career.

The last letter written by dSV is [Letter 58](#), dated December 10, 1885, is a call to all members of the Committee in favor of JB, reading: "Dear Sir, I am realizing that I have lost the last sentence of the analysis of your work. The sentence is in a paragraph that was on a loose sheet. Indeed here's how I finish my draft. Can recall whether we did not finish with other things and added them?" Then, dSV presents his draft of the message to be sent to his members of the Mechanics Section, reading: "His [Sic.: that of JB] admission will be an acquisition specified by the *Académie* for his work, and for this truly masterful assistance, for his studies and judges with ardor and facility in a friendly way the works of others. He knows how to really put himself into the focus of the authors, in order to adopt their opinions temporarily. Where others see only contradictions, only things to refuse and reject, he sees things that are to be reconciled and able to assimilate, by honoring their discovery, as is the right of those who do the first interviews. However, when a man is so much engaged and interested in various directions, is it true, my dear colleague, that only the *Académie* does not ask for it, and puts itself in danger of staying outside of the current movement, at the head where rival academies fearing losses in the reputation are placed. Give your votes, gentlemen, to this man of dedication and true progress! Yours dSV." What words of excellence and warmth were selected by dSV in his last writing, which is hardly to decipher, given his weakness and age. He was completely convinced that his colleague would satisfy the great expectations set into his future career at the *Académie*. As stated, he did no more than have the great satisfaction to see the entrance of JB in the 'temple of science' in Paris.

The last letter written by JB to dSV is [Letter 59](#), dated December 11, 1885. It reads: "Sir and dear Master, I do not recall that there was another paragraph after the one you reproduce in the attached letter that I am sending back to you. Yet, immediately before, there came one or two sentences, about the services I could render in hydrodynamics, and that is where Mr. Graeff's name appeared, in a sentence conceived roughly as follows: "In addition, for one of the most important contributors relating to the Mechanics Section, namely hydrodynamics, Mr. Boussinesq has been for quite a long time, in the opinion of the most distinguished hydraulicians, the true master, as one of them wrote." I believe that this sentence, the exact terms of which I do not recall, will be of a very good effect, and that it is one of the most important of the Report. However, it must be immediately before the paragraph you reproduce and, if I am not mistaken, it has been transcribed on your draft but not on a loose sheet. Yours devoted disciple, JB."

The passing of dSV occurred on January 6, 1886, at his home at Vendome, following a cold capturing him during his last visit to Paris, where he prepared the election of the new member of

the Mechanics Section. One of the great engineers of the 19th century thus has left, yet without having put all his influence to support his best friend. Indeed, JB was elected as a new member of the Mechanics Section on January 18, 1886, replacing Mr. Rolland. During the next more than 40 years, he was at the forefront of the developments in mechanical questions, as well as in metaphysics and ethics.

2.4. *Personal obituary of Boussinesq*

Given the passing of dSV when JB just stood at the midst of his life, the years to follow are perhaps best summarized in an obituary. In contrast to the 'official obituary' published by the then active perpetual secretary of the *Académie*, namely the mathematician Emile Picard (1856–1941), the words selected here do not penetrate into scientific details. It was written by Elie Douysset in 1930, by the publisher Rambal, Clermont. It reads:

Mr. Boussinesq: A great scholar, a great Christian

On February 19, 1929, died in Paris, at the age of 87, surrounded by two sisters of Sainte-Agonie, his nephew Mr. Marius Boussinesq and his niece Blanche, born Vican, all bereaved, on which his last glance was fixed, while his last thought had been for his dear Saint-André, a great scholar, whose name was barely known to the general public and remains one of the purest glories of France. Valentin Joseph Boussinesq, born in Saint-André-de-Sangonis (Hérault) on March 13, 1842, to Jacques Boussinesq, known as Cadet, of old and solid local earthrock, of rather modest resources, and Anne Marie Cavalier, born in Fontès, (Hérault), married civilly and religiously, had been entrusted, from the age of seven, to the good care of the free teacher of the so-called Saint-André, named Cros, a very distinguished man, that the *coup d'état* of 1852, was first struck by the precocity of the child's intelligence, and also very flattered by the sustained attention he brought by listening to him. As a scientist, he was attached particularly to himself, when he was recognized for his natural predisposition to the study of the exact sciences: he made them his little companion. On the whole set, chatting and devising, the teacher speaking and the student listening. In class, out of class, in the fields, in the vineyards, wherever the opportunity is given, Cros gave his student these solid lessons of things that are never forgotten and that sheave so generously in the brain intended for the young Boussinesq.

During the summers, they both frequented the banks of the Herault River where Boussinesq sometimes went on strike to join the children of the village and to brighten up with them by projecting, over the water, towards the opposite bank, flat stones, to set in motion, during their trajectories, these myriad silver and shuddering waves, which delighted them all by their vivacity and fleetingness, except for Boussinesq who regretted not being able to prolong the duration. As soon as they are released, in fact, they grow disproportionately into fantastic circles that soon collide with each other, intersect, are reduced to short and lapping blades, bizarre and unspeakable, evoking arcs of circles, triangles curved, horned or uncoordinated crescent moons, with a hilarious and picturesque effect, and which suddenly emerge, meet, encompass each other and grouped into flirtatiously ordered theories, go away in procession and slowly as if with regret, fainted at the foot of the intended shore. Boussinesq also loved to dive in the deepest places of the Herault, stayed there until he lost his breath, violently hitting the ground with his feet. He immediately emerged and was explained by the always present Cros that the duration of the round movements, the bubbling and whirlwinds are important as caused at the surface by his kicks on the ground.

During the school holidays the two friends separated, but Boussinesq, instead of resting, went to meet his good uncle Father Cavalier, then parish priest of Lieuran-Cabrières, to familiarize himself with Latin, Greek, and all the classical elements necessary to enter the university that

was his dream. The Holy Priest, amazed at his ardor, his tenacity in the study of the letters-in-law, lovingly gave him all that was left of his school background on this subject (he himself was a bachelor of letters) and did not spare him the time necessary to assimilate it. The holidays flowed like this, and when the time came to return, Boussinesq received the kiss of peace and the blessing of his uncle. And after making an appointment with him for the following year, he returned to find Cros in Saint-André who was already waiting impatiently for him. So much, so that, after a single year of rhetoric at the small seminary in Montpellier and some lessons given to him by Arthur Roche, a mathematics teacher at the high school. Boussinesq, just 17 years old, made a bachelor of science degree in 1859, a success all the more commendable because he had to walk to Montpellier, his bundle under his arms, and beat the pavement, to finally find, after many failures, to place himself at the free institution Ferrer, Place Saint-Denis, as a pawn or supervisor with a fee of 20 pennies per day, housed and fed. His job was to motivate the students of the institution who attended the classes twice a day, morning and evening. Surely it was not joyful, but one should consider that he could stay in Montpellier without resorting to his father's scholarship for three years only that his studies would require.

After having received the bachelor of science degree, Boussinesq prepared: (1) His bachelor of letters by corresponding with his uncle Cavalier and following his lessons, (2) His bachelor of science, which he obtained at the age of 19, following from 1860 to 1861, as a student of the Faculty of Sciences, the course of Edouard Roche, professor of calculus and mechanics and later Correspondent of the *Institut*. As his disciple, Boussinesq wrote in 1883 a touching biography because at home the heart had always been at the level of intelligence, and after three years of stubborn studies this made him, alone, day and night, but equally attached to books of illustrious mathematicians. Thus equipped with mathematical knowledge, Boussinesq was admitted at the age of 20, that is to say in 1862, to the university body as professor of mathematics at the College of Agde. From there, he sent to the director of Paris Academy of Sciences his famous memoir on the effects of capillarity in the state of movement, which earned him, three years later, in 1865, his appointment as a professor of mathematics at the College of Vigan, at the age of 23, where he was the hero of an adventure that should be reported.

Absorbed by his high scientific studies, Boussinesq was not respected by his students who heckled him. Some night falls into this lost class when a detective general, Mr. Rolland, attended the students respond badly, and the teacher was elsewhere. To interview the students, the inspector took a book that was lying on the pulpit. It was Laplace's mechanics. This book was filled with added notes. Rolland was surprised. He asked to take the book to the hotel. He flipped through it and read the notes. It became clear that this little respected teacher was a master. His annotations indicated a higher spirit. Boussinesq sensed to expect a change. A note arrived from the minister to the principal of the College. Boussinesq was moved, but with increased salary. He was appointed professor of mathematics at the Gap College.

Before leaving Vigan, that is, on February 10, 1866, he applied to The Rector of Paris to be admitted to the examination of the PhD in Mathematics in front of the Faculty of Sciences in Paris. He obtained it and it was during these examinations that he found the solution to several problems of mechanics, which had been unsuccessfully sought before him. His thesis, which he presented in April 1867, at the age of 25, dazzled the jury, which awarded him the degree of doctor of science with all the congratulations of the Faculty of Paris. At that time, after receiving his title, he thought of giving himself a companion and chose Mrs. Constance Giscard de la Roque, whom he had known from Montpellier, and who was well worthy of this honor because of her personal worth. After his marriage, he met Barré de Saint-Venant, a member of the Paris Academy of Sciences and one of the greatest hydraulicians of his time. The latter greatly appreciated Boussinesq's scientific work and admired him so much that he devoted himself entirely to making him known to the entire *Académie* and the scholarly world. Sup-

ported by all his colleagues at the Academy, he obliged Jules Simon, then Minister of Public Instruction, by his repeated bodies, to appoint Boussinesq professor in a Faculty of Science. And, indeed, Boussinesq was appointed professor of differential and integral calculus at the Faculty of Science in Lille in 1873, that is, at the age of 31. In 1874, the Prefect of the North appointed him professor of pure and applied mathematics at the Industrial Institute of northern France. The intervention of Barré de Saint-Venant and his colleagues was fully justified by the series of Boussinesq's works which were a succession of triumphs, notably by his studies on hydrodynamics, the mechanisms of fluids, conditions of swirling flows in rectangular channels, the marsh theory, and the flowing waters. Not only do his memoirs have high theoretical value, they also have important applications, although not taught at the *Ecole Polytechnique*; several were published in the Annals of Bridges and Roads, mainly read by the Corps of engineers.

It was he who gave the law and the formula that describe the speed of solitary waves in particular, of waves of seismic action, caused in the oceans by cataclysms of the underwater soil. A convulsion of the seabed causes a wave of great height whose propagation is made with such speed that it travels in 12 hours from Japan to San Francisco. The formula that gives this speed contains the expression of the average depth of the ocean traveled by this wave whose arrival on a low coast causes the dreaded phenomenon of the tidal wave. When Boussinesq gave his formula, the major polls in the Pacific were not yet conducted. He had estimated 4000 meters as average depth of the Pacific Ocean. Today, there are thousands of such polls. They made it possible to know rigorously the so-called depth of the Pacific and we found the number of 4000 meters, determined fifty years ago, by the formula of the young teacher of Gap. This already remarkable work had led to the rank of Boussinesq, the first scientist of France, as Barré de St.-Venant called him, his illustrious colleague and whose heart beat in unison with his own. But Boussinesq didn't stop there.

He made studies on the laws that govern land against a wall, that of balance on bicycles in action, the mechanics of fluids, semi-plastic, semi-pulverulent bodies, Newtonian attraction, molecular actions, or thickening of the earth's crust in the manner of Coulomb. Concerned also with philosophical problems, he had published in 1873 in Lille, the reconciliation of true mechanical determinism, with the existence of life and moral freedom and studied the formation of the human being at the beginning of the creation of the globe. Finally, from 1886 at the Sorbonne for more than 30 years, he and Henri Poincaré held the two chairs of mathematical physics (calculation of probabilities) and physical mechanics, during which he had literally handicapped the learned world where he was to be regarded as a superman.

On January 18, 1886, Boussinesq was elected member of the Paris Academy of Sciences, in the mechanics section, replacing Rolland, who had discovered him at Vigan, early in his career. Boussinesq had been appointed Officer of Public Instruction, Officer of the Academy, Officer of the Legion of Honor, and Vice-President of the Higher Commission of Inventions of Land and Sea Armies. In 1871, he was awarded the Poncelet Prize for his already outstanding work. He was an associate member of almost all the academies of sciences in Europe, holding numerous French and foreign titles and medals.

By the effect of age, he had become the dean of the entire Academy of Sciences, after having been the youngest, and even of the four others reunited, a title that had already occupied before him, his most faithful friend, Barré de Saint-Venant, who died on January 6, 1886, at the age of 88 and a half, at his castle in Villeporcher, Saint-Ouen, near Vendôme (Loire and Cher) and on the tomb from which Boussinesq went to pronounce his funeral oration, which was the cry of his heart in memory of his friend. The honors did not trouble him: He had remained modest as when he was watcher at the Ferrer Institution. He was fleeing all worldly meetings, he was deeply Christian and Catholic acting. On holidays, he would rest every year, a few weeks, at the

Vans, in the Ardèche, where he had acquired a small house in front of the convent of St. Joseph. While he was staying, he remained very obliterated, dividing his hours between the tabernacle, the correction of his works, some close friends, most being priests, and very long walks through mountains and valleys where he liked to preferably evoke his crazy children's races and admiring nature in the calm and silence of this rather melancholic land. He followed all the processions at such a modest and absorbed altitude that the companion's population was surprised to see a great scholar so properly practice the commandments of their parish priest. In the church especially, Boussinesq surprised them with his gesture to kneel on the floor and stay there as long as the ceremony lasted.

In Paris, he sought opportunities to cause difficult theology problems that often arise in the everyday conversation and which he resolved with such verve, such precision, such clarity, that he amazed his listeners. He liked to provoke discussions on the very delicate question of whether there was an impossibility in bringing together faith and science, and he insisted until he had led his adversaries to bow to this truth, that faith and science were made because they are sisters in every respect. And he came to this conclusion, that every man of good faith, after careful consideration, could deny it, and this in such sweet, persuasive terms, that by separating from his interlocutors, he had completely brought them back to his opinion.

Boussinesq closed his eyes after having blessed his nephew and niece, whom he particularly loved because of the dedicated care he had received. His death was as uplifting and serene as his life had been holy and innocent. He had the pleasure of falling asleep from the last sleep, his soul imbued with immortal hopes, which doubt had never tarnished, and without which existence would be nothing more than bitter irony and cruel disappointment. In saluting this beautiful and imposing figure of a child of the people, who reached only by his own strengths and his absolutely personal resources, at the supreme summit of science, apart from any recommendation, I believe, I must fulfil two pious duties: (1) That of bringing to the memory of my illustrious compatriot and friend Boussinesq Joseph Valentin, the tribute of my deep veneration, as well as to his nephew Mr. Marius Boussinesq and to Mrs. née Blanche Vican, the emotional assurance of my condolences, (2) to highlight, before the eyes of the primaries, who would be tempted to sneer at it, the morality that can be drawn from the radiant picture of a superman almost, kneeling in ecstasy before his God.

Little science can move away from God, but much brings it closer

Elie Douysset

3. Conclusions

Both Barré de Saint-Venant and Boussinesq are well known scientists in technical physics and applied mathematics. They have revolutionized and greatly advanced the knowledge in these disciplines. In contrast, few is known of their private lives. This research would like to particularly find answers to various questions relating to these issues. Whereas the life of Boussinesq is considered in this work, that of de Saint-Venant will be highlighted in an ensuing study. The basis to these works is available in the so-called Correspondence between the two, lasting from 1868 to 1885, shortly before de Saint-Venant passed away. Accordingly, his long support for the access of his colleague and friend to the Academy of Sciences, Paris, one of the most outstanding scientific institutions then worldwide, was well prepared by the mentor, yet who passed away before Boussinesq stepped into this palace of the sciences.

It was more or less a lucky chance that de Saint-Venant contacted Boussinesq on a paper published in the *Comptes Rendus* of the Paris Academy of sciences. From a simple question emerged both an intense exchange of ideas and theoretical bases as well as a personal relationship, including not only the two main actors, but also their wives and the family of de Saint-Venant. Next to

meetings in Paris, the Boussinesqs also visited the de Saint-Venants at their castle at Vendome, where the latter lived during his last three decades of his life.

In turn, the reader also may become interested in the yearly holiday program made by Joseph Boussinesq and his wife, leading them to Boussinesq's home village St. André de Sangonis, where he met mainly his parents and his early mentors, who brought him into contact with scientific studies. He thereby was always accompanied by his wife, given his difficult health conditions. Despite her much advanced age, she was for him the best companion, as expressed by him in his letters to de Saint-Venant. She cared for him not only in terms of personal problems, she also tried to advance his professional position by letters sent to important persons in the educational sector, including of course also de Saint-Venant as the head of the Mechanics Section of the *Académie*.

Given that the life of Boussinesq at the death of de Saint-Venant had just reached the summit, his further years are dealt with by the obituary of one of his close colleagues, allowing for a closer look at the Paris years. In summary, it may thus be stated that the Correspondence gives an excellent approach to the scientific and personal lives of two of the most important scientists of the late 19th century. Given the shyness and privacy concerns of Boussinesq, this is hardly attained by any alternative available today. The authors thus hope to provide to the interested readership an additional element on these two personalities.

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