

The Spanish Monopoly of Platina

PART II: FIRST ATTEMPTS AT ORGANISING THE COLLECTION OF PLATINA IN THE VICEROYALTY OF NEW GRANADA

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The success of Pierre François Chabaneau and Fausto de Elhuyar in the refining of platina may be seen as marking the end of the first phase of the Spanish attempt to establish a monopoly of this new metal. It then became necessary to organise the collection and shipment of platina from New Granada to Spain. Initially this was not as successful as the Viceroy would have liked, and an attempt by Juan José de Elhuyar to refine platina in New Granada prior to its shipment to Europe was also fruitless.

The first phase of the Spanish attempts to establish a monopoly of platina, following the discovery of this new metal in gold bearing alluvial deposits in Spanish South America, has been reported here previously (58). On March 17th, 1786 the assignment which the Marquis of Sonora had commissioned at Vergara began to show results when platina was refined for the first time and an ingot was produced for despatch to him (59). He must have been very promptly informed because on March 28th he ordered the Viceroy of Santa Fé to ship more platina and to take precautions to avoid contraband activities (60). This may be taken to be the start of the next phase of the Spanish attempt to establish a monopoly of platina, which is the subject of this second paper.

Sonora considered this royal order for the shipment of platina to be of "great interest to the State and the Royal Service of His Majesty" and he asked for "secure and efficient reports". Similar reports were due to be sent to the Superintendente de Hacienda (Superintendent of the Treasury) of Peru, and probably also to others (61).

The response to this official note was swift since 1 arroba and 17 pounds of platina were already being stored in the Royal Treasury of Santa Fé de Bogota. On July 17th, 1786, this platina was sent to Cartagena de Indias for shipment to Spain (62), where it arrived in February

1787 (63), thus making it the third shipment.

This same royal order probably led to the fourth shipment, as the Lieutenant of the Nóvita province, Roque Ugalde, announced from Chocó the delivery of a shipment of approximately 149 pounds before October 25th, 1786, this being the date when the Governor of Chocó informed Viceroy Caballero of the latest situation regarding "white gold" (64)

This fourth shipment consisted of 6 arrobas, 4 pounds and 8 ounces. The approximately 5½ pounds not accounted for in Roque Ugalde's shipment could very feasibly have been the six pounds that Sorribo, the superintendent of the mint of Popayán, sent to the Viceroy archbishop on April 11th, 1787 (65). The fourth shipment must have left Cartagena in November 1787 since official transit documents were signed there on the 24th of that month (66), and on December 7th the shipment was received by Chabaneau in Madrid (67, 68).

In response to a letter from the Marquis of Sonora, in which he expressed Charles III's satisfaction with the first fruits of the discovery of the refinement method, Chabaneau wrote explaining the chemical process and giving an initial evaluation of costs and benefits (69). This reply, probably sent in April 1786 and read to Charles III on May 4th, may have been the key factor that resulted in a new order for platina being sent to the Viceroy, dated June 5th, in

which he requested “as many pieces as can be obtained”, which were to be used “in manufacturing a crockery for the King” (38).

Perhaps the founding of an establishment in Madrid specifically for platina refinement had already been proposed, since this could be expected to result in important economic benefits and scientific prestige for Spain. As mentioned



**Don José de Galvez, Marquis of Sonora
1729 – 1787**

An Andalusian of humble birth, he studied law in Alcalá and after practising in Madrid, he climbed the ladder of State administration. He aided the political Borbon renewal as General Visitor of Mexico. In 1776 he became Minister of the Indies, achieving an enormous working administration and fiscal reforms of Spanish possessions in America and the Philippines, emphasising free commerce between Spain and the Indies in 1778. At a technical and scientific level he supported scientific expeditions to the Indies. He planned to establish a royal platina monopoly in Spain

earlier, carrying out studies on platina was not to be a casual matter, but was probably part of a larger plan drawn up by José de Galvez for establishing a royal platina monopoly.

This new order for platina, together with the former request, constituted a turning point in the plans of the colonial authorities. To date, the platina shipped to Madrid had come not only from the mines but had also been collected from “fundiciones” or “castings”, which were Crown Property buildings where gold was smelted and assayed. Other amounts had come from “cajas reales” or “strongboxes”, which were secure places where the King’s share of gold as well as other items received as taxes, were stored. These quantities of platina were small, but the requests for it were also few in number.

From this moment onward continuous shipments of platina were urged, and therefore the collection and storage of the metal had to be organised; but there was one further difficulty. Madrid had been informed on various occasions in the past that the platina in New Granada was considered to be useless, and as a result, it was most unlikely that the authorities would now be willing to pay noble metal prices for it.

As a consequence of the former Royal Ordinances, on August 21st the Viceroy of Santa Fé ordered the Governor of Chocó, Carlos Smith, to amass as much platina as possible. Two means were proposed: (i) collecting it from those sites where it had traditionally been pitched, such as the “Quebrada de la Platina” (Platina Gorge) in the Nóvita province or from the Bogotá river in its passage through Santa Fé, using “trustworthy confidants” for this purpose, and (ii) extracting it from those mines in which it was found in the largest proportions. Furthermore, the Governor emphasised the need to act with discretion so as not to reveal the Spanish crown’s interest in the metal, since otherwise its value would automatically rise, and also that all platina obtained had to be paid for immediately but “without excessively burdening the Royal Treasury” (38).

The Governor of Chocó’s response to the Viceroy is dated October 25th. First he gave

assurances that no publicity had been given to the Viceroy's order:

"... having taken ... precautions with the miners involved in the matter. Given their background, I have decided not to give the issue any further public notice, nor publish a proclamation on this matter in order not to arouse or stir the curiosity of the proprietors, since this would only lead, given the present circumstances, to loss and not obtaining the ends proposed ..." (64).

Next, he indicated the means to be used for amassing the platina: (a) collecting it from smelting works and strongboxes and (b) making secret arrangements with important miners who were authorised to exploit the mines with a high platina content, on condition that it would be handed over to the Royal Treasury. Despite this, it appears that both the existing prohibition on the extraction of platina and the obligation to close any mine which produced it in abundance were maintained.

Here the pattern dictated by the Viceroy was followed. Furthermore, the working of private mines was proposed; gold-panning was authorised at sites which yielded a high proportion of platina, selling at two or three reales per pound. In such cases where the yields proved to be worthwhile, other mines could be leased out to the Royal Treasury. In any event, the activities of the mazamorreros (Indian or mulatto panners) would have to be resolved before hand.

The Governor considered that it would be difficult to recover the platina pitched into rivers and ravines, putting forward the opinion of "practical experts" who claimed that the platina would be mixed with "many mazamorras [sand and gravel sluice tailings] which supposedly exist in the waters". Other difficulties foreseen were getting agreement among the many mine owners as in the case of the N6vita Gorge, or the excessive distance to, and abandonment of, other mines, as, for example, the Opogod6 mine.

The Viceroy, in his response, recommended that the authorities should recruit mazamorreros for these purposes (70). On the other hand, he accepted the need to sign contracts with mine owners, agreeing to pay them 3 to 4 reales per pound of platina. With this modest increase in payment, as compared to that proposed by

Carlos Smith and to which Minister Galvez subsequently agreed, he aimed to motivate the miners to sell, not just the newly extracted platina, but also stored platina.

In spite of everything, however, these attempts were not very successful. Various excuses were made to the Viceroy. For example, Manuel del Sorribo Ruiz, superintendent of the Popay6n Mint responded that "there is not one sole mite of platina", alleging that the gold arrived there cast and marked, that is to say with the platina already removed (71).

While a large-scale platina storage system was being set up in the Viceroyalty of New Granada, albeit with relatively little success, Chabaneau travelled to Paris. The reason for this particular trip is found in a letter from the Marquis of Narros, Joaqu6n Maria de Eguia y Aguirre, Secretary to the Basque Royal Society. When sending two refined platina bars and a small platina coffee spoon manufactured in Vergara to the Marquis of Sonora, Aguirre remarked that according to Fausto de Elhuyar work on platina was being done in France and it would therefore be advantageous to send Chabaneau to Paris (72).

It may be that Chabaneau was interested in going to Paris, and so suggested to the Marquis of Narros that he should put this idea before Sonora. In any case, shortly afterwards Chabaneau proposed to Sonora that the Marquis of Narros should be appointed permanent director of the chairs of physics, chemistry and mineralogy at the Vergara Seminar (72). This occurred on February 17th, 1787, and was said to be in recognition of his contribution "to the important discovery of refining platina achieved by Nobleman Francisco Chabaneau" (73).

The probable motives underlying Chabaneau's trip were to learn what was known in Paris about platina, as well as to enable him to evaluate both the usefulness of the metal and the demand for it by scientists and jewellers; in other words a market study. This trip must not be considered as a private expedition, but rather as an integral part, once again, of the actions taken by the Spanish administration for the establishment of a royal platina monopoly. Chabaneau's travelling expenses were paid for - 3,000 reales being

drawn by Royal Ordinance of August 6th, 1786 (74) – and in Paris he presented himself to Ignacio de Heredia, who was in charge of Spanish commercial affairs (72); furthermore, during his stay Chabaneau introduced himself as the Spanish king's chemist (75).

Chabaneau left for Paris sometime in August 1786, taking with him excellent references from the Spanish Ambassador Pedro de Abarca – who was the Marquis of Aranda – and Ignacio de Heredia. While in Paris he met with Marc Etienne Janety (1739–1820), goldsmith to Louise XVI, who manufactured various objects from the forty-four pieces of platina that Chabaneau had brought. He remained there until the end of 1786, and delivered the pieces manufactured by Janety to the Marquis of Sonora early in 1787.

As a reward for having successfully refined platina, Charles III granted Chabaneau a pension for life, of one thousand reales “with the intention of having him settle in Madrid to refine the portions of the metal as they arrive” (76).

Furthermore, in response to his request of May 1786, Chabaneau was given more platina; specifically, “in January 1787 he is given in Madrid to take with him to Vergara ... 2 arrobas and 1 pound” (67). This was all that remained of the second platina shipment, and the third was not due to arrive until February 24th. Consequently, on January 17th of that year, the Viceroy of Santa Fé was ordered to ship quickly all the platina stored in the Viceroyalty's mints “given the urgency with which the metal is needed in Spain for the largest amount possible which can be collected of this precious metal” (76, 77). Moreover, he was requested to ship all the platina which could be acquired from the miners at Chocó and Barbacoas, authorising the Royal Treasury to pay fixed prices that had been agreed with the miners for platina, which at the very most would have been the same amount as that paid for silver.

The official note from Sonora warned that precautions should be taken to see that gold workings were not abandoned in favour of exclusively getting platina, since this would affect the taxes levied on gold; nonetheless, in the event of this

happening, he ordered that platina should be processed through the Royal Treasury using trustworthy workers and as economically as possible.

The metal was declared “to belong exclusively to the Royal Crown” and an order prohibiting the trade and export of platina was declared throughout the entire jurisdiction of the Viceroyalty.

The justification for the considerable amount of platina requested was the same as stated in previous official notes, that is for the manufacture of crockery for royal use and, in addition, a complete altar set for the Royal Chapel. This was the first official communiqué in which the authorities in the Viceroyalty were informed of the successful refining of platina, and of the intentions to set up a platina refinery in Madrid and a workshop where platina objects would be manufactured.

The ever increasing importance attached to the metal, as judged by the insistence with which it was requested, can be observed from one platina shipment order to the next. Hence the request made on December 21st, 1781, which generated the second shipment, stated:

“the King wishes ... the existing platina in this Viceroyalty to be shipped ... I inform Your Excellency of His Majesty's order so that it can be followed precisely” (49).

In the request for the third shipment made on March 3rd, 1786 we read:

“to serve the purposes proposed, I direct Your Excellency ... to immediately carry out this Royal Resolution, which should be conceptualised as of great interest to the state and to the Royal Service of H.M.” (38).

Finally, as noted above, in the Royal Order dated January 17th, 1787, it is indicated that

“this service is one of the greatest Your Excellency can do for the King in his government, who places his trust and confidence in the most exacting fulfilment of such an important assignment”

and, shortly afterwards, he insisted:

“I hope from the expected trust placed in Your Excellency and your devotion to provide the best of services that you shall not spare any means nor effort in carrying out His Royal intentions” (76).

The first action which was taken by the Viceroy archbishop, in response to the royal order, was

to appoint two miners as his commissioners and to instruct all governors, royal agents and superintendents of the mints in the Viceroyalty to comply with the resolution. Miguel Antonio Moreno for Chocó and Pedro Agustín de Valencia for Popayán were the two miners appointed on April 11th as commissioners for the storage and shipment of platina belonging to the Spanish king (78).

The Viceroy fixed the price of platina at eight reales per pound, and instructed the royal agents to draw the necessary money; furthermore, he requested information concerning the cost and output of metal extracted. Finally, he reminded them of the prohibition on the extraction of platina outside the Viceroyalty and the penalties imposed should anyone decide to do so.

Miguel Moreno, in his response dated June 7th, indicated the difficulties of assembling a large amount of platina quickly, explaining that it was only present in small proportions, as compared to gold (78). He therefore proposed working his own concession in the Quebrada de Opogodó (Opogodó Gorge), as it had a 70 per cent platina content.

Finally, he announced the shipment of six and a half arrobas of platina and "endeavouring to excuse the cost" said it had been amassed in a variety of ways, but it is the opinion of the author that the platina came from his own privately owned mines.

The Viceroy thanked him for the platina sent and requested him to continue. In addition, the Viceroy authorised a rise in the price paid for the metal to 12 reales per pound, in order to encourage the miners and mazamorreros to take greater care in extracting and delivering the metal (79). It is possible that on the same date he wrote to Pedro Agustín de Valencia, his commissioner in Popayán, reproaching him for not having sent platina and authorising him to raise the price to 12 reales per pound (80).

Manuel de Sorribo, from the Popayán Mint, responded to the official communiqué dated April 11th by repeating the arguments given in his earlier letter dated October 2nd, 1786: that he never had to separate impurities from platina since gold was never mixed when it

arrived there. Furthermore, he indicated, with a touch of irony, that it was not easy to find platina in Popayán owing to the orders prohibiting its trade and exportation, and the fact that the agents of the law as well as the miners did their utmost to ensure these orders were honoured. In spite of all this, he enclosed six pounds which he had obtained at a price of seven reales per pound (81).

Other communiqués about the collection of platina, on March 28th, 1786, June 5th, 1786 and in January 1787, were not appreciated by the recipients, who perceived that the new metal was a potential source of income, because of the requests for it from Europe. For this reason they tried to make the implementation of the official instructions as difficult as possible.

This was precisely the case in Popayán, where royal officials sent representatives to the Viceroy on April 17th, 1788 – practically a year after the enforcement of the last royal order – to discuss the legality of the free market in platina by individuals, as had been carried out previously, given the value of the metal (82). This explicit petition justified the prohibition in that

"we do not dare to go further in the matter to thereby avoid critique and competences which at each step are being fostered pleading privileges and imaginary exemptions from obligations".

The Viceroy instructed the governor to make a public proclamation prohibiting any type of trade in platina or even its possession, and necessitating its sale to the Treasury at 2 pesos per pound (83). Another edict concerned the need for vigilance to avoid possible frauds:

"I am forewarning your worships about the frauds which are concocted in this field by individuals, and you are to inform me immediately about the slightest movement which may cause detriment to and delay the storage of this metal ..." (84).

In spite of the precautions taken, Viceroy Caballero y Góngora was dubious about their effectiveness. This is precisely what was indicated in a letter addressed to the Marquis of Sonora on July 14th, 1787 (85), where postscripts, appearing at the end of several paragraphs, suggest

reconsideration and are crossed out in the corresponding draft copy:

“... I feel it is more ... from the interest that the miners have in [not] working H.M. mines than for carrying out the service. Proof of this is that he [Moreno] himself has not begun to work the Opododó mine, which ... is abandoned and I cannot persuade myself otherwise that it be for any other reason than because the King has not ventured inside. I know the character of the miners and I totally mistrust them. These may be nothing more than conjectures which do not impede taking advantage of the activity of said commissioner and his knowledge of the province”.

As the Viceroy foresaw and in spite of all his actions, the only platina obtained was that men-



Juan José de Elhuyar
1754 – 1796

A student of Rouelle in Paris and member of the Basque Society of Friends of the Country. He undertook a study trip which took him to central and northern Europe. In Upsala he studied with Bergman, and on his return to Spain he isolated metallic tungsten from tungstic acid in collaboration with his brother Fausto. Minister Galvez sent him to New Granada in 1783 to improve the mines. Informed of the method of purifying platina by Fausto he tried unsuccessfully to set up a factory in New Granada to purify it

tioned earlier, which presupposes a complete failure considering the large quantities requested. Other means were now necessary.

An Attempt to Refine Platina in New Granada

The pitiful state of mining in New Granada at the beginning of Antonio Caballero's administration as Viceroy prompted his request for specialised personnel, such as the German miners who had been employed in the past (86). In response to this petition, the Minister of the Indies, José de Galvez, gave the task to Juan José de Elhuyar who was to be assisted by his brother-in-law, Angel Díaz.

When J. J. Elhuyar was transferred to the Secretary of the Indies, Minister Galvez, his superior, who knew of his metallurgical background, commissioned him to improve the method of smelting silver, since the system of amalgamation then in use was extremely costly. In addition, he was expected to teach metallurgical techniques to the miners. These circumstances were to present an opportunity to establish a platina processing plant in New Granada which, if successful, would have enabled the metal to be sent to Spain in a refined malleable state. As will be shown, however, the attempt was unsuccessful.

As mentioned earlier, following the first refinement of platina in Vergara by Chabaneau and Fausto de Elhuyar, the latter wrote to his brother on March 17th, 1786, describing in great detail the procedure used in order that the same methods could be tried in New Granada.

“As advances are made, I will give you news about the results; it may prove befitting that with this information you carry out some experiments for the purposes of beginning to prepare your planning of a factory in that country; even though a less expensive method be discovered, this one will undoubtedly serve you ...” (59).

The official nature of the platina refining operation developed in Vergara and, very possibly, the subsequent intention to create a royal monopoly, explains the secrecy with which everything was carried out. In response to a question from Minister Galvez, Chabaneau indicated that he alone had been informed of the method developed by Fausto de Elhuyar (69); at the same

time, however, Fausto admitted that his brother Juan José was also familiar with the method. It is within this context that the letter written by Fausto de Elhuyar to his brother Juan José on May 19th, 1786 should be read. In this he urged absolute silence with regard to the procedure:

“My response has been ... that I have already provided you with part of it [the method] for the purpose of, should you have large quantities of the metal available, you could carry out studies, yet at the same time I have informed the Minister that I would forewarn you not to do anything until receiving his express orders” (87).

With the information supplied to him by his brother Fausto, and in spite of the Minister Galvez's prohibition, J. J. Elhuyar planned to refine platina in New Granada. Therefore he requested that the Viceroy should ask the Governor of Chocó to send him five arrobas of platina “to carry out a series of tests using the recently discovered procedures” (88).

Before the Viceroy responded to this petition, the official communiqué dated June 5th, 1786 arrived requesting shipment of the largest possible supply of platina. In his response on August 6th, he mentioned the request made by J. J. Elhuyar for platina for refinement in America:

“offering me with this desirable opportunity to present to Your Excellency, from the very kingdoms from which it is born, refined and workable, this new fruit from your rich possessions” (38).

The Viceroy's offer was rejected by Madrid on January 25th, 1787 (89), possibly because the Platina Laboratory had already been founded in Madrid, and, of course the volume of platina was very meager as compared to silver and gold. Another reason why the request was rejected could have been to restrict the activities of J. J. Elhuyar who had acted without authorisation on previous occasions.

Yet, in contradiction to this Elhuyar was ordered to collaborate with the Viceroy, if necessary, “In order to recognise and put into work and benefit the entire Nóvita region and others in Chocó wherever the metal is found”.

Fausto de Elhuyar was not the only person who had informed his brother Juan José about platina refinement in Vergara. In addition to the official information which arrived in the

Viceroyalty, José de Eizmendi, chaplain to the Royal Basque Patriotic Seminary of the Basque Society of Friends of the Country, wrote to J. J. Elhuyar on August 12th of the same year with very different intentions. In addition to giving him news of Chabaneau's discovery Eizmendi told Elhuyar that on his trip to Paris Chabaneau had taken several platina ingots and also a certain amount of steel-platina alloy to be used for making pieces of jewellery for the King.

The main purpose of this letter was to tell J. J. Elhuyar that, following the success of the mining process, demand for platina was likely to increase substantially so it would be an excellent business proposition to store platina. Eizmendi therefore invited J. J. Elhuyar to send Chabaneau one hundred quintals of platina before Christmas 1786, since by then news of the refinement would be well known and a “hunt for platina” would result (90).

When J. J. Elhuyar did not respond, Eizmendi wrote to Pedro Diago, royal agent for Honda, asking him to intercede with Elhuyar with regard to his intentions and to find out if he had tried Chabaneau's method of refining. Although Diago wrote to Elhuyar (91) nothing more is known, so it is likely that any attempts to refine platina were unsuccessful. This is not the only known contact made by Eizmendi regarding platina, since in 1787 Pedro Manuel Chaparro, chief engraver (*tallador mayor*) for the Santiago de Chile Mint, sent him a metal sample for analysis and to verify if it was platina (92).

Although J. J. Elhuyar did not specialise in the refinement of large quantities of platina, we know that on several occasions he was involved as an expert in matters relating to the new metal. In 1795, at the request of Pedro Diago, he successfully refined a bar of gold mixed with platina (93). This incident was recalled in 1800, after J. J. Elhuyar's death by Pedro Mendiñeta, Viceroy of New Granada, when a similar problem could not be resolved (94). In addition, in 1795, J. J. Elhuyar wrote a descriptive report on the separation of gold and platina, as well as on the means for preventing frauds with gold (93, 95). Thus ended the second phase in the attempts by the Spanish authorities to establish a monopoly in platina.

References

- 58 L. F. Capitán Vallvey, "The Spanish Monopoly of Platina", *Platinum Metals Rev.*, 1994, **38**, (1), 22–31
- 59 Letter from F. de Elhuyar to J. J. de Elhuyar, Vergara, 17.03.1786. Papers belonging to Mutis, copied by F. Gredilla, see Ref. 86, p. 161
- 60 Archivo General de Indias, Santa Fé, leg. 835, 17.07.1786, Galvez to Caballero, f., 160r
- 61 Archivo General de Indias, Lima, leg. 1108, 18.12.1786, Galvez to Escobedo
- 62 Archivo General de Indias, Santa Fé, leg. 835, 17.07.1786, Royal Officials from Santa Fé to Galvez, f., 159r
- 63 Archivo General de Indias, Santa Fé, leg. 835, 17.07.1786, Galvez to Royal Officials from Santa Fé, f., 180r
- 64 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 25.10.1786, Smith to Caballero, ff., 820r–821v
- 65 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 2.06.1787, Sorribo to Caballero, f., 855rv
- 66 Archivo General de Indias, Santa Fé, leg. 835, 24.11.1787, Royal Officials from Cartagena to Galvez, f., 186r
- 67 Archivo General de Indias, Santa Fé, leg. 835, 18.03.1789, Nota de la platina recibida (*sic*) y entregada por D. Francisco Chavaneau, ff., 196r–197r
- 68 Archivo General de Indias, Santa Fé, leg. 835, 6.12.1787, Acuse de recibo de platina de Chabaneau, f., 191r
- 69 F. Yoldi Bereau, "El aislamiento del platino y el Real Seminario Patriótico de Vergara", *Anales R. Soc. Esp. Fis. y Quim.*, 1945, **41**, 193–200. Yoldi transcribes an undated letter from Chabaneau to Galvez relating to platina purification. This letter was not found by the author of this article even though Yoldi asserted in the article that this letter was in the Archivo General de Indias but without specifying exactly where. In the margin of this letter a note indicates that it was read to Carlos III on 4th May 1786
- 70 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 26.12.1786, Caballero to Smith, f., 877rv
- 71 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 2.10.1786, Sorribo to Caballero, f., 818rv
- 72 Archivo General de Indias, Santa Fé, leg. 835, 18.03.1789, Resumen del extracto del expediente de la platina, ff., 5r–7v
- 73 L. Silvan, "Los estudios científicos en Vergara a fines del siglo XVIII", 2nd ed., San Sebastian, 1977, pp. 100 and 109
- 74 Archivo General de Indias, Santa Fé, leg. 835, 18.03.1789, Nota de los gastos ocasionados con motivo del nuevo establecimiento de la R. Fabrica de Platina, ff., 193r–195r
- 75 V. Salzas Malibrán, "Noticias sobre la platina" (1804); in V. Restrepo, "Estudio sobre las minas de oro y plata de Colombia", 2nd ed., Bogotá, 1888, pp. 77–83
- 76 Archivo General de Indias, Santa Fé, leg. 835, 17.01.1787, Galvez to Caballero, ff., 172r–173r
- 77 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 17.01.1787, Galvez to Caballero, ff., 803r–805r
- 78 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 2, 7.06.1787, Moreno to Caballero, ff., 850r–851r
- 79 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 2, undated manuscript due to damage, probably between 7.06.1787 and 14.07.1787, Caballero to Moreno, f., 853r
- 80 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 2, undated manuscript due to damage, probably between 7.06.1787 and 14.07.1787, Caballero to Valencia, f., 852r
- 81 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 2, 2.06.1787, Sorribo to Caballero, f., 855rv
- 82 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 17.04.1788, Royal Officials from Popayán to Caballero, f., 871rv
- 83 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 17.06.1788, Caballero to Popayán Governor, ff., 872v–873r
- 84 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 17.06.1788, Caballero to Royal Officials from Popayán, f., 874r
- 85 Archivo Histórico Nacional de Colombia, Cauca Mines, Vol. 5, 14.07.1787, Caballero to Galvez, ff., 857r–858v
- 86 F. Gredilla, "Biografía de D. Jose Celestino Mutis", Madrid, 1911, p. 147
- 87 Letter of F. de Elhuyar to J. J. de Elhuyar, Paris, 19.05.86 Documents belonging to J. C. Mutis. Transcribed by F. Gredilla, *op. cit.*, (Ref. 86), p. 162
- 88 Archivo Caycedo, between September 1785 to July 1786, J. J. Elhuyar to Caballero, see (i) B. J. Caycedo, "The Life and Times of Juan Jose d'Elhuyar Discoverer of Tungsten in 18th Century New Granada", Coronado Press, Lawrence, Kansas, U.S.A., 1981, p. 127. Also (ii) B. J. Caycedo, "Elhuyar y el siglo XVIII neogranadino", Bogotá, 1971, pp. 139–140. Also (iii) J. M. Lopez de Azcona, "Los hermanos Elhuyar, descubridores del wolframio 1782–1783". Madrid, 1983, pp. 47–51
- 89 Archivo General de Indias, Santa Fé, leg. 835, 25.01.1787, Galvez to Caballero, ff., 176r–177r
- 90 Archivo Caycedo, 21.08.1786, Eizmendi to J. J. Elhuyar, *op. cit.*, (Ref. 88), (i), p. 129
- 91 Archivo Caycedo, 21.05.1787, Diago to J. J. Elhuyar, *op. cit.*, (Ref. 88), p. 130
- 92 Archivo General de Indias, Santa Fé, leg. 835, 9.04.1802 Portales to Soler, f., 582r
- 93 *Op. cit.*, (Ref. 88) (i), p. 267
- 94 Archivo General de Indias, Santa Fé, leg. 835, 19.03.1800, Mendinueta to Soler, f., 498rv
- 95 V. Restrepo, "Estudio sobre las minas de oro y Plata de Colombia", 2nd ed. Bogotá, 1888, pp. 243–245