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Compañia Corocoro de Bolivia 1873-1923: a Chilean Copper-mining Venture in Bolivia seen in the Context of the Contemporary Development of the Industry.

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In the following paper [1] I shall (Part I) take a brief look at the development of the mining industry in Chile with a fleeting glance at Mexico, the chosen period being post-independence and to the First World War. I shall proceed to present in as summary way as possible some of the standard explanations for the special character of Chilean development (Part II). I will then (Part III) take a look at the Corocoro company, a Chilean mining venture in Bolivia which covers the crucial period of change in the world mining industry, a period which is generally associated with new technology and massive scale.[2]

As my attention will be mainly directed to Chile, and our Chilean mine in Bolivia was a copper mine, I will limit any analysis to copper mining. The conclusion (Part IV) will be tentative and rather take the form of queries.

Part I

It is generally accepted that the new age of mining, as far as copper is concerned, can generally be related to the Jackling revolution in mine technology and in the development of Bessemer and later electrolytic processeses in smelting (Peirce-Smith and others). This is certainly a central part of any explanation. The presentation in the literature of the rise of modern American copper mining, gives us a picture of developments from small beginnings and a process which by leaps and bounds restructures the industry, pushing it into a position of world leadership by the beginning of the present century.[3]

This is part of a more general picture which has been analyzed by many, and where the contributions of A.D.Chandler, O.E.Williamson and T.P.Hughes are particularly pertinent.

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Taking a look at these developments from a point of view South of the Rio Grande confirms this picture in many ways, but the perspective is different. The litterature which has dealt with it has often been obsessed with problems of dependent development or the development of underdevelopment, economic imperialism and the like. Alternately it has also been obsessed with a variety of what may be loosely called Weberian and pseudo Weberian explanations: Social and economic attitudes and policies inimical to industrial development and economic growth are central to many of these explanations.

I wish to explore the nature of the developments in the late 19th and early 20th centuries, to see if they represent or do not represent a radical *caesura* or discontinuity, and if so, in what sense. The archival detritus of the Corocoro Company of Bolivia will be used in this pursuit. A paper of this sort cannot be expected to posit any answers, but it may be possible to raise a question or two which could be worth pursuing in some other place.

Mining

The economic backbone of the Spanish-American empire was mining and the colonies could very well be conceived as a string of more or less specialized mining societies stretching from Northern Mexico, through the Central American region, Colombia, Peru (including present-day Bolivia) and ending in Chile. This picture is not entirely adequate, but it will serve us here. This Spanish-American mining world has been the subject of serious study, although a lot needs to be done yet. Mexico has been particularly well served by modern scholarship.[4]

The wars of independence and the liberation of these republics in the opening decades of the 19th century were followed by periods of political turbulence and the disruption of the traditional economic patterns which had sustained the colonial mining industry. The mid-nineteenth century world was an entirely new world, very different from the world of the Bourbons.

While mining survived in various ways throughout the Spanish-American world, only Mexico and Chile were to develop into major metal mining powers in the 19th century: Bolivia and Peru were in an entirely different class through most of the century, minor producers with a great past, and also with a great future. They would come into their own in the early 20th century.[5]

Before proceeding to the main analysis it will be usefull to look a little at the contrasting development of the Chilean and Mexican mining industries in the nineteenth century.

The contrast is rooted partly in the nature of the geology and mineralization of the two countries, partly in politics, social structures and attitudes, partly also in geography: Mexicos long common border with the U.S.. The outcome, when we come to the opening of the present century, was however not very different: The mining industry of both countries was largely in the hands of the dominant U.S. mining corporations and combines: ASARCO, Guggenheim, Kennecott, Anaconda, Phelps-Dodge, but especially Guggenheim.

The breakdown of the colonial mining economy with the wars of independence, was common to the whole region. All witnesses testify to the primitive state of the early nineteenth century industry, comparing it both to the late colonial situation and even more so, comparing it to contemporary practices in Europe.[6]

It would be fair to say that the colonial mining industry suffered what amounted to a collapse: its institutions were destroyed, mines were flooded, the technical and administrative personnel were either dead, dispersed or exiled. However, the legal framework: the Spanish regalist, statist and mercantilist heritage, remained largely intact from Chile to Mexico. And was by and large to remain so throughout most of the century. Remnants of this heritage have shaped mining policies and politics also in the present century.[7]

In Mexico, we find that after the War of Independence, mining recovered slowly. "Capital was lacking, the commercial impulse was inhibited, the clergy monopolized the wealth of a closed feudally oriented society, and mass apathy was linked to political instability".[8]

In the 1820s British capital moved into Mexican silver mining in a rather grand way. The result was largely unhappy.[9] Then came the Mexican-American War, the French intervention and the civil war which all thoroughly discouraged any further investments.

In the 1870s political stability was at last achieved. The positivist development policies of the regime of Porfirio Diaz ("order and progress") had the old Mexican mining code declared void, and an entirely modern (i.e. anglo-saxon) code enacted (1884). This was followed by a reform of the tax law which by and large exempted the industry from all taxes and export duties, barring a 2% (later 3%) levy on gold and silver (1887 and 1897).

By mid century between 20 and 30 American mining companies had already moved into Mexico and were on the way to dominating the industry. In the 1880s large scale American operations got started (especially in silver, copper and lead). Railways linking Mexican mines to Texan smelters (later Colorado, Missouri, Kansas, Oklahoma) were laid, new harbours and new towns built, and whole fleets of ships to transport the ores, launched.

The new Mexican mining law of 1892 was still more favourable to the miners and still more American capital moved in. Mexico became a considerable producer of coal, providing a base for a Mexican smelting industry. It was the age of the Guggenheims, ASARCO, Anaconda (following the lighthearted Greene), Phelps- Dodge, Huntington, Towne and the others. In 1913 there were 124 silver-lead blast furnaces in North America: 3 in Canada, 76 in the United States and 45 in Mexico.[10] The development in Mexican copper was almost as dramatic (Cananea, later bought by Anaconda, being preeminent). Mexican mining and smelting was in effect an American industry. The Mexican North was a U.S. economic province.

Among these American entrepreneurs we find one Mexican, Pedro Alvarado, who struck a bonanza. Alvarado's management of his mine and his fortune conform to, and confirm all the most extreme Anglo-Saxon prejudices.[11]

If an explanation for the American takeover of the Mexican mining industry were needed, Alvarado goes a long way in providing it.

Summing up, two points will be made: we find that at no time did a Mexican entrepreneurial group or Mexican capital play any substantial role in the development of the mining industry. This, in spite of the fact that Mexico had been a leader in world mining in the late 18th century, even getting round to founding its own, vigorous, school of mines.[12] The second point to note is that the legal and fiscal liberalization of Mexico is simultaneous with the rise of modern, large scale mining, in the case of copper, simultaneous with what has been called the "founding era" - the period from about 1880 to 1900.[13]

Turning south, to Chile, we find a situation which was initially entirely different. While there has always been some mining in Chile - a little silver, but chiefly gold, her colonial economy was basically agrarian, the export of wheat being a mainstay. Some copper had been exported up along the coast, and towards the end of the period some had also been shipped to Spain. But by and large minerals played an unimportant role.[14] Her mountains were enormously rich in copper, but there was no effective European market for Chilean copper in the colonial period. It was the breakdown of the Spanish American empire and its economic system together with the development of an industrial market in Europe which in a sense pushed Chile into copper. A key element here was transport and marketing -i.e. ships and commercial houses - these were British[15]

The industrial development in Great Britain and Europe is not paralelled by a corresponding increase in copper mining in the traditional copper mining districts of the old world, but rather by a falling off, especially in Cornwall.[16] Britain was then the world's leading copper consumer and manufacturer and Swansea in Wales was the world smelter.

We have mentioned British capital and expertise in Mexico in the first decennia of the nineteenth century, and this is also the case in Chile. We find a fair amount of British investments in Chilean mining throughout the century, and above all, in the early and middle years of the century there was a significant inflow of Cornish specialists .[17] In 1842 reverbatory ovens were introduced, and in 1857 their first blast furnace was ercected. The Swansea monopoly was effectively broken. However, in contrast to the development which we have seen in Mexico, the mining industry at this stage in Chile came to be entirely dominated by Chilean entrepreneurs and capitalists. It did not become a "British" industry, and this may account for the discouragement of Cornish emigration to Chile by the British commercial establishment.[18]

Between 1851 and 1880 Chile was the world's leading supplier of copper.[19] Production rose from about 10.000 tons p.a. in the 1840s peaking in 1876 with 52.000 tons. "Chile bars" was the standard unit of copper traded on the London Metal Exchange and also set the price.

In the latter parts of the 1880s, production went into a dramatic decline, falling to about 20.000 tons in the 1890s, The relative decline of the Chilean industry was much more dramatic. In 1876 Chile provided 44% of the world's

Table I

Primary Copper Production 1850-1930

–	1	2	3	4	5
1850	12000	–	–	22	–
1855	22000	3300	–	27	–
1860	34000	8000	–	23	–
1865	41000	9500	–	39	–
1870	44000	14000	–	21	–
1875	48000	20000	2500	22	–
1880	40000	30200	2100	21	170000
1885	40000	82900	43900	11	248000
1890	27000	130000	68000	16	300000
1895	22000	180000	60700	11	36200
1900	28000	303000	169000	17	536000
1905	29000	490000	267000	16	750000
1910	–	540000	354200	13	951000
1915	22500	690000	340900	18	1190000
1918	90000	954000	372000	25	1095000
1920	88000	603000	311500	18	1056000
1925	186500	837400	504100	14	1546000
1930	217400	697000	372600	13	1733500

Column 1: 1850-1905: Chilean copper production, tons - Przeworski p. 17 (from *Estadística minera de Chile en 1908 y 1909,* Santiago 1910).
1910-1930: Copper production of the *Gran Mineria,* tons - Przeworski p. 286 (from M. Mamalakis, *Historical Statistics of Chile 1840-1967*, Yale Economic Growth Centre 1970). In these figures "native" Chilean mining is not included, but it also soon becomes insignificant. Better figures are desirable.

Column 2: U.S. primary copper production, tons. Secondary copper becomes important in the years immediately before the 1st WW. By the 1930 secondary copper was equal to (sometimes in excess off) primary copper. Navin pp. 398-403.

Column 3: U.S copper exports, tons. Navin pp. 398-403. The U.S was also a considerable importer during the period. Imports are not considered here.

Column 4: Average price in cents. Navin pp. 398-403.

Column 5: World Production. Navin pp. 398-403.
The quantities given in the sources have been converted to standard tons and are approximate. Chilean production figures around 1910 are uncertain.

total output, and with an insignificant home market, completely dominated the international copper trade. By the end of the 1890s Chilean production accounted for less than 10% of world output and a few years later Chilean copper accounted for hardly 4%. The U.S. had become the dominant exporter (See table 1).

The dramatic decline of the Chilean copper industry was followed by massive U.S. investments in Chile's "new" copper industry, the *Gran minería*. This term denotes a group of three mines: "El Teniente" (Braden 1904), developed by the Guggenheims to be the world's largest underground mine; Chuquicamata, a group of 300 claims encompassing the largest ore body in the world and the largest producer, aquired (1912) and developed by the Guggenheims, and later sold to Anaconda, the third being Portrerillos, bought in 1913 by the Andes Copper Company and later reorganized under Anaconda.

Chile soon again became a major producer, second only to the U.S. and with 17% of the enormously enlarged world production in 1929. While the traditional mining industry had been "Chilean" and an integrated part of its economy and society, the new, *Gran minería* was not. It functioned very much as an enclave, an extraneous body in Chilean society. It provided most of this society's foreign income and was of necessity a continuing and acute political problem. Many Chileans felt that much as the Mexican North had became an *ex oficio* new U.S. mining state, so had the Chilean North.[20]

Part II

The decline of the native Chilean copper industry has been a central theme in modern Chilean historiography. It has also been a theme taken up in modern development studies. Because of the high level of conflict in modern Chilean history, one must presume that political partisanship has entered, to some extent, into the explanations offered. The debate has been a part of a larger debate which has also in part shaped it: The contribution of the country's manufacturing sector to the national development and the ròle of the traditional elites in this process. This ties up with a more general contemporary debate of modernization in the third world. These themes cannot be broached here.[21]

This partisanship is not new, but is contemporary to the crisis in the industry. The Chilean mining interest of the 1880s was a very vocal and articulate political pressure group.

In the literature dealing with this individual Chilean development, we can (for the sake of convenience) distinguish between six general explanations. Sometimes they are used in combination. The central premise for all these explanations is that the decline is geologically unwarranted.

These are:

1. Chilean mining was primitive by any standards, and was not able (or willing) to follow contemporary technological developments. This notion is

generally based on early, 19th century traveller accounts (Darwin et al.) and has found its way into many modern descriptions.[22] The mines were by and large small, and some must have been very small indeed (there were in 1880 more than 1600 mines in operation). While these descriptions may have been valid enough in the first part of the century, they do not cover the facts when we move into the second half, the "great" period of Chilean mining. As late as 1860 Chilean mining is stated to have been technologically ahead of Michigan.[23] The Chilean mining industry was very conscious of the necessity to keep up to date in technology: this is well attested. The Chilean National Mining Society (SONAMI) was founded for this reason and its *Boletín* is systematic in reporting and reviewing technological practice abroad, and Chilean experts were to be found inspecting and collecting information worldwide where this was to be had.[24] This debate is not closed: we do not as yet have good enough descriptions of representative Chilean mines. A detailed analysis of the Corocoro enterprise could perhaps fill a void here.

2. Chilean upper classes were poor industrial entrepreneurs. This theory has been central to much recent analysis of Chiles aborted modernization. It is the central explanation to Zeitlin,[25] and Ratcliff, and in a more general way falls in with much of the critique of Latin American upper classes and their role in modernization which is still current. In the Chilean case a special point has been made of the integration of the elites: capitalists became landlords, industrialists and mine owners became integrated into the landowning elite, aquiring in the process their values and priorities. The entrepreneurial class was to some considerable extent foreign, and success brought assimilation into the landowning class. The roots of this interpretation go back to 19th century critics such as Louis Dorte,[26] Francisco A. Encina[27] and others, and has been reinforced in the present century by central authors such as A. Edwards Vives,[28] Enrique Molina, Julio Heise Gonzales, Arnold Bauer[29], James Petras[30] and Maurice Zeitlin. Related to this interpretation is Kirsch's.[31] He postulates the existence of one generic economic elite, a landed aristocracy whose interests also included industrial activities. It was a small, closed group, a group whose strengths was flexibility and ability to transfer its capital and talent among the different areas of the economy in accord with the relative opportunities available. The consequences of this situation have been variously drawn. This elite accomodated its industrial activities to its other economic interests. The state it controlled never pursued a coherent industrial policy. Thus Chile, in spite of its early industrial breakthrough, did not develop an industrial bourgeoisie, a constituency willing to fight for the survival of the copper industry.[32] The dominant position of "social" explanations is in great measure a result of the dominant position of the social sciences (sociology and political science) in contemporary Latin American studies.

3.The Santiago government's mining policies were inimical to the mining sector and carry the mayor blame for the demise of Chilean mining capitalism. This is the main position of Przeworski and Culver and Reinhardt.[33] The

fundamental problem facing the Chilean mining interests was political. The legal underpinnings were mercantilist and did not encourage capitalist development. The fiscal burdens were unreasonable and destructive (also part of the Spanish heritage).The central government did not invest in the necessary infrastructure - especially transport. This criticism is in a more general way found in much of the literature. The obvious contrast is of course the policies pursued by the U.S. federal authorities and the state authorities: "...it is in the political arena that mine operators... face the greatest challenge."[34] Chile should have followed Mexico's Porfirio Diaz. When reforms came in 1888, they came too late. The sources of this explanation are to be found in the mining industry itself, which was battling with the Santiago political establishment. The central authorities on Chilean mining come from this group: Alberto Herrmann,[35] Benjamin Vicuña Mackenna,[36] Juan B. Guerra and Charles Vattier. Summing up, the position here is that the technology was at hand, capital was available, skilled labour too. What was lacking was the "crucial catlyst" for the factors of production to combine: government action for industrial progress.

4. The U.S. governments policies in relation to the mining and smelting industry, combined with the mineral and capital resources available effectively squeezed out Chilean producers. Actions which are generally cited are the tariffs of 1861 and 1864, the *Mineral Lands Act of 1866,* the *Copper Act of 1869,* and the *Mineral Development Act of 1872* which were conceived to close the U.S. market to Chilean copper and make it possible, from the 1880's, for American copper to undersell the Chilean product on the international markets. To these one could add the *Webb-Pomerene Act of 1918* which exempted export cartels from the provisions of the antitrust laws, and which led to the formation of the United States Copper Export Association. These arguments are central to some economic imperialism theorists, and are often presented in conjunction with our pt. 5 below. Again, it could be fair to argue that the Chileans should have done likewise, and we are in the realms of our pt. 3 above.

5. Capital. This is an exceedingly complex group of explanations touching on the structure of the Chilean capital market which is by many held to have been inadequate.[37] It also ivolves the financing of the *Gran minería*, and it involves the financing of the U.S. copper industry (which was quite adequate),[38] and also must include questions touching oligopoly, cartelization and price control.[39] Chilean copper is by some said to have been squeezed out of the international markets by the U.S. producers.

6. Technology. This is really a lable for a another handfull of explanations. We have already touched on the contention that Chilean mining was exceedingly primitive: It follows that there was no real possibility of catching up when the big technological changes were introduced in the late 19th century. Perhaps more interesting is the theory that the Chilean engineers introduced foreign technology on which it was totally dependent, and failed to adapt these to local conditions, and also failed to seek alternatives when imported technology was inadequate. Chilean industry failed to develop a heavy equipment which

could handle the poorer porphyry copper ores which in which the country was so rich in, and which were to be decisive for the development of the *Gran Minería*. More significantly, they failed to produce the technological innovations which could have kept the typical Chilean mine - small or midling - in operation.[40] These are all counterfactual arguments which need carefull handling. Some of the issues raised here will be returned to in greater detail towards the end of the paper.

Looking over the literature it would appear that explanations which lean heavily on our #2 and #3 have been given prominence. Explanations which stress the inadecauacies of the Santiago government in promoting the healthy development of the national copper industry, go back to the political conflicts of the nineteenth century and have been repeated in the twentieth century historiography. These criticisms stem from the industry itself and should be more thoroughly scrutinized. Yet it is reasonable to infer that normal historical research working with traditional sources will tend to favour these answers.And they can not be ignored by researchers familiar with the development in the nineteenth century U.S. mining industry, which, because it was so enrmously successfull tends to set the norm for other mining regimes. "Political" explanations also satify authors describing the industry from an internal point of view: the literature aimed at mining professionals (business or technology), is often written by authors all too aware of the political problems which complicate the smooth running of their industry.

The explanations which focus on class have, I believe, a double background. The Chilean upper class - its "aristocracy" - was far more defined than any similar group in Latin America. It was small and monopolized both political and economic power. They were also the entrepreneurs, the bankers and the factory owners. The failure of Chilean modernization, leading to, and culminating in the crisis of the 1960s and 70s invites a class explanation. This would be natural within the framework of Marxist analysis which has been current for the last 30 years or more. However, explanations which turn on the social variable as central to the process of modernization come naturally to the social sciences generally, and the field has been dominated by researchers working in the sociological and political science tradition.[41] One of the strong areas in modern social science research has been Latin America, and one of the central concerns has been the "middle sectors," "middle groups," "middle elements," sometimes even "middle class", as carriers (or non-carries) of economic and political development.[42] This was natural for a science which is rooted in the tradition of Weber, Marx and Tönnies.

Turning to our points #5 and #6 we find that there has been little substantial research from an historian's point of view. The mining industry has not been a favourite of the profession.Turning to Latin America, we find some areas badly covered, some very badly covered indeed. It would be reasonable to infer that an understanding of the decline of the native Chilean copper industry in the late nineteenth century and its replacement by the *Gran minería* cannot entirely disregard company archives. This is however not very far from the case. There

is, to my knowledge no monograph on a Chilean copper company.[43] Modern scholarly work on the big American mining companies engaged in Mexico and Chile are not abundant either: The exception is probably Anaconda.[44] Przeworskis dissertation is enormously learned, but she does not seem to have seen a single Chilean copper mining company archive. Neither has she (judging by her references, and in the case of U.S. companies) had access to Guggenheim or ASARCO archives. It cannot have been for lack of trying as she has made some use of the Gibbs company archives in London and also some Rio Tinto documentation (Huelva).

The reasonable explanation for the lack of archival material from the Chilean mining companies may be that as the companies were small and mostly dissolved between 1890 and 1910, their archives have, by and large, been either lost or destroyed. Nor has there been any incentive to write company histories: Dead companies do not engage in getting their histories written. Yet it is not unreasonable to expect that some pertinent archival material has survived in private collections.

The record as we have it, and which these mines have left is often political and always external: in the writings of Vicuña Mackenna and Alberto Herrmann, in the official mining journals, the press, in banking records, ministry records, national and provincial statistics, and so on, *ad infinitum.*

To sum up so far, Chile did develop a native mining industry of very considerable proportins. The contrast with Mexico could hardly be greater. The legal and fiscal framework of this industry was however traditional, and the reforms which came in 1888 did not stop the rapid decline of the industry. It must be remarked that these reforms did not come significantly later than the reforms we have noted in Mexico. As in that country, the reforms, if they had any effect, served only to ease the way for foreign mining enterprise. How crucial the new legal and fiscal regimes were to the development of a modern mining industry has yet to be thoroughly examined.

However, Chile's copper ore reserves were (and are still) second only to those of the U.S.. For this reason, any explanation of the demise of the native mining industry, has had to look for other explanations. It has been generally agreed that a central factor explaining this "death" is to be found in the social composition of Chile's aristocratic elite which both served as Chile's entrepreneurial class, and which also framed the economic and fiscal policies pursued by the Chilean government.

Part III[45]

The *Compañía Corocoro de Bolivia* was founded i 1873, that is in the golden age of Chilean copper, before the decline had set in.[46] It was for many years the largest Chilean venture in Bolivia. Its original capital was Bs. 5300000 which in 1913 roughly corresponds to £ 42.000. (Only Bs. 100000 were emitted, and there was, in the fifty years of the company, no new emission of shares.)

The list of shareholders places the owners within the sphere of the *fronda aristocrática*, the cousinhood at the center of the Chilean polity.[47] This connection is also clear when one looks at the leadership of the firm.

The mines were situated by the town of Corocoro, about 4000 meters above sea level and a little less than 100 km. SSW of La Paz close to the Desaguadero River, but with no direct access to it. (the Desaguadero is the great inland waterway of Bolivia and is navigable). Corocoro is a town with a mining tradition previous to the formation of the Chilean company, mining in the region dating back to inca times. Around the turn of the century the population was about 3000, mostly Aymará indians.[48] They would by and large be translocated indian subsistence farmers, with little or no knowledge of Spanish. In addition there would be a *cholo* group, more urbanized and also bilingual. It is reasonable to suppose that some of the workforce was recruited from the general area.

Table II[49]

Key Produduction Figures for the Compañia Corocoro de Bolivia

1873	–[a]	10.8	729.2
1885	14000[b]	6.87	957.6
1890	21924	6.23	1178.6
1895	29339	4.11	1209.2
1900	39387	2.43	1131.9
1905	27889	3.61	1481.8
1910	26191	3.19	833.9
1915	25175	4.00	1401.0
1917	63713	2.64	1677.1
1920	81031[c]	3.27	2912.3
1922	93723	2.74	2507.9
1923	73003	1.98	1641.5

a: Free copper (cobre nativo). From October 1873 to October 1877, 114863 metric tons were exploited.

b: The mines were confiscated by the Bolivian government during the war of the Pacific. There is therefore a gap between and including 1879 and 1884.

c: Chalcocite (SCu_2) first exploited in 1914, and the dominant ore from 1818.

Column 1: Extracted ores in metric tons. Waste not included.
Column 2: Copper metal content of ores in %.
Column 3: Refined copper. The copper bars varied in their copper content between 79% and 91%. The figures here indicate net copper content in metric tons.

In the *Bolivian Area Handbook* we read, "Transportation has been a crucial problem ever since colonial days".[50] The first important Bolivian rail connection to the sea was the *Antofagasta and Bolivian Railway* to Oruro (1892) which was of no help to Corocoro. The La Paz - Arica line (part of the treaty with Chile of 1904) was completed in 1911. This is the line which served Corocoro. Up til then all transport to and from the port of Arica was by pack animals - horses and mules, the distance being about 300 km. in very rough terrain and on bad roads. The distance to La Paz was roughly 100 km.

Arica was not only far away on a difficult road, it was also "foreign", Peruvian up to 1884, Chilean thereafter.[51] Corocoro ore therefore risked, and payed over periods, double export duties: at the border with Chile and at Arica.[52]

Corocoro was a considerable mining centre. Originally production was organized in the colonial fashion, with a large number of "estacas" operated on a family basis.[53] Towards the midle of the century some foreign capital moved in, and larger mining properties were put together, and this movement is also reflected (up to a point) in a paralell consolidation within the "family" sector of the industry.[54] One of the entrepreneurs in the 1860s was Hugo Teare, and it was this consolidated property our group of Chilean capitalists bought in 1873.[55] Teare's company was apparently British, the personell mentioned in our letters, are British.[56]

Mr. Teares mining properies in Corocoro was composed of 21 concessions - what were to be called the "concesiones antiguas" - and which comprised 162 hectares. To these were added in the course of the following fifty years, 389 new hectares which came to be known as the "concesiones modernas". The company owned in 1923 552 hectares of mining property (about 1380 acres) in all.[57] In addition the company owned a canal, quarries, railway sidings, water rights, mills, foundries etc., as well as ordinary real estate with buildings in Corocoro and in Arica.

At no time was the company sole exploiter in Corocoro, the other enterprises we know of were the "Compañía Sudamericana de cobre", Carrera Hnos., J.E.Child & Co. and the "Corocoro United Copper Mines, Ltd."[58] The Corocoro Company was certainly not a small family company generally associated in the literature with Chilean enterprise before the advent of foreign capital, and its position in Corocoro must have been significant.[59] It is reasonable to suppose that it in the early 20th century was the most considerable enterprise in Corocoro. This town was a prime mining center in Bolivia before the advent of tin.[60]

Summing up so far, we have a Chilean take-over of a British mining company which seems to have been of a decent technical standard (judging by the inventories of 1873).[61] The group behind the company formation is constituated by representatives of elite families with background in national politics, industry and mining. This mining company operated in competition with at least two, it must be safe to presume,"modern" enterprises (one probably British, the other with a base in Buenos Aires).[62] They ran their mining enterprise reasonably well for 50 years under conditions which were very far from favourable. They seem to have made considerable profits, though not al-

ways. Previous work with British and American companies operating in Latin America in this period, suggests that the Chilean company's management principles and practice were much of a piece with what we know from these. It is difficult to see anything specifically "Latin-American".[63]

Characteristics

We shall not describe the mines here, we shall only give a few indicators of what kind of an enterprise this was. The area covered by the mining properties was (1923) a little less than 1400 acres and employed around 500 to 600 workers.[64] The mining work seems to have been well planned (maps of the system were made from the first years and forward planning of new mining projects was part of the dayly, continuing, management routine. The half-yearly reports to Santiago were in large measure being devoted to them, and they figure largely in the correspondence. The pits were lined with timber, and the galeries sometimes lined with walls of dry stone. Attention is constantly directed to the question of new machines, power and light: first steam and then diesel. Gunpowder was the explosive used, and the mineral (which was mostly soft) extracted by hand-tools. Generally the shafts descended to about 200 meters (the limit generally being about 240 meters below the surface). One mine shaft, however, (Remedios) descended 480 meters. The Company did its own concentration, smelting or flotation, and its own refining. The loss of metal in these processes was about 0.5% for native ores, and somewhat more for the chalcocites (SCu2), about 1.5%.[65] In the early years losses were slightly greater.

Mining in Corocoro was not easy. The problems involved may be summed up under thee headings: labour, transportation, and the political system at all levels. Behind these we discern the problems involved in remoteness and inaccessibility. We may say at the outset that these problems were overcome or neutralized, otherwise the company could not have been a commercial proposition for most of 50 years.

From the start labour was a problem. This is a recurring theme in management letters to Santiago.[66] The "peones" were monumental drunks (insignes borrachos) who celebrated as many saints (male and female) as possible and the weeklong celebration of carnaval is a recurrent theme in the reports. The workers stole provisions and also ore, which they sold privately.[67] The local Bolivian officials were in these cases of no help. Nor was the company in a position to fire its workers, as there was a chronic shortage of labour throughout the whole period.

The shortage of labour, rather than the quality of the labourer seems to have been the main problem. It clearly set limits to production, and the situation did not improve throughout the life of the enterprise. In the new century, competition for labour from the tin mines became difficult to surmount as these could pay more.[68] We see the problem again with the building of the railway connecting La Paz and Corocoro to the coast at Arica: this necessary project

became a real threat to production at the mines, as the government authorities forced the indians to work on the railway.[69] This provides the immediate background for the management's desire for japanese imigration.[70] For these reasons the management at Corocoro saw it from the very beginning as necessary to replace manual labour with machines. This course of action seems to have been pursued systematically and apparently with some success throughout the fifty years of operation.[71] Initially the main problem seems to have been the lack of coal.[72] Yet, at a relatively early date, however difficult supply conditions were and in spite of the lack of a rail connection, coal became the dominating input factor.[73]

Yet manual labour was nevertheless always the key factor. The idea was raised in the first years to use Chilean labour, ordinary miners. They were to set an example to their Bolivian brethren, show them the advantages of steady work and fixed contracts - the advantage of being "contratados" - as against the Bolivians predilection for arrangements on a day to day basis. This was however found to be not an ideal solution: among other things, the Chileans did not know the language and seemed to have disliked the country.[74]

Machinists and specialists were however largely brought in from Chile as was, of course, the management team.[75] The "gerente" in Corocoro admitted that the discipline maintained among the workforce, was almost military.[76]

With the necessity to mechanize, good mechanics and good technicians were desirable. Chilean experts were used systematically, but it appears, were not always satisfactory, and Europeans were brought in.[77] These were, however, apparently, never an important group excepting for the strategic role they could sometimes have, nor were these either always satisfactory.[78] They would be recruited from a pool of European professionals available in these years in Latin America and which complemented the locally educated professional cadres. Management and technical staff was therefore mixed: Chilean, some Bolivians (very few -in accounts - and not technical) and the odd European. These last could be recruited from a local labour market, the senior technical staff having to be passed by the directors in Santiago with outside professional help.[79] A foreign manager with the trust of the Santiago directors could recruit mining experts directly in his own professional, European network.[80] We are dealing with the "old boys" and professional networks of of the old world. This is clearly seen in Corocoro, linking it to the engineering world at large. In this way, through a primary Chilean network with its subsidiary, connected European networks this enterprise could operate quite efficiently in an as remote and inaccessible corner of the world as one could find.

Bolivia

Bolivia was a violent country on several counts: its nature and its politics could play havoc with the efficient running of any mining company. At near 4000 m above sea level and about 17°S, nature is bound to be extreme. The

reports from Corocoro are full of weather: Snow,[81] torrential rains which washed away the roads, or the chronic lack of water for the production processes.[82] Transport was a permanent problem, in all its forms. Horses and mules were crucial, and therefore also forrage.[83] Forrage was scarce at all times, and mules and horses were confiscated by passing revolutionary or government armies.[84] Transport throughout these fifty years was a real limiting factor of production. By 1908 things were getting desperate: "if the Arica railway is not completed, we will be fried".[85] At last the line did come, but the problems remained. In 1915 the manager reported that most of the chalcocite (i.e. most of the total production - see table I) was still at Corocoro because of the bad railway service, i.e. there was almost no adecuate rolling stock.[86] The costs of transport that year were also enormous (tables III and IV).

Bolivia was a country of revolutions and civil disorder. This was no doubt a threat to the commercial viability of the mines. Revolutionary or government armies passing through Corocoro would forcibly enlist mine labour into their ranks, and they would requisition provisions, gunpowder and forced loans. Miners not pressed, hid away as best they could. Chilean workmen, if there were any, returned to Chile.[87] Presidential elections were the occasion for collective drunkenness among the workers, and things could get out of hand with the sacking of company stores.[88]

The company tried to maintain strict neutrality in the political conflicts of the host country. The manager was generally also Chilean Vice Consul, and the administration building was therefore covered by diplomatic immunity.[89] Diplomatic status was seen as a way of protecting the enterprise, but this did not always suffice. It was of no help during the Pacific war (1879-84) when the two countries were at war. It proved no help against the rage of revolutionary indians in 1898-99, when the company buildings were sacked and razed and the manager and his wife presumably murdered.[90]

When the local office of the Bolivian National Bank was empty of national tender, the company was confronted by a government *ad hoc* prohibition to pay its workers in company money.[91] When general Hilarion Daza approached the management, asking for support in the forthcoming elections, Sotomayor, the manager at Corocoro, was in a quandry: he wrote to the directors in Santiago that as he understood it, if Daza won the elections he would become president, if he did not, he would still become president. Sotomayor assured the Santiago directors that he would secure Daza's friendship without mixing in politics.[92] The outcome was in every way unfortunate. Daza won the elections, and as president promptly proceeded to introduce the export duties mentioned above.[93] As we already have seen in the case of thieving, local authorities were also often less than helpfull, allying themselves with with local pressure groups against the mine management.[94] In the fateful revolution of 1898-9, the role of local authorities was positively sinister.

The political problem was essentially unmanageable. In the turbulence of the Bolivian power game, the company tried to pursue a policy of strict neutral-

ity, complying with the (lawfull) desires of local and national authorities. In periods of internecine war it tried to avoid taking sides, and at least expressing the wish to help the persecuted, regardless of party.[95] As a mining company in a society which resented modern capitalist production, and as a Chilean company in "enemy" territory things could not be kept that simple.[96] Official support was seldom forthcoming, and dangerous in any case.

Yet some sort of official good-will was essential: The company was a big importer of machines, tools, coal, etc. and it made a difference if it could import directly over Arica, or had to do it in a roundabout way through La Paz, which was further inland.[97] The company's produce had to be transported by road or (in its very last years) by an inefficient rail service (which it did not control), across the Bolivian border and out of a Chilean port. Transport costs and at times a double set of export duties were obviously a serious problem. We must remember that the mining companies' control of transport and fiscal benignness has been given a prominent place in the literature as a fundamental explanatory factor for a thriving mining industry.[98]

We will here pause a moment in our argument and look specifically at these costs:

Table III[99]

Cost of bar Copper at Corocoro and on board at Arica

	1	2	3
1875	171.24	244.74	42.9%
–	–	–	–
1895	164.37	212.37	29.2%
1900	325.13	385.03	18.4%
1905	265.03	338.23	27.6%
1910	451.36	506.39	21.7%
1915	253.31	431.54	70.4%
1920	269.16	317.26	17.9%

All figures are in Bolívares.

Column 1: Costs at Corocoro of 1 metric ton bar copper.
The cost is always taken from the second half of the yearexcepting1875 which is a general figure for the 1870s.

Column 2: Costs of 1 metric ton on board at Arica.
This includes freight and duties.

Column 3: % difference between 1 and 2.

The duties exacted in the 1890s were relatively light on bar copper. It was a flat rate which was doubled in 1892 (?), and once again in 1900. By then copper prices were dropping dramatically, and the "derecho de exportación" could, by 1914 - 1916 just about equal the cost of transport (these being extreme values). Duties on ore did not follow the copper market but the needs of the fisc. With the rapid rise of the tin industry, the national authorities could also ignore the problems of the copper miners. The Bolivian system of flat rates, independent of the fluctuating international copper prices, was similar to the much reviled Chilean system, scrapped in 1888.

The relative weight of transport costs and export duties of the chalcocite have not been unscrambled yet (see table IV). The dramatic differential of the cost at Corocoro and aboard in Arica is probably explained by the nature of the product, an unconcentrated ore. Prices during the war and the richness of the ores involved made this export worth while - it is a war phenomenon.

Table IV[100]

Calchocite (SCu_2) exported without concentration 1915-1922

	1	2	3	4	5	6
1915	6354	1145	18.0	112,806	226,784	112.8%
1916	6514	1065	16.4	93,291	215,665	132.2%
1917	6494	778	12.0	98,138	217,717	121.8%
1918	2145	410	19.1	38,040	104,010	173.4%

Column 1: Ores in metric tons
Column 2: Refined copper in m.t.
Column 3: % copper in ores
Column 4: Total costs of ore at shipping point, Corocoro
Column 5: Total costs of ore on board at Arica
Column 6: % difference between coumn 4 and 5

Having taken a look at the three mayor problem areas affecting the Company, a couple of additional points will be touched upon. A positive political environment has been highlighted as important to a strong mining industry. Of almost as great importance is a rational and resourceful economic environment: This has been recognized as a basic problem in the Chilean case.[101]

Turning to Corocoro, we find that liquidity could be a problem. The Chilean banking system upon which the company ultimately was dependent, was not strong. It was, at its best, a conservative support for the mostly international export houses, the landed interest and trade. It did not provide in any significant way venture capital for industry.[102] Economic storms in Santiago - when they did occur - were a threat to Corocoro, presumably because the there was no real

banking support to be had in Bolivia.[103] The financial and monetary problems of Bolivia had also to be lived with. The Company's work-force would only accept payment in silver. The national bank did not always have specie, and the company would then not have the wherewithal to pay its workers.[104] They would then drift away. The National bank's paper money was not acceptable to the local tradesmen or the indian work-force.[105] When the Company tried to issue its own "fichas", it was stopped by the local authorities.[106]

Table V [109]

Profits, losses and dividends, selected years

	Losses	Profits	Dividends
1875		977330*	409525
1880			947368
1885	5932		
1890		87887	
		7841	
1895		33526	
		138594	
1900		162176	249548
		189449	216998
1905		97632	273554
		316556	
1910	101516		
	13178		
1915		1410384	
		1293601	
1920		283320	
		55700	
1921	8975		
	128147		
1922	160080		
	25554		
1923	290935		
Totals:	933331	14862588	10102778

The *totals* are for all years. The value of the Bolívar varies in the period against the £, from 42 pennies down 16.75. In calculating the dividend *total* a mean figure was used. The figur chosen, 22 pennies pr Bolívar, should be representative of the big years for dividends: 1896-1907. There were no dividends in 1875: the figure given is for 1874. This figure is abnormally large for the period, when dividends in any case were rare. The dividends for 1880 are compensation from the Bolivian government for the years of expropriation.

These problems were not of a dayly nature, but they recur and are acute in times of political crisis. They do reflect a fundamental, underlying weakness of the Bolivian economy which had to be taken into account by the Company if it was to survive. The Company did not have access to international sources of finance or credit.

In the literature on Chilean copper, a point is often made that the Chilean mining industry did not dispose of its own fleet of freighters, but was dependent upon foreign carriers which were inadecuate. The contrast is implicitly drawn with the *Gran minería* which when it was desirable built and organized their own integrated transport systems which included both rail and sea link.[107] In the letter-books and semi-annual reports from Corocoro we find no complaints on this point. The Company shipped its products to Europe, with between 4 and 10 sailings per semester, the ships being French, British, German and others of not easily identifiable nationalities.[108]

The success of an enterprise is in large measure observable in its profits and in its ability to pay dividends. In the case of the Corocoro Company it should be quite feasable to estimate output in relationship to capital and employment for most of the years, and this would give a better picture, which also could more easily be compared to the situation in the industry generally, but this will not be attempted here.

A look at table II will show that the metal content of the free copper ores which were the original resource base of the Company, had fallen to levels well below those which traditional mining enterprises could exploit commercially.[110] This is, for a company of this sort, a very real geological limit. With the good prices obtainable from 1912 to 1918, the management at Corocoro waited til 1918 to discontinue this part of its production. However, from 1915 it had concentrated its main efforts in the exploitation of the large deposits of rich chalcocite which it posessed (see table IV). Under the war-time conditions it was worth while to sell these without concentration. This was possible because, at last, Corocoro had a rail connection to the coast. This connection was, however, of limited use, as it did not have the transport capacity desired by the Company.[111]

The mining of the rich "yanabarras" was very cheap.[112] In the second half of 1915, 50 tons of chalcocite were sent to the U.S. to try out flotation in oil. Thus also poorer chalcocites (below 5%) could also become commercially viable and need not be wasted.[113] The Company started its own experiments in flotation and by 1918 had found mixes which were suited to its ores and achieved a concentration of about 60%.[114] Three new mills were installed to cope with the new production process and achieve as high a degree of metal extraction as possible.[115]

Already in the second half of 1918 the fall in prices forced the company to stop all new projects, excepting further improvements on the flotation processes.[116] A lot of the work was now limited to keeping the mines from deteriorating. Profits were very small and no dividends were paid. With the 1920s,

losses started piling up. The reserves of richer, exploitable chalcocites, "yanabarras", were also strictly limited.[117] Stilt is is clear from the half-yearly reports that the personnel in Corocoro was doing its utmost to keep the mines going and investigating all the possibilities available to secure the future of the mines. However, in September of 1923, all work was suspended.

In the long, final "Informe sobre las operaciones" The management in Bolivia explain why they did not close the works at an earlier date, and why they had to close now.[118] The answer to the first question was simple: They could not read the future. If they closed the mines when the losses started piling up, it would be very expensive to restart operations under better market conditions. Keeping operations going at a low level of activity would be, in the medium term, cheaper: it would keep them in repair and would prevent wholesale robbery. The attempts to join up with the other remaining large producer in the area had aborted. Pressure from the workers and the government had also made a stop difficult.

The sale of the mines had been discussed on previous occasions.[119] Some of the central arguments produced then, are absent or have a very marginal place now. The management had previously adduced the standard complaints throughout the years, as their basic argument: ...if, in addition to the low yield of the ores, one considered "the (political) conditions in Bolivia, the scarcity of fuel, water, people, roads, and guarantees, (besides) the abundance of rates, taxes, and messes": it would, taken all together dispirit any company trying to operate in the country. Nevertheless they had done so for fifty years, and with reasonable success. The primary arguments advnaced in 1923 relate to the low international prices of copper and the inability to discern any improvement in the forseeable future. They then proceed to bolster these arguments saying that things might have been different if the Bolivian government had reduced freight rates and cut out export levies. These echo the arguments put forward by the Alfredo Herrmann and Vicuña Mackenna in late nineteenth cetury Chile.

We may add here that the logic of the actions taken by the Corocoro board and management fits nicely with with the pattern we can trace for the small independent copper miners in the U.S. While the big producers like Kennecott and others closed, the small independents tried to remain open, either because their ores were exceptionally high grade, or because closing down would involve bigger losses than keeping going, waiting for better times.[120]

Part IV

The general questions which we posed in the first part of the paper, cannot be answered adecuately with such a narrow empirical base as has been presented here. But there is room for suggestions, and also some questions.

However, before we proceed any further, it would be proper to stop a

moment and ask if the Corocoro enterprise we have looked at, is suited to our more general purpose. The objections which may usefully be raised are:

a) That its life stretches over too long a period, and that the problems of the 1920s are not relevant in a discussion of Chilean mining in the 1880s and 1890s.

b) That the managers in Corocoro for long periods were foreigners. That it thus was Chilean only in a limited sense.

c) That Chile and Bolivia are two very different propositions, and that you cannot argue from one of these countries about the situation in the other. This is counterfactual analysis of the most insiduous sort.

d) And the most telling: One cannot argue from one example about the situation in a whole industry.

Taking these objections in due order, we will briefly note the following. In our discussion of Corocoro we have lagely kept to the early part of its history, the 1870s and 1880s. We have of necessity strayed beyond, but I do not think this is crucial.

During the 1880s and 1890s the manager in Corocoro was by and large European. This fits the picture which has often been presented of the Chilean elite in the earlier (and dynamic) parts of the 19th century, when it was open to foreign entrepreneurs. With the decline of the late nineteenth century some authors find a closing of ranks in this elite.[121] This may be the case, but the pattern found in Corocoro is rather typical of earlier Chilean practice and is mirrored in the contemporary nitrate industry. The argument would, perhaps, gain some weight if we find a considerable difference between Chilean and foreign practice, but not enough. It is probable that the development of Corocoro as a modern mining enterprise dates back to L. Sundt's and O. Sandstad'management periods. Yet these men were employed by a wholly Chilean board, and we find a series Chilean managers in the years that followed. The mines were, in the 1870s, perhaps rather sorry things.[122] But it must be remembered that they were bought of a British enterprise. We do not find this objection very telling.

The third objection, that the ability to mine in Bolivia gives few indications about possibilities in Chile, is in some degree valid. We have not systematically compared levels of taxation, export duties and other official levies. We have not compared wages. Yet in a more general sense, and in relation to some of the the points made about negative factors in Chile, the comparison is not irrelevant.

The fourth objection is true enough, and for that reason we shall also tread carefully.

Causes of decline

The criticism levelled against Chilean mining in explanation of its decline was summed up earlier on in this paper in six points: 1) primitive technology; 2) elite attitudes, the lack of a legitimate entrepreneurial class; 3) govern-

ment policies; 4) U.S. policies; 5) capital; 6) technology. We shall briefly touch on these again.

1) We have indicated that explanations which posit poor technology are based largely on (early) travellers observations and no proper study of the industry. Some studies would indicate that Chilean mining technology was quite up-to-date in the 1860s and therefore, clearly post-colonial and presumaby quite adecuate. We find no substantiation for the alegation that the Chileans were unable to adapt foreign technology to their specific needs. Rather, the Corocoro material would seem to indicate that they were, indeed, active adapters. This is not an aspect which has been central in our run through 50 years of Corocoro mining, but it seems perfectly clear that the Corocoro management was at all times technologically awake, and willing to adapt and change. If it had not, it is difficult to se how it could have survived for so long. Their very promt adoption and experiments with flotation is here a very telling point.

2) The Chilean landholding, aristocratic, upper classes were also its entrepreneurial class and ran its industrial enterprises. They are held to have done this with (if one be allowed an overstatement) the same conviction one might expect from Bertie Wooster. The Corocoro experience does not support this interpretation. Behind this Company we can identify the family names of the Chilean political and economic elite, the social core of the country with their Basque ancestry. It is too much to say that they are all there, but they are there in quantity. The point here, however, is not that we find here representatives of a group which mined copper in Chile and failed, and trying again in Bolivia, had better luck. The point is that the Bolivian mines they owned were exploited to the limit of their possiblities. The copper content of the ores (free copper) throughout the 20th century was on average very low, descending to below 2% in 1923. Exploitation was discontinued for geological reasons. (It is true, that using an entirely different technology, production may have been continued. This is a point we shall return to.) The exploitation of chalcocites was discontinued for market reasons. (Again, the same reservation can apply here, and we shall return to it, as promised.) Until a close study of Chilean mining practice in the 1880s has been effected, it is not reasonable to explain the decline in terms of the quality of the countrie's entrepreneurial class.

3) The Chilean political system is said to have been idifferent or inimical towards the needs of the mining industry. The the public sector's extreme dependence upon mining as a source of income was detrimental to a dynamic development of Chilean mining, and in effect weakened it to the degree that it could not (if it would) take up the challenge posed by the fabulous resources of Chuquicamata, El Teniente and Portrerillos. There was a possiblity: geology provided an oportunity - which was passed by.

We have already remarked that a proper comparative analysis of government policies towards mining in Chile and Bolivia should have been part of our presentation - sadly, it is not. However, our Corocoro story does, in a rough and ready way, suggest that the Bolivian government and its officialdom was the

kind of fairy god-mother miners could well do without. Mining in Chile was never beset in a similar way or on a similar scale by the importunities of disordered, venal and inimical public authorities. If we consider infrastructure a government responsibility (which is a current assumption in much of the literature), we must bring to mind the extreme transport problems at Corocoro, which survived 40 profitable years without a railway connection. There is no need to go through the other areas where government policies, local government practice, and the quality of the political system are of importance to an industry. But it is not out of place to be reminded that the Bolivian fisc was as dependent upon mining as was the Chilean, only it was poorer.

4) Three points remain of our six. We have already remarked that in so far as U.S. government was instrumental in helping its mining industries to their dominant position in the world, it was doing what other governments, also Chile's, could have done. This is admittedly a little naïve, but we shall, never the less, let it go at that.

5 & 6) We shall deal with the two remaining points, capital and technology,in tandem. We do this for the sake of brevity. Navin defines the period 1880-1899 as the founding period of the modern, U.S., copper mining industry. This is correct if one has ones eyes fixed on the North American devel-

Table VI[123]

Yearly Mean Copper Prices, London and New York

	£	$
1875	82	22.50
1880	63	21.40
1885	44	10.80
1890	54	15.60
1895	43	10.76
1900	–	16.19
1905	69	15.59
1910	57	12.74
1915	72	17.27
1920	97	17.45
1922	62	13.38

The unit of weight employed is the quintal (the metric quintal equals 100 kgs. The measure used here must be the regular quintal, which measures 100 Spanish lbs. of each 460 grams). The price in "£" is given in shillings. Sales were to Europe. Up to and including 1899 sales were in francs and through French banks to the French market. From 1900 on sales were in sterling, through London banks to the British market.

opment (including Mexico). Copper mining and smelting become big business. A series of enormously rich mines were discovered and developed (Michigan, Butte, Old Dominion, Cananea, and we may add Rio Tinto in the old world, for good measure) and a host of smaller ones too. The effect of this development was twofold: it put pressure on the smelting industry, which went into a period of rapid transformation, and the price of copper fell dramatically.

We clearly see the break in the 1880s which may go a long way in explaining the decline of Chilean copper mining. What we do not see, is the changes which occur around 1900 and in the years leading up to the World War and beyond. These are nevertheless crucial: lowish prices were maintained in spite of the falling grades of the ores. The inter-war years are largely years of glut and low to very low prices. The situation reflected the difficulty in adapting to peacetime markets, and is a general phenomenon. It is also a result of the technological breakthroughs in the production of copper.

The changes in the 1880s are not associated with new technology, but find expression in the rise of the big copper concerns. The changes around in the beginning of the new century are also associated with big capital, but at their root (and in a symbiotic relationship with capital) we find new technology. The breakthrough in the large-scale exploiting and processing of low grade (2%) porphyry ores is best seen in two mines, Bingham Canyon (1903) and at Chuquicamata (1910). The Guggenheims were associated with both enterprises. Chuquicamata was bought for $25m, and a further $15m went into The Chile Exploration Company (Chilex) formed to develop the mining property. Chilex was very much a modern R & D enterprise which was to map and research the resources, develop new mining, concentration and smelting technologies suitable for the special, low-grade ores characteristic for Chuquicamata, and guarantee a product which could sell at a profit for a very long period of years, and under the most adverse market conditions. The Guggenheim metalurgical laboratories (central element in the Chilex $15m development project) developed methods to handle the ore, complete through to the market (London or New York) for $2.10 a ton, 80 years, year in and year out, with the capacity to process 10,000 tons of ore a day. The work was carried out in part at the Guggenheims laboratories in Perth Amboy, and in part on location, in Chile. A commercially sized trial plant was constructed, and proved the viability of the project, and Guggenheim had no problems in launching the new "Chile Copper Company" formed to run the mines, capitalized at $110m: There was no problem in mobilizing capital for the Chile Copper Company.

It has been argued, that the nineteenth century Chilean copper industry, if it had been better run by its owners or if the government had pursued more sensible policies, could well have survived the 1890s and secured a Chilean development of it's enormous riches of low grade copper. We have followed one Chilean mine - in Bolivia - through the whole period. It was by Chilean standards a large enterprise. It worked under very difficult conditions, and yet, it was a success. We see it in 1920 as a modern, innovative and dynamic company,

trying to survive under adverse conditions, pushing through new technology, but in the end giving up.

In the context of the development we have sketched at Chuquicamata, it is difficult to envisage a continuous development from an enterprise of Corocoros character to the Chile Mining Company's vast project in the Atacama desert. We suspect that it would have been impossible to start off with a reasonable, traditional mining company, and, through alertness, clean living, and with the support of an enlightened government, turn it into a modern low grade copper mine. We suspect that we are here confronted by a caesura. This break is not immediately perceivable in the industry as it developed in the U.S.. It is very clear we suspect in an economic periphery. This break must be conceived as determined in terms of the classical cycle inherent in all mining: the gradual impovrishment of the metal bearing ores, their increasingly difficult nature, and the technological response.

So far it is not possible to come with any hard conclusions: a more thurough investigation of the Chilean industry is certainly desirable.

Notes

1 I wish to thank the Sundt family in Santiago de Chile for generously giving me access to the Corocoro papers in their possession. I wish also to thank professor James C. Williams of the California History Center for constructive comments on an earlier version of this paper. Thanks are also due to Stein Johansen, university librarian here in Trondheim, for for help in searching up literature.

2 Compañía Corocoro de Bolivia and the Rio Tinto Company were both founded in 1873. In 1923 Guggenheim sold Chuquicamata to Anaconda having built it up to be the world's major copper producer. 1923 is also saw the sale of the Corocoro mines in Bolivia, the Company being wound up the next year. The mines themselves were later, in 1934, leased by ASARCO, i.e. the Guggenheims. See I.F. Marcosson, Metal Magic. The Story of the American Smelting and Refining Company, New York 1949, p. 171.

3 Clark C. Spence, *Mining Engineers & the American West. The Lace-Boot Brigade, 1849-1933,* New Haven 1970; Thomas R. Navin, *Copper Mining and Management,* Tucson, Arizona 1978; Isaac F. Marcosson, *Metal Magic. The Story of the American Smelting & Refining Company,* New York 1949; Dorothea Mezger, *Copper in the World Economy,* London 1980. See also Angus Murdoch, *Boom Copper: The Story of the first U.S. Mining Boom,* Calumet 1964, and Yvonne Levy, *Copper: Red Metal in Flux,* San Francisco 1968.

4 Modesto Bargalló, *La minería y la metalurgía en la América Española durante la época colonial,* Mexico 1955; D.A. Brading, *Miners and Merchants in Bour-*

bon Mexico 2763-1810, Cambridge 1981; D.A. Brading og H.E.Cross, "Colonial Silver Mining: Mexico and Peru", *Hispanic American Historical Review* 1972 - vol 52 pp. 545-79; Alfred Tischendorf, *Great Britain and Mexico in the Era of Porfirio Diaz,* Durham NC 1961, pp 71-95 and 148-166; Benjamín Vicuña Mackenna, *El libro del cobre y del carbon de piedra en Chile ,* Santiago 1883; Luz María Méndez Beltrán, *Instituciones y problemas de la minería en Chile 1787-1926,* Santiago 1979. The classical treatise is Alexander von Humboldt, *Political Essay on the Kingdom of New Spain,* London 1811-22 (4 vols.) - the first version in English. Several modern editions are available.

5 Peru was, of course, the world producer of guano. Peru was also a producer of nitrates until The War of The Pacific.

6 Charles Darwin, *The Voyage of the Beagle* (Evryman edition) London 1980. The London edition of 1890 has a different title: *Journal of researches into the Natural History and Geology of the countries visited during the voyage of H.M.S Beagle round the world.* Other editions have variations of these titles. In our context it is the most quoted work. Other early travellers who published were Captain Basil Hall (1824), Francis Head (1826) and John Miers (1826).

7 The expropriation/nationalization of foreign mining and oil properties in Mexico (1930s), Peru (1960s) and Chile (1970s) was in a fundamental way based on Spanish regalism which separated rights to the subsoil from common property rights and vested them in the state. The state could lease or grant concessions to the exploitation of the subsoil, but these could not be granted in fee simple. Alberto J. Pinelo, *The Multinational Corporation as a Force in Latin American Politics. A Case Study of the International Petroleum Company of Peru* New York 1973; Lorenzo Meyer, *México y Estados Unidos en el conflicto petrolero (1917-1942,* Mexico 1968; Paul Sigmond, *Multinationals in Latin America: The politics of Nationalization,* Madison 1981. Nationalization could also have a socialist logic, as in Bolivia: Guillermo Lora, *The History of the Bolivian Labour Movement,* Cambridge 1977.

8 M.D. Bernstein.*The Mexican Mining Industry 1890-1950,* Albany N.Y. 1964.

9 R.W.Randall, *Real del Monte: Una empresa minera británica en México,* Mexico 1977 (English version 1972). See also Marshall C. Eakin, "The role of British capital in the development of Brazilian gold mining" in W.W. Culvers and T.C. Graves, *Miners and Mining in the Americas,* Manchester 1985. A less constructive view will be found in the first chapters of J.Fred Rippy, *British Investment in Latin America, 1822-1949. A case study in the Operations of Private Enterprise in Retarded Regions,* Hamden, Conn., 1966.

10 *Engineering and Mining Journal,* XCVII, 1914, p. 63 ff..

11 Bernstein p. 70.

12 The "Real Tribunal de la Minería" was set up in 1777. The "Real Tribunal" then founded a full school of mines (1790) and set about providing it with an adecuate building. The "Colegio de Minas" took 10 years to build, cost 1.6 million silver pesos and must have been, when it was finished in 1813, the grandest secular building in the Western hemisphere. Manuel Toussaint, *Colonial Art in Mexico,* Austin 1967, pp 168-9. The Norwegian school of mines at Kongsberg was founded in 1786.

13 T.R. Navin, *Copper Mining and Management,* Tucson, Arizona 1978, p. 111.

14 M. Carmagnani, *Les mécanismes de la vie économique dans une société coloniale: le Chili, 1580-1830*, Paris 1973.

15 R C.R. Nugent to G. Canning, Valparaiso 17 March 1825 in R. A. Humphreys, *British Consular Reports on the Trade and Politics of Latin America 1824-1826*, Camden Society, 3rd series, vol. LXIII, London 1940, pp 95 f. and 98 f.; Claudio Veliz, "Engaña, Lambert, and the Chilean Mining Associations of 1825", in *Hispanic American Historical Review*, 1975 - vol 55 no 4, pp 637-63; W. M. Mathey, *The House of Gibbs and the Peruvian Guano Monopoly,* London 1981, pp. 11, 19, 224; T.W. Keeble, *Commercial Relations between British Overseas Territories and South America 1806-1914* London 1970. It has been argued that dependence upon British commercial houses was a disadvantage (Hernán Ramírez Necochea *Historia del Imperialismo en Chile,* Santiago 1960; and Przeworski): It is difficult to conceive how Chilean copper could have been marketed in Europe without their help.

16 The acceleration of European copper mining came with the redevelopment of the vast copper resources in Huelva (Spain) which had been taken over by a British group of capitalists with no mining background: Hugh Matheson (of Matheson & Co. and closely connected to Jardine-Matheson) with the support of an assorted group of merchant banks: Smith Payne and Smith (London), Union Bank of Scotland (Glasgow), Deutsche National Bank (Bremen), Arthur Heywood and Company (Liverpool), and a railway firm, Clark, Punchard and Company who set up a syndicate strong enough to take over the Rio Tinto mines. This was the origin of the Rio Tinto Company (later RTZ). This is a phenomenon of the 1880s when this company become the leading supplier of pyrites to Europe. The competition this firm had to fight off was not from the traditional Chilean industry, but the big American producers and smelters. Charles Harvey, T*he Rio Tinto Company. An Economic History of a Leading International Mining Concern 1873-1954,* Penzance 1981; David Avery, *Not on Queen Victoria' Birthday. The Story of the Rio Tinto Mines,* London 1974. See also D. B. Barton, *A History of Copper Mining in Cornwall and Devon,* Truro 1968.

17 Joanne Fox Przeworski, *The Decline of the Copper Industry in Chile and the Entrance of North American Capital, 1870-1916*, PhD thesis, Washington University, St. Louis, Missouri 1978.1978, pp. 86-96. See also S.G. Checkland, *The Mines of Tharsis. Roman, French and British Enterprise in Spain,* London 1967, p. 62.

18 Przeworski finds it puzzling why they came, especially as *The Economist* warned them not to. Cornish miners came to Kåfjord (70_ N) in Finnmark, which was hardly more hospitable, as the graveyard there testifies. The same business elite also attempted to discourage Welsh emigration to Patagonia and probably for the same reason. Englishmen in Latin America had to observe certain standards, conform to an image: they were the preeminent foreign business elite and nobody was to confuse this image.

19 J.F. Przeworski, p. 9 ff..

20 Ricardo Latcham, *Chuquicamata, Estado Yankee: Vision de la montaña roja,* Santiago 1920.

21 Central to the more general discussion are the following: Maurice Zeitlin and Richard Earl Ratcliff, *Landlords and Capitalists, The Dominant Class of Chile,* Princeton 1988; Zeitlin, *The Civil Wars in Chile (or the bourgeois revolutions that never were)*, Princeton 1984; James Petras, *Politics and Social Forcès in Chilean Development,* Berkeley 1969; Henry W. Kirsch, I*ndustrial Developmnent in a Traditional Society. The Conflict of Entrepreneurship and Modernization in Chile,* Gainsville 1977; Brian Loveman, *Chile. The Legacy of Hispanic Capitalism,* New York 1979; André Gunder Frank, *Capialism and Underdevelopment in Latin America. Historical Studies of Chile and Brazil,* New York 1967; Aníbal Santa Cruz Pinto, *Chile, un cazo de desarrollo frustrado,* Santiago 1959.

22 Leland R. Pederson, *The Mining Industry of the Norte Chico, Chile,* Evanston ill. 1966; Brian Loveman, *Chile. The Legacy of Spanish Capitalism,* p. 159.

23 John D. Davis, *Corporations*, New York 1961, quoted in W.W. Culver and C.R. Reinhart, "The decline of a mining region and mining policy: Chilean copper in the nineteenth century" in Culver and Greaves, *Miners and Mining in the Americas*, Manchester 1985.

24 Przeworski, pp. 46-8.

25 "Class, state and capitalist development: The civil wars in Chile (1851 and 1859)" in Peter Blau and Robert Merton (eds.) *Continuities in Structural Inquiry*, London 1981. See also *Landlords and Capitalists*. See also Clark Winton Reynolds, "Development problems of an export economy. The case of Chile and copper", in Marcos Mamalakis and Reynolds (eds.), *Essays on the Chilean Economy*, Homewood ill. 1965.

26 *El Porvenir en Chile de los emigrantes europeos,* Santiago 1884.

27 *Nuestra inferioridad económica. Sus causas, sus consequencias,* Santiago 1912.

28 *La fronda aristocrática en Chile*, Santiago 1928

29 *Historia de Chile, el periodo parlamentario 1861-1925,* Santiago 1974, and, of course Arnold Bauer. *Chilean Rural Society from the Spanish Conquesat to 1930,* Cambridge 1975.

30 *Politics and social forces in Chilean development,* Berkeley 1969.

31 Kirsch, p. 75.

32 This became critical when the going became less easy in copper, and investments could be diverted into nitrates, with their low capital demands and high profits (see John Mayo, "Commerce, credit and control in Chilean copper mining before 1880" in W.W. Culver and T.C. Greaves, *Miners and Mining in the Americas* pp. 29-46.

33 William W. Culver and Cornel J. Reinhart, "The decline of a mining region and mining policy: Chilean copper in the nineteenth century" in W.W.Culver and T.C.Greaves, Miners and Mining in the Americas, pp. 68-81. See also Przeworski pp. 292-3.

34 W.W.Culver and T.C.Greaves, pp.70.

35 *Estado de la minería del cobre en Chile,* Santiago 1900; *La producción en Chile de los metales y minerales más importantes ... desde la conquista hasta fines del año 1902,* Santiago 1906; *Algunas ideas sobre el fomento de la minería en Chile,* Santiago 1903.

36 *El libro del cobre y carbón de piedra,* Santiago 1883.

37 D. Joslin, *A Century of Banking in Latin America*, London 1963; John Mayo, *op. cit.*; Agustín Ross, *Chile 1851-1910. Sesenta años de cuestiones monetarios y financieras y de problemas bancarios,* Santiago 1910.

38 Some insight may be gained by reading Part III, "Company Histories" and T. Navin's *Copper Mining and Management* pp 197-366.. See also M.V.Sears, *Mining Stock Exchanges, 1860-1930: An Historical Survey*, Missoula, Montana 1973; William Y. Elliott and others, *International Control in the Non-Ferrous Metals,* New York 1937.

39 United States, Federal Trade Commission, *Report of the Federal Trade Commission on the Copper Industry,* Washington 1947. Alfred D. Chandler, Jr., *The Visible Hand. The Managerial Revolution in American Business,* Cambridge, Mass 1977, p.362; Isaac F. Marcosson, *Metal Magic. The Story of the American Smelting and Refining Company,* New York 1949; Dorothea Mezger, *Copper in the World Economy*, London 1980, pp.172-212.

40 Kirsch pp.52-6; Clark Reynolds, "Development Problems of an Export Economy: The case of Chile and Copper", in M. Mamalakis, *Essays on the Chilean*

Economy, Homewood, Ill. 1965; Marcelo Carmagiani, *Sviluppo Industriale e Sottosviluppo Economico, Il Caso Chileno (1860-1920),* Torino 1971.

41 This has become an academic (sub)field, with its own publications likethe eminent *Economic Development and Cultural Change,* 1952-.

42 Gabriel Almond, Reinhard Bendix, James Coleman, Seymour M. Lipset, R. Merton, Talcott Parsons, and Sidney Verba, to mention some central figures which have pushed the social sciences in this direction. Central in the Latin American field are Claudio Veliz, John J. Johnson, Sergio Bagú, Gino Germani, Bert F. Hoselitz, Richard Morse, Caio Prado, Cole Blasier, Torcuato di Tella, Pablo Gonzales Casanova, Joseph Kahl, and Aldo Solari. The social sciences have since moved on to other themes and interpretations, but the legacy of this mighty tradition are still premises for our interpretation.

43 There are a few histories of U.S. copper mining companies operating in Chile: these are Luis Hiriat, *Braden: Historia de una mina,* Santiago 1964; Alejandro Fuenzalida Grandon, *El trabajo y la vida en el mineral El Teniente,* Santiago 1919; Marcial Figueroa and Eulogio Gutierrez, *Chuquicamata: sus grandezas y sus dolores*, Antofagasta 1920. These, however, cover the "Gran minería" and the present century, nothing else.

44 Navin writes: "material published on Anaconda nearly equals that published on all the other American copper companies combined" (Navin, p. 375). ASARCO and the Guggenheims are very badly covered: The most substantial contribution is that of Isaac Marcosson, *Metal Magic. The Story of the American Smelting and Refining Company,* New York 1949. Others are E.P. Hoyt, *The Guggenheims and the American Dream*, New York 1967, and the very informative work by Harvey O'Connor, *The Guggenheims, The Making of an American Dynasty*, New York 1937. None of these are based on Guggenheim papers: the closest the authors get are gracefully granted interviews. The Kennecott Copper Corporation has yet to be described. The Rio Tinto mines have been very well served by , David Avery and Charles E. Harvey, while the neighbouring mines of Tharsis, also in Huelva have been covered in an eminent way by S.G.Checklandand. The outstanding work in the Latin American context is Marvin B. Bernstein's study of Mexico.

45 The papers of the Company are in Santiago de Chile, and are in the possession of the descendants of the last manager, Sr. F.A.Sundt. These include legal documents, maps and plans, many of them manuscript, two volumes of Board papers (complete and not very informative), most of the correspondence from the management in Corocoro - probably above 2000 letters, and including all the manager's semi-annual reports whith the corresponding economic statements, which from 1892 become very detailed and informative.(The manager wrote to his superiors in Santiago once a week, in times of stress the frequency could be greater. What is missing almost entirely is the correspondence from Santiago to Corocoro. The dayly accounts survive in a very fragmentary way. F.A.Sundt compiled a very large and comprehensive table over the Company's activities,

and he also excerpted the whole correspondence: The copy is a very substantial collection. I have compared Sundt's work to the original and have used both. I have not come across discrepancies in quoted text or obfuscation of any kind. The material used here is, when not otherwise stated, taken from the Santiago originals.

46 The company was founded 27th april 1873 and exploitation was started simultaneously. Workings were closed 29th sept. 1923.

47 Unlabeld parcel of legal documents (1 of 6). Among the names on this list we find Urmeneta, Montt, Bascuñán, Ossandon, Errazuris, Pratts, Puelma, Irarrazaval, Ossa, Riesco, Prieto, Vial, Rivas, Vicuña, Zañartu, and Subercaseaux. They have been chequed against J.Fuentes, L.Cortes, F. Castillo, and A. Valdes, *Diccionario histórico de Chile*, 2 vols., Santiago 1978.

48 This is an inference: The Aymaras are the dominant indian group in the department of La Paz, concentrated in the region South of Lake Titicaca. "Before 1952 the social isolation of the Aymará was extreme. There was little sense of community with neighbouring groups or with the nation. Political participation was nil. Aymará communities were self-sufficient, non-cash oriented societies..." (*Area Handbook for Bolivia*, DAPam 550-66, Washington 1974, pp. 82-83.)

49 Accounts were finished on a semester basis. From 1893 to 1879 the semesters ended in April and October. From 1880 to 1909 accounts were finished in February and August. From 1910 these dates were moved to June and December. In part due to the war of the Pacific 1879-84 when the mines were expropriated by the Bolivian government, and the revolution of 1898-9, when the administration buildings were razed, early figures are incomplete or missing. Uncertain figures are not given. Calculated from F.A.Sundt, "Cuadro de las operaciones de la Compañía Corocoro de Bolivia desde su fundación , 27 de Abril de 1873, hasta la clausura de sus trabajos, 29 de Setiembre de 1923".

50 *Area Handbook for Bolivia*, p. 321.

51 Previous to the War of the Pacific, Bolivia had access with the port of Antofogasta in excess of 1000 km away from Corocoro.

52 Sotomayor To Rivas, 13.4.1878.

53 Estaca, Chilean term denoting basic unit for mining concessions.

54 Some insight into this process can be gained from a close reading of the "Relación de los titulos de propriedad de las minas , aguas, terrenos, edificios, organizacion de la sociedad etc. formada de sus abogados Walter A. Mendez y José E. Rivera" February 1916- December 1924. which is a register and history of all the deeds collected by the Corocoro company.

55 Diario de Corocoro, 27.4.1873 (FAS), inventory of sale. According to Marcosson the Corocoro mines had previously been owned (first) by Bolivian and (then) French interests. No sources are given.

56 Sotomayor to Rivas 25. april 1873.

57 "Arreglo y Relación de Titulos de las Propriedades Mineras, Terrenos y Aguas de la Compañía Corocoro de Bolivia Verificada por sus abogados Dres. Walter A. Mendez y Jose E. Rivera", 1916-1924.(FAS)

58 See group of papers "Litigios" in the "Relación de los Titulos...".

59 It's copper production was in all years two or three times as large as the production at R¢ros.

60 Guillermo Lora, in *A History of the Bolivian Labour Movement,* Cambridge 1977, p. 297, describes Corocoro in 1914 as one of the most important mining centres of the country. The labour leader Juan Lechín Oquendo was born there.

61 Sotomayor to Rivas 25.4.1828; 1.5.1873; 6.5.1873; 9.5.1873; 16.5.1873.

62 "Modern" is a relative term. The British had been leaders in world mining into the second half of the nineteenth century. However, when American engineers towards the end of the century took over what had been British mines in Mexico they "were astounded by the antiquated design of new machinery imported from Britain" (Marvin D. Bernstein, *The Mexican Mining Industry 1890-1950,* New York 1964, p. 63.

63 See G.Stang, "Aspectos de la politica de personal de las empresas Británicas en America Latina 1880-1930" in *Capitales, empresarios y obreros en America Latina*, Instituto de Estudios Latinoamericanos de la Universidad de Estocolmo, 1983, 2nd vol pp. 501-550. Some of the companies investigated were: Pearson & Son, Ltd., Cordoba Light, Power and Traction Co., Lautaro Nitrate Co., Santa Luisa Nitrate Co., Western Telegraph Co., Ltd., The Peruvian Corporation, Ltd., Mariano and Havana Railway Co., The Great Southern Railway Co., Ltd., Ferrocarril Buenos Aires al Pacifico.

64 It is difficult from the halfyearly accounts to calculate the workforce. The correspondence and reports give considerable information on employment figures at individual sections, yet I have not come across a single complete survey. The figure here is taken from the Sandstad biograpy in *Studentene 1880.* We do not know if these figures includes those involved in haulage to Arica. We have good figures for the productivity of labour.

65 F.A.Sundt, "Notas y datos jenerales" appended his "Cuadro de las operaciones..."; "Lista de planos, catálogos i (sic!) antecedentes sobre las maquinarias e instalaciones de la Cia. Corocoro de Bolivia", F.A.Sundt, no date (1924); "Lista

de los planos existentes en el archivo de la Compañía Corocoro de Bolivia", F.A.Sundt 9.1.1924; Compañía Corocoro de Bolivia, "Relación de los titulos de propriedad de las minas, aguas, terrenos, edificios...".

66 Sotomayor to Rivas 13.6.1873. Criticism, often in strong terms, of local labour is pervasive in these letters. This is, in my experience, uncommon: It is not found in company papers I have been through anywhere: British firms working in the Chilean nitrate fields, portworks also in Chile, railways in Mexico, Argentina and Colombia, hydroelectric power companies in Argentina, telegraph in Brazil, and so on.

67 These ores went into the local brass industry, prominent in this sector being the bell foundries.

68 Antenor Martines to Rivas 28.5.1906.

69 Martínez to Rivas 20.9.1906. It is also indicative of the labour market that the government was forced to use impressed labour.

70 Martínez to Rivas 15.2.1906.

71 We are told for example (20.9.1878), that the machines are giving much better results than in Teare's time.

72 Sotomayor to Rivas, 14.11.1873.

73 Coal (and later petroleum) - "combustible" - is singled out as a main cost item from 1893 when it amounts to about 5% of total production costs at Corocoro, and rising to 25% and 30% in the early years of the new century (F.A.Sundt, "Cuadro de operaciones...". See also the semi-anual reports).

74 Sotomayor to Rivas 6.11.1874.

75 Sotomayor to Rivas 18.12.1874; Sotomayor comes back to this:"Enpleados superiores deben ser Chilenos o extrajeros", 16.3.1877 .

76 Sotomayor to Rivas 18.7.1873. In Argentina it was generally accepted that discipline was much tougher and social distance considerably greater in native (i.e. Argentinian) firms than in English firms. If this was also the case in Corocoro, "peones" would first try their luck in the two foreign firms, and this may in part explain the chronic lack of labour.

77 Sotomayor to Rivas 15.1.1875; 22.1.1875; 1.9.1877; 25.1.1878.

78 Sotomayor to Rivas 7.2.1878.

79 Sotomayor to Rivas 1.9.77; 8.11.77; Jorge Herrmann seems to have been used as a consultant to the firm in many technological contexts: he was with Rivas when he inspected Corocor in 1877 and was brought in to vet Lorenzo Sundt who became subgerente, and later followed as gerente, manager in Corocoro.

80 Sundt was "Bergkandidat" from Kristiania (present day Oslo) as far as we can judge (Johannes Seland, *En by og en Bank. Farsunds historie og Farsunds Sparebanks historie,* Farsund 1967, p. 240). He recruited Ole Sandstad, also "Bergkandidat" (mineralogisk embedseksamen, University of Kristiania) of great promise, who in due course succeeded him as manager in Corocoro (*Studentene av 1883*, Oslo (Kristiania) 1905, pp. 335-338) and probably a couple more, Axel Thorgersen, Kr. L. B¢ckman (F.A.Sundt to Rivas 26.1.1915) and perhaps "Berglund" which I have yet to trace. We do not have manning lists of any kind. L.Sundt published several technical and scientific books and wrote regularly in the *Boletin de la Sociedad Chilena de Minería* (*El Mercurio*, 28.2.1929). A description of the process of search is found in F.A.Sundt to Rivas 15.1.1915 - these abound.

81 Sotomayor to Rivas 27.7.1878.

82 Sotomayor to Rivas 27.1.1878.

83 Sotomayor to Rivas 27.6.78 ("...falta forraje, venderé animales"). Similar comments are found throughout the letter books.

84 Sotomayor to Rivas 8.1.1875.

85 Martínez to Rivas 10.1.1908.

86 F.A.Sundt, 2nd semiannual report 1915.

87 Sotomayor to Rivas 8.1.1885.

88 Sotomayor to Rivas 6.1.1878.

89 Sotomayor to Rivas 19.2.1875.

90 Granier to Rivas 16.12.1898; Sandstad to Rivas 23.12.1898; 30.12.1898; 6.1.1899; 13.1.1899; Granier to Rivas 30.1.1899; 3.2.1899; Bates to Rivas 24.3.1899.

91 Sotomayor to Rivas 27.1.1878; 9.4.1875.

92 Sotomayor to Rivas, 27.7.1875

93 Sotomayor to Rivas 13.4.1878. See also Mario Barros, *Historia diplomática de Chile 1541-1938,* Barcelona 1970 p. 325. The Chilean point of view is described

in Francisco Encina *Las Relaciones entre Chile y Bolivia 1841-1963*, Santiago 1963 pp.107-125. Sotomayor charecterizes Hilarion Daza in no uncertain terms: "...cholo sin lealtad, interesado, egoista, dotado de todos los defectos de su baja extracción; no inspiran seguridad en sus palabras", Sotomayor to Rivas 25.2.1879. Daza is hardly attractive from a Bolivian point of view either, see Guillermo Lora, *A History of the Bolivian Labour Movement*, pp. 56-59.

94 Sotomayor to Rivas, 14.6.1878.

95 Sotomayor to Rivas 19.2.75.

96 Martínez to Rivas 19.5.1899. He complains of the people's hate - "odio".

97 Sotomayor to Rivas 14.7.1878.

98 M.M.W.Culver and C.J.Reinhart, "The Decline of a Mining Region and Mining Policy: Chilean Copper in the Nineteenth Century", pp. 69-70 and 77-78. Charles Harvey, *The Rio Tinto Company*, pp. 36-8, 297; M.D. Bernstein,*The Mexican Mining Industry 1890-1950*, pp. 32-33; T.R. Navin, *Coper Mining & Management*, p.13; H. Barger and S.H.Schurr, The Mining Industries, 1899-1939, p. 102; Clark C. Spence, *British Investmestments and the American Mining Frontier, 1860.1901*, Ithaca 1958, pp. 8-9.

99 Based on and calculated from F.A.Sundt's in "Cuadro de las operaciones de la Compañía Corocoro...". 10.3.1926.

100 F.A.Sundt, "Yanabarras esportadas sin concentración", addendum to the "Cuadro de operaciones..." already mentioned.

101 John Mayo, "Commerce and Credit Control in Chilean Copper Mining before 1880"; Przeworski, pp. 111 -115; Kirsch pp. 58-60.

102 David Joslin, *A Century of Banking in Latin America. The Bank of London & South America Limited*, London 1963, pp. 174-201.

103 Sotomayor to Rivas 29.11.1877.

104 Sotomayor to Rivas, 14.6.1878.

105 Sotomayor to Rivas, 9.4.1875.

106 Sotomayor to Rivas, 27.6.1878

107 Przeworski, p. 42, and 118 ff., makes a mayor point of this. Isaac F.Marcosson, *Anaconda,* New York 1957, p. 205. The Chile Copper Company (i.e. Guggenheims Chuquicamata enterprise) owned the Chile Steamship Company which specialized in ore ships. The company also had five tankers securing a

regular fuel supply. American Smelting and Refining Company also had its own fleet of ships. Some problems in not having them are sketched in M.D.Bernstein, *The Mexican Mining Industry*, p. 130.

108 "Resumen general de ventas" and "Cuadro de ganancias" were made up twice a year and give a detailed analysis starting from 1891.

109 "Balance General: Ganancias y Perdidas" all years; Also F.A.Sundt "Cuadro de las operaciones..." for dividends. Dividends have been calculated from £ at the yearly maximum rate.

110 Navin, *Copper Mining and Management*, pp. 118-19.

111 "Informe del gerente", 2nd half 1914; 2nd half 1916.

112 "Informe semestral del gerente", 1st half 1915.

113 "Informe del gerente", 2nd half 1915.

114 The flotation process was originally developed in Australia around 1910 and its use in copper concentration (U.S.) dates from 1913-16 when it was used as an accessory to gravity concentration. H.Barger and S.H. Schurr, *The Mining Industries, 1899-1939. A Study of Output, Employment and Productivity*, New York, 1944, p. 155.

115 "Informe sobre las operaciones de la Compañía" 1st half 1918.

116 "Informe de las operaciones de la Cia." 2nd half 1918. The dayly milling capacity was now 600 tons, and the flotation tower heightened to 25 m., "Informe de las operaciones de la Cia." 1st half 1919.

117 "Informe de las operaciones de la Cia." 2nd half 1921; "Informe sobre los trabos (sic!) de la Segunda Sección de Minas de la Cia." 13.2.1923; "Mina Remedios.- Informe correspondiente al segundo semestre de 1921".

118 F.A. Sundt, 12.3.1924.

119 Sandstad to Rivas 6.1.1899.

120 T.R.Navin, *Copper Mining and Management*, p. 127.

121 Maurice Zeitlin and Richard Ratcliff, *Landlords and Capitalists, the Dominant Class of Chile*, Princeton 1988.

122 L.Sundt to F.A.Sundt 31.12.1923.

123 F.A. Sundt, "Cuadro de operaciones..."