

MINING IN THE MOUNTAINS: THE DEVELOPMENT OF AERIAL ROPEWAYS ON THE IRON MINES AROUND THE CANIGOU MASSIF (PYRÉNÉES-ORIENTALES, FRANCE)

MINERÍA EN LAS MONTAÑAS: EL DESARROLLO DE CABLES AÉREOS EN LAS MINAS DE HIERRO DEL MACIZO MONTAÑOSO DE CANIGOU (PIRINEOS ORIENTALES, FRANCIA)



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ABSTRACT

The introduction of the Bessemer process for bulk steel production created an increased demand for low phosphorus iron ores. Mines around the Canigou massif (Pyrénées-Orientales, France) had supplied such ores since late prehistory, latterly for the advanced charcoal-fired bloomeries used in the Forges *Catalanes*, but large scale exploitation was held back by the lack of adequate transport links. The introduction of aerial

ropeways at the turn of the 19th century, linked to mainline railways in the principal valleys, resulted in a dramatic increase in production. But where did the investment for this innovation come from? Was it from the Catalan *maîtres de forges*, or from external sources linked to the developing iron and steel industries based on or close to the coalfields?

Key Words: France Iron Mining Ropeways Transport

RESUMEN

La introducción del proceso Bessemer en la producción de acero bruto originó un incremento de la demanda de minerales de hierro con bajo contenido en fósforo. Las minas de la zona del macizo de Canigó (Pirineos Orientales, Francia) habían abastecido de estos minerales ya en la Prehistoria; posteriormente para los hornos de carbón vegetal empleados en las Forjas Catalanas, pero la explotación a gran escala no se consiguió por la falta de adecuadas opciones de transporte. La aparición de los cables aéreos a finales del siglo XIX, permitió

la conexión con las líneas de ferrocarril de los valles principales, produciéndose entonces un vertiginoso incremento de la producción. Pero, ¿de dónde procedió la inversión necesaria para esta innovación? ¿Fue de los maestros de las forjas catalanas, o de capitales externos relacionados con el auge de las industrias basadas en el hierro y el acero o de los yacimientos de carbón?

Palabras clave: Cables aéreos en la minería del hierro francesa

Introduction

The iron ores of the French department of Pyrénées-Orientales had been worked since the late Iron Age and, up until the late-19th century, had supplied the advanced charcoal fired bloomeries of the *Forges Catalanes*. Production of iron by this means was limited in scale. Utilising local woodland for fuel, it could not develop to supply an expanding industrial economy, but the rich ores found around the Canigou massif and in the mountains to the north and west of the department were too remote to justify movement untreated over any distance until improved transport techniques were developed in the mid to late 19th century. It was not until railways were developed from the coast, west along the narrow valleys of the Tech and the Têt, that there was any prospect of large scale iron mining. There still remained the problem of bringing the ore out of the high mountains to the railways and the investment needed to overcome that problem came, not from the Catalan *maîtres des forges* (forge masters) but from outside the department, initially from individuals with unclear connections to iron working and, later, from the developing iron and steel industries. It was they who appreciated the qualities of the low phosphor iron ores of the Pyrénées-Orientales for bulk steel production¹.

In the latter half of the 19th century the demand for iron ores changed dramatically with the development in Britain of bulk steel processes, the Bessemer converter and the later Siemens open hearth. Initial failures restricted production to that using low phosphor ores. It was not until 1879 that the development of the basic lining, the Gilchrist-Thomas process, allowed the use of high phosphor ores, and it was quickly adopted by the French and German steel industries. The

British, on the other hand, continued to prefer low phosphor ores².

The early Bessemer bulk steel process in Britain initially utilised local ores, principally hematite from the north-west and manganese-rich carbonate ores from the south-west of England³, but demand quickly outstripped local resources and the industry came to rely to a large extent on imported ores. These came primarily from Spain⁴. The rich ores of the Pyrénées-Orientales department in France were not initially attractive due to the limited available transport facilities. Although they lay within 50 kilometres of the coast they were found in mountainous terrain. The most extensive deposits were in the Cambrian limestones around the granite massif of the Canigou, or in the far west of the department at Puymorens close to the border with Andorra. In the Agly valley, in the north of the department, there were also deposits of low phosphor ores, albeit not rich in manganese, in the area around Saint-Paul-de-Fenouillet.

With the development of the Gilchrist-Thomas basic steel making process in 1879 allowing the use of ores which were high in phosphor, the French were able to exploit the vast deposits of low grade 'minette' ores found in the north-east of the country. Despite that, the ores of the Pyrénées-Orientales were not ignored. Charcoal fired blast furnaces had already been established at Ria, near Prades, in the Têt valley in 1858. Additional blast furnaces were subsequently opened in the area around Prades, with a total of five in place by 1881, some of which operated on a mixed fuel (charcoal and coke) but all production ceased after 1885 and no bulk steel production was established⁵. These furnaces could draw on iron ore resources at relatively low levels, around Taurinya and Fillols, on the northern slopes of the Canigou. And it was these deposits which attracted



the first external investment with the establishment of the *Société des mines de fer de Fillols* with Belgian financial backing in 1875, initiated by the railway entrepreneur Simon Philippart⁶.

Small quantities of ore from Pyrénées-Orientales did reach iron works, predominantly Forges Catalanes, in adjoining departments and parts of Spain prior to the late 19th century but it was the arrival of main line railways which made them available to a wider market. The railway down the Mediterranean coast towards the Spanish border reached the harbour at Port-Vendres in 1868 and by the late 70s, after a number of false starts, had reached Prades in the lower, open part of the Têt valley. It took much longer for a railway to be constructed further up the Têt and up the narrow Tech valley to the south of the Canigou, and it did not reach Arles-sur-Tech until 1898.

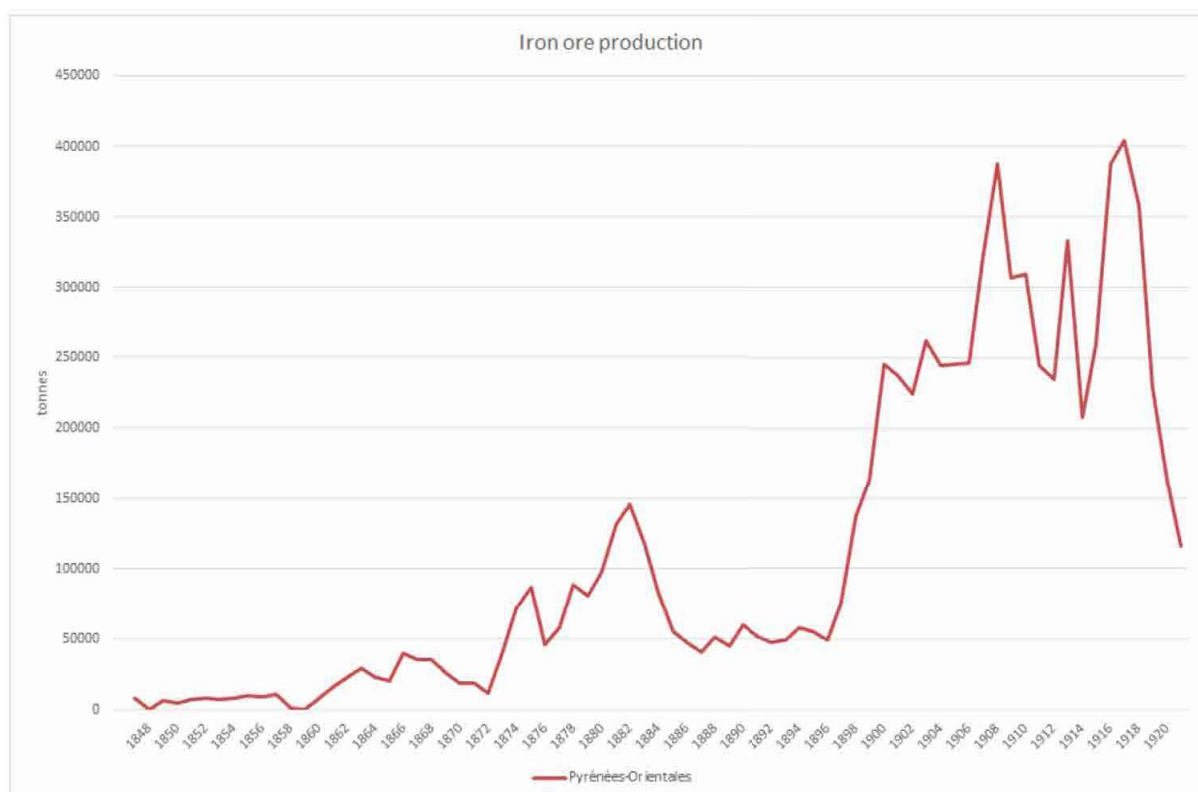
The developments at Fillols in the 1870s were linked to the arrival of the railway in Prades with a view to supplying iron and steel works in the southern part of France, particularly in the Rhone valley. Works such as those at Alès (then spelled 'Alais') where, over the next sixty years, the *Compagnie des mines, fonderies et forges d'Alais* would have a close connection with the mines at Fillols. Whilst early railway development favoured the lower mines to the north of the Canigou massif, it was the higher deposits to the south and east which had the greater production potential but it took a further twenty years to get the railway within reach of those mines.

By 1905 new bulk loading facilities were in place in the harbour at Port-Vendres⁷. All that remained was to establish efficient, low cost means of getting bulky iron ore cargoes out of the high mountains to the main line railways, and thence to Port-Vendres, for Pyrénées-Orientales to make a contribution to supplying the steel industry in Britain as well as that in France.

Transport systems

Prior to the late 19th century, the transport of ores relied primarily on pack horses and some carts. The mountainous terrain did not favour the building of tramways. Abundant charcoal supplies also meant that many of the Forges Catalanes were established close to the ore sources⁸.

The first serious attempt at a bulk transport system was the erection of a continuous chain funicular tramway linking the mine at Salve, near Taurinya, to the main-line railway at Prades by 1890. This was not innovative technology, continuous chain systems had been in use since the early years of the century, and the altitude of the mine at Salve was not great, 250metres above the level of the railway at Prades, but the distance travelled was perhaps unique at around six kilometres. In the 1890s an aerial ropeway of unknown type, using wooden structures, was in use at Batère, on the southern slopes of the Canigou, and by 1899 work had commenced on a larger system, nine kilometres in length, linking that mine to the newly opened railway at Arles-sur-Tech¹⁰.

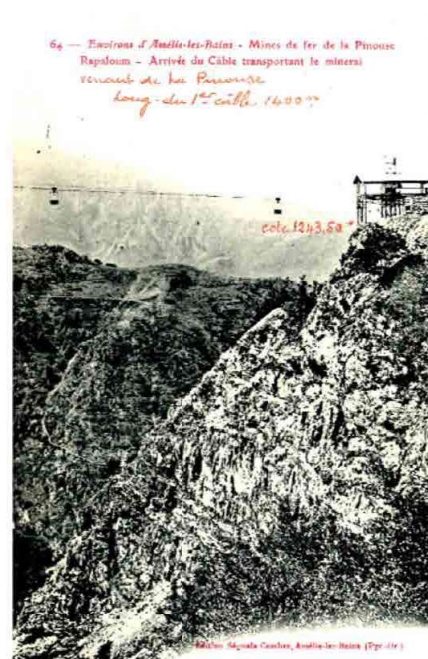




In 1909, after three years in construction, a more complex system involving two aerial ropeways and a 12 km long high altitude narrow gauge railway was opened to link the iron mine at La Pinouse, 1500 metres high on the inaccessible eastern slopes of the Canigou, with the main line railway in the Tech valley at Amélie-les-Bains, 220 metres above sea level (Figure 3). This, and the earlier installation at Batère, appears to have been the first applications of aerial ropeways to mining in Pyrénées-Orientales but came some decades after their first use on mines in the Pyrénées as a whole. The concept of aerial ropeways had been around since at least the Post-Medieval Period but it was not until the development of twisted steel wire ropes in the 1850s that practical systems were possible¹¹. They were increasingly applied to mining from the 1860s onwards and the zinc mines at Sentein (Ariège) in the mid-Pyrénées introduced a system some 2.8km long, with a descent of 1000 metres in 1879¹².

There are two basic aerial ropeways types - the single-rope system, where the buckets are

supported and moved by the one wire rope, and the double-rope system, where the load is supported on a fixed rope and a second, lighter rope is used to move the buckets. The latter system was generally preferred where heavy loads were expected and, although of a more complex nature, achieved a high degree of efficiency¹³. The double-rope system was used at Batère. It was also chosen by Messrs Valentin Frères for La Pinouse and was erected by Bleichert of Leipzig, one of the leading manufacturers of aerial ropeways at that period. Valentin Frères had taken over the concessions for La Pinouse and Palalda, and for Velmanya, in 1906 and, focussing on the working of the former, commenced construction of the transport system immediately. Ore from the upper parts of the mine at La Pinouse was trammed out of the lowest level into massive ore hoppers above the top station of the first aerial ropeway, at 1350 metres above sea level. From there the ropeway crossed a spur of high ground before descending to a discharge station at Rapaloum, at 1243.50 metres above sea level and 1.4 km to the north-east (Figures 4 and 5). Ore was discharged into a second set of ore





hoppers for transfer to 4 tonne wagons on a 750mm gauge railway, powered by steam locomotives and generally following the contours but descending 200 metres in its 12 km route, to a terminus at La Redoute. There the ore was discharged into a third set of hoppers feeding the top station of the second ropeway which descended 900 metres over 4.5km to the railway at Amélie-les-Bains, with an intermediate station at Can Kire. Ore from the fourth set of hoppers at Amélie-les-Bains was transported by Compagnie du Midi railway wagons to the immense storage hoppers at Port-Vendres for transfer to shipping destined for steelworks of Schneider & Co in France, those on the Rhine in Germany, or British steelworks, of which that of the Ebbw Vale Steel, Iron and Coal Co. in South Wales was evidently the principal destination¹⁴. The ropeways were capable of moving 50 tonnes

per hour and generated a surplus of electricity. A secondary source of power was a small hydro-electric station located in the valley immediately below La Pinouse¹⁵.

Later modifications to the transport system included an extension of the narrow gauge railway south from Rapaloum to the mouth of a cross-cut into the lower part of the La Pinouse mine at Roque Jalère, at 1250 metres above sea level. This had been completed by 1914¹⁶. At Les Manerots, 1.5km east of Rapaloum, a water-balanced incline was installed to lift spathic ore from an open-work below the level of the narrow gauge railway (a deposit which had been found during the construction of the railway)¹⁷. The spathic (carbonate) ore required roasting to increase its iron content and reduce its weight before shipping,



and furnaces (*four de grillage*) were installed here and at Le Redoute for that purpose. In 1915 the three concessions were acquired by Schneider & Co. who formed a separate operating company, the *Société Anonyme des Mines de la Pinouse*, contributing significantly to the production of hematite steel during the First World War¹⁸. By the early 1930s La Pinouse had ceased production as a separate entity, having been absorbed in the concessions of the Société de Batère, and worked through a direct connection underground to that mine, with the ore being transported by the aerial ropeway to Arles-sur-Tech¹⁹.

Aerial ropeways became the standard mode of transport between the iron mines of Pyrénées-Orientales and the railways in the valleys. They radiated around the Canigou massif and those linked to Batère and Escaro continued in use until well into the second half of the 20th century. When a new concession was granted for Planèzes, Agly valley, in 1917 a new aerial ropeway was erected to link the mine to near Mas Amiel, on the railway between Rivesaltes and Saint Paul. The pylons and associated installations were constructed of wood as steel was in short supply during the First World War²⁰. The last ropeway to be constructed was probably that serving the mine at Puymorens in the far west of the department. It was not until the Trans-Pyrénées railway reached Puymorens in 1929 that it was possible to send ore from that mine in bulk north into Ariège²¹. By that date the pattern of investment for transport out of the mountains was well established, it came through the companies operating the mines.

Investment

As noted above, there was significant external investment in the iron mines at Taurinya and Fillols in the 1870s. Philippart's background in the promotion of railways in Belgium and northern France, linked to the opening up of the coalfields there and the market for coal in the expanding iron and steel industry, will have had a bearing on his interest in the iron resources within Pyrénées-Orientales. It will have influenced his acquisition of the concession and the subsequent formation of the *Société des mines de fer de Fillols*, but his subsequent bankruptcy has masked any continuing personal interest in the operation of that company²².

While Philippart provides the first evidence of external investment others were to follow as the mines of the department became more accessible. However, even as late as 1901, the earliest date at which comprehensive details on the ownership and operating companies for mining concessions are available in France, many in Pyrénées-Orientales remained in the hands of individuals who might be linked to *maîtres de forges*²³. Their continuing involvement is also masked by the manner in which mining was regulated. Not all iron workings were subject to a grant of a mining concession by the state. After 1810 workings less than 30 metres from surface, referred to as *minières*, unlike the deeper workings, the *mines*, were not subject to state control. Many iron workings in Pyrénées-Orientales fell into that category – until 1868 there were no active deep mining concessions, but the

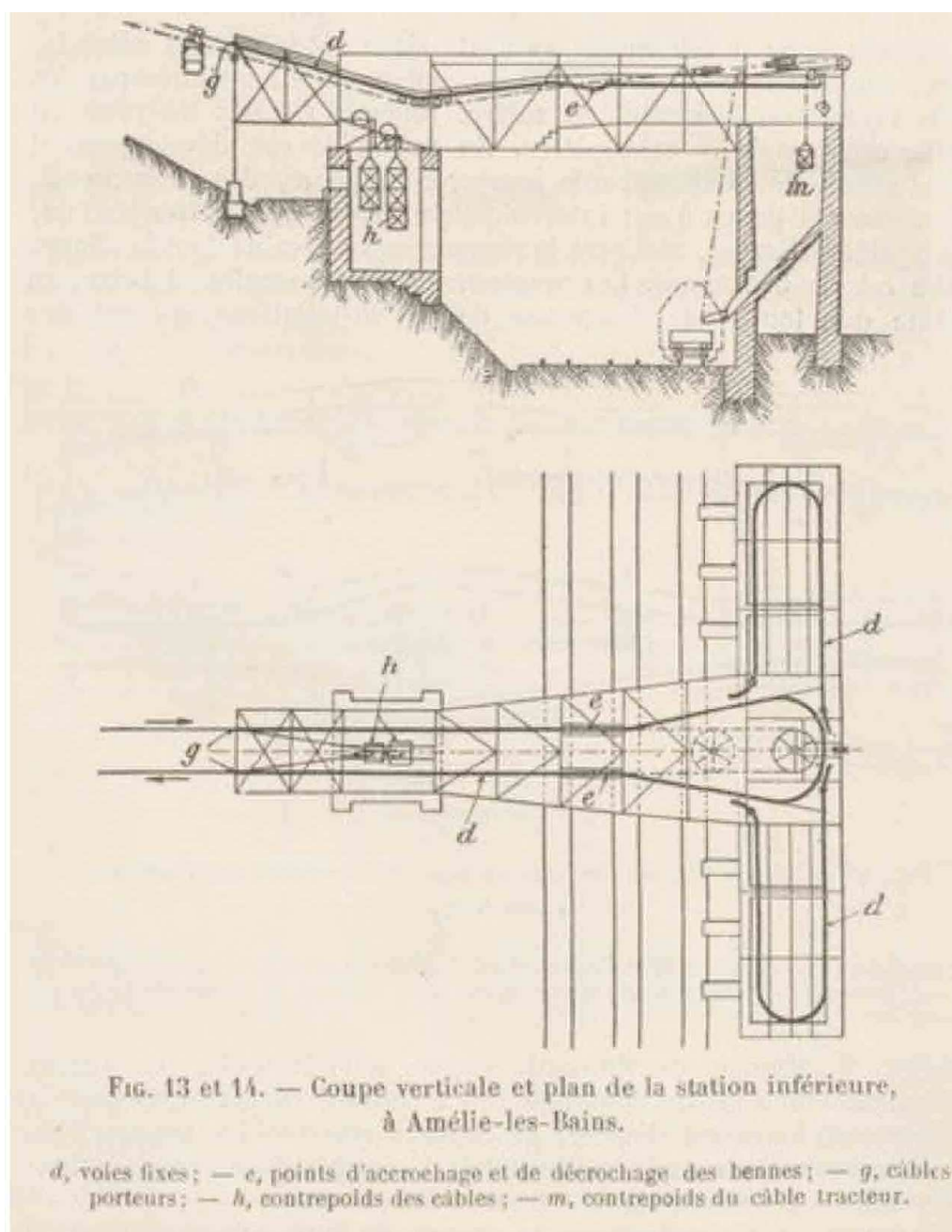


number of minières varied from around nine up to as many as nineteen, and at the turn of the century they were still making around a 10% contribution to total iron ore production for the department. The large mines of the Agly valley continued to operate as *minières* until well into the 20th century, Planèzes being the first to be worked as a deep mining concession.

From 1901 iron and steel making companies from across France appear increasingly as owners or operators of iron mining concessions in Pyrénées-Orientales – companies such as *Société anonyme des fonderies et forges de Crans* (Haute-Savoie), *Société anonyme des hauts fourneaux de Pauillac* (Gironde) and Schneider & Co (based in Le Creusot). Schneider had only one, largely inactive mine at Saint Vincent in the early years of the 20th century but

were to become a major consumer of iron ores from the department as the century progressed²⁴.

By the late 1890s the name of Joseph Pierre Monin appears in connection with the mines later known as Batère²⁵. Described as a mining engineer, living in Paris, he had acquired the concessions for a number of small mines on the southern slopes of the Canigou, in Corsavy and adjoining communes, in the late 1890s. These were united under the title Batère and, by 1908, were controlled by the *Société civile de Batère*²⁶. This company evidently had a close working relationship with the *Société de Commentry, Fourchambault et Decazeville*, a long established iron and steel producer. What Monin's role in the linkage between the mine at Batère and that company is unclear but, as described above, he was instrumental in erecting the first of the aerial ropeways in the department.





In 1906 another new name appears in the *Statistique de l'industrie minière* amongst the owners of iron mining concessions – Messrs Valentin Frères (Valentin Brothers), sometimes described as being from Alsace in the north-east of France, later joined by Louis Belavoine, took over the concessions for La Pinouse and Palalda from individuals linked to interests in the *Forges Catalanes* and obtained that for Velmanya after the operating company went bankrupt²⁷. What is more, they had evidently seen the potential for exporting iron ores from Pyrénées-Orientales to the wider market before they invested in the mines themselves. The Valentins had formed the *Société d'Embarquement de Port-Vendres*, with an office in Paris, well before 1905 and by that date had established sophisticated facilities in the only deep

water port serving the mines in the department. These were capable of loading a ship at a rate of 1500 tonnes in 24 hours (rising to 2000 tonnes in 10 hours by 1909), with four (later increased to nine) storage hoppers holding around 4000 tonnes each²⁸.

Their experience at Port-Vendres ensured that investment was made not just in the mines themselves but also in the transport infrastructure. The mine at La Pinouse was linked to Amèlie-les-Bains by the aerial ropeway system described above, whereas Palalda utilised self-acting inclined tramways²⁹. When, in 1914, Schneider & Co. were considering their options for securing a regular supply of manganese-rich low-phosphor iron ores for steel production using the acid process, they looked at investing in the mines operated by the



Valentins, those at Aytua (close to Escaro on the north-west slopes of the Canigou), or the relatively under-developed mines at Puymorens in the far west of the department. That they chose to purchase the mines at La Pinouse, Palalda and Velmanya was testament to the sound investment in their infrastructure by Valentin Frères – ironic, as the bankruptcy of the previous operating company for Velmanya can be credited to insurmountable difficulties in transport. As to how they, the Valentins, financed their investment in the transport infrastructure between 1906 and 1909 is another matter – the subject for further research.

Summary

This is very much a work in progress. It is not just ‘mining history’, it is also archaeology requiring an investigation of the field evidence (the material culture), and it is intimately linked to the industry which consumed the products of the mines, the iron and steel industries of Britain and France. It continues work started over ten years ago but draws on new research as well as that of other researchers³⁰. Having been introduced to the breath-taking landscapes of iron mining in the Pyrénées-Orientales in connection with another line of research this has provided for a fascinating study with benefits from exploring new sources and new locations across France³¹.

It is too early to draw definitive conclusions but the evidence indicates that the investment for the development of effective transport for iron ores based on the use of aerial ropeways came from within France but from outside the Pyrénées-Orientales. This was despite the ores having a market much wider than the French iron and steel industry, particularly in Britain. The British were already investing significantly in Spanish iron ore

production and were not averse to investing in French metal mines but that was confined largely to the non-ferrous sector. There were a few British ventures into iron mining in the south of France, for example the Maurian Iron Mines Ltd. at Saint Gervais (Hérault)³² and Praca implies that there was an English interest in Fillols (Pyrénées-Orientales) prior to 1873³³, but nothing of any substance.

Contrary to initial expectations the operating companies linked to iron and steel making did not initiate the investment in aerial ropeways. That came from individuals, one group of which, Valentin Frères, had no clear link to iron working. The role of Joseph Pierre Monin, the concession holder for Batère and its constituent mines, who installed the first ropeway, is equally unclear³⁴.

It is evident that Valentin Frères had the foresight to invest in an effective transport infrastructure. Although not the first application of aerial ropeways in Pyrénées-Orientales, that honour appears to go to Batère, theirs was the more complex and has the added benefit in that it was not modified to any great extent before it was abandoned and the physical evidence survives on the ground. This allows for interpretation using the well documented accounts of the system in use. Batère, on the other hand, was the last iron mine active in the department and its aerial ropeway was upgraded over time and, although much of the last system survives at the bottom station in Arles-sur-Tech, most of the upper sections are now lost due to remediation on the mining site.

In a sense, despite drawing on work begun over ten years ago, this research is very much in its infancy. There are archives yet to be visited across France, from Roubaix in the north to Alès in the south, and many hours of fieldwork still to be carried on and around the Canigou massif – a prospect not without its pleasures.

Footnotes

- ¹ The ores were primarily carbonates (spathic) ores but, around the Canigou in particular, these had weathered to a high grade hematite - Rapport BRGM R.40712 p. 9
- ² See Claughton, 'New Techniques, New Sources', for more detail
- ³ The manganese content was recognised as a valuable deoxidising agent.
- ⁴ See Claughton, 'New Techniques, New Sources', p. 287, Fig. 2.
- ⁵ Statistique de l'industrie minière, 1858 et seq. There is, however, the suggestion that the Ria blast furnaces were later reactivated and operated up until the 1930s (Izard, Cartographie successive des entreprises métallurgiques, p. 124)
- ⁶ Kurgan – van Hentenryk, Rail, Finance et Politique, p. 267
- ⁷ ADPO 165J/199 - letter from the Société d'Embarquement de Port-Vendres to the director of the mines at Fillols, dated 6 March 1905.
- ⁸ Izard, 'Cartographie successive entreprises métallurgiques, p. 127.
- ⁹ Cathala-Pradal et al. Taurinya, p. 35
- ¹⁰ Cortsavi Sempre: Mines et Forges.
- ¹¹ Schneigert, Aerial Ropeways and Funicular Railways, pp. 1-16
- ¹² Dubois, Un patrimoine industriel menacé et méconnu
- ¹³ The Engineer, Jan 15, 1915, p.53
- ¹⁴ Like most British steelworks, Ebbw Vale relied primarily on ores imported from Spain but, from 1907 onwards, were seeking to secure an iron ore source of its own. At which period it was consuming around 10,000 tons of ore per week. As it turned out, that did not happen until 1920 and the mine chosen was at Irthlingborough in the English Midlands – producing high-phosphor Mesozoic ores. By that time the works was using the basic process, with a much reduced reliance on imported low-phosphor ores (Gwent Archives D9634.6 – history of the works to 1924).
- ¹⁵ Giraud, 'Transport des Minerais de Fer du Canigou à Port-Vendres (Pyrénées-Orientales)'; Gradenwitz, 'An Ore-transporting Railway in the Pyrenees'.
- ¹⁶ AFB 01G0563, Mines de fer de La Pinouse, plan d'ensemble des travaux, plan dated 19 March 1914.
- ¹⁷ Giraud, 'Transport des Minerais de Fer du Canigou à Port-Vendres (Pyrénées-Orientales)', p. 83
- ¹⁸ Passaqui, J-P. 'Fair face à la rupture des circuits d'approvisionnements pendant la Première Guerre Mondiale: Le Creusot et les mines de fer des Pyrénées'.
- ¹⁹ Statistique de l'industrie minière
- ²⁰ Statistique de l'industrie minière, 1918; Anon, Planèzes; Un autre fief du fer en Fenouillèdes.
- ²¹ Bouneau, C., 'La Compagnie des chemins de fer du Midi, acteur du développement régional du grand Sud-Ouest, 1852-1938', p. 162
- ²² It is possible that searches yet to be carried out in the Archives Municipales d'Alès (Gard) and Archives Nationales du Monde du Travail (ANMT), Roubaix (Nord) will reveal further information in this area.
- ²³ Statistique de l'industrie minière, 1901
- ²⁴ Ibid, various years
- ²⁵ Cortsavi Sempre, Mines et Forges – citing unreferenced correspondence between Monin and the préfecture.
- ²⁶ Statistique de l'industrie minière, 1908
- ²⁷ Ibid, 1906; Rapport BRGM R.40712 p. 13
- ²⁸ ADPO 165J/199 – letter dated 6 March 1905; Giraud, 'Transport des Minerais de Fer du Canigou à Port-Vendres (Pyrénées-Orientales)', pp. 84-85
- ²⁹ AFB 01G0563, Mine de Palalda: Plan d'ensemble des travaux, plan dated 20 March 1914
- ³⁰ Claughton, 'New techniques, new sources'.
- ³¹ See Jenkins Carter, 'In Search of a Journey'
- ³² The Mining Journal, May 20, 1905, p. 564
- ³³ Praca, Concession et sociétés des mines de Fillols
- ³⁴ But will be the subject of further research in the Archives Nationales du Monde du Travail (ANMT), Roubaix (Nord).

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