James Douglas in Chile

By
William W. Culver
Past-President of the
Mining History Association

The thought that he might become very wealthy stayed with James Douglas as he left Valparaíso's Barón Station at 7:40 AM on the Santiago train.[1] It was a clear summer morning, Wednesday, February 22, 1871.[2] Out the left side of the car he could see sailing ships at anchor as well as the British steamship *Panama* that had brought him south from Lima. His weeks at sea were at an end. Now, on the last leg of the trip that would change his life, all was going just as he imagined—almost.

The day before, his contact in Chile, Juan Stewart Jackson, assured Douglas that if the experiments at the mine bore out his promises, he, Douglas, would "go home with a fortune."[3] Wonderful words to Douglas' ears. If this were so, it would protect his family from the threat of ruin that emerged as his father, little by little, recklessly tied their family's finances to a single copper mining company at Harvey Hill, Quebec.[4]

The complication was Jackson's request that Douglas stay longer than originally planned. Douglas explained to Jackson that his wife, Naomi, had limited his leave to a total of four months, inclusive of the weeks spent traveling from Quebec City to Chile and back. The apparent reason for limiting his stay was their children: Elizabeth was eight, Naomi was six, Jim was only three, and baby Walter was not yet a year old. Jackson argued that Douglas should be "rebellious for the result would lead" his wife to mitigate his punishment.[5]

Douglas noted that the English railway carriage was stuffy and confined in comparison with American ones. The train, as was routine that summer, consisted of five cars—two of them first class.[6] Seated in a first-class compartment, Douglas felt confident striking up a conversation with the stranger seated next to him. Douglas related that he was going to a copper mine, the Invernada. The young Englishman, for his part,

explained he was only going as far as Limache, where he was headed "in search of health"—he needed to leave behind the coastal humidity for the drier inland air.[7]

At the first stop after Valparaíso, El Salto, just inland from the coast at Viña del Mar, they were joined by another passenger whom Douglas observed to be an "Englishman with an angular, comical face, and a body with all the members attached to one another by hinge joints."[8] Further down the line at Limache, as the young seeker of health rose to get off, he bent over so he could whisper to Douglas a suggestion; he should make friends with the English gentleman, Mr. Charles Swinburn,[9] "the first merchant of Santiago." It was now about 9:00A.M. In his first letter home from Chile, Douglas detailed to Naomi how he immediately "commenced operation" and before they parted when the train reached Douglas' destination, Tiltil, Swinburn had treated Douglas to a bottle of "native claret." Douglas told Naomi that Swinburn, in addition to sharing his wine, had been very kind in offering all sorts of assistance in making local contacts.[10]

James Douglas, Jr.

James Douglas was his full name—no middle name. Up until his father, Dr. James Douglas, died, he always added "junior." In 1858, Douglas, Jr. finished his theology degree at Queen's College in Kingston, Ontario, following his two years of theological studies at the University of Edinburgh. Subsequently (1861), with further graduate study in Edinburgh, he passed his final church exam, thus becoming a licentiate, but was never ordained as a minister of the Church of Scotland.[11] This education should have led to a position with the Presbyterian Church in Canada. However, by the time he sat for his examinations his "faith in Christ was stronger," but his "faith in denominational Christianity was so weak" that he could not sign the Church's required Confession of Faith.[12] In later years Douglas never sought ordination, although he not infrequently gave sermons up until 1880.[13]

As an alternative career, Douglas intended to take over the family business by gradually assuming administration of Quebec's Beauport Lunatic Asylum[14] from his father, a physician. Privately owned by Dr. Douglas, the Beauport Asylum opened in 1845 to serve all of Quebec on the basis of an exclusive contract with the government. In preparation for his new career, Douglas, Jr. began medical studies, including chemistry, at Laval University. Unfortunately for Douglas, his father, after decades spent building the asylum into a leading and progressive institution, in 1865 lost the contract, and thus Douglas' future as the director of the Beauport Asylum was not to be.[15] With this turn in his life, Douglas' future again seemed uncertain.

Tiltil and the Invernada Mines

Six years later in Chile, Douglas was a Canadian metallurgist consulting with a newly organized Chilean copper mining company—a company born out of an international network of British gentlemen. Before Douglas disembarked from the train in Tiltil he learned more about the "network." Swinburn was born and raised in Liverpool. A coincidence and another connection—Douglas had traveled to Chile due to his relationship with Arthur Lewis, of Lewis and Son, Merchants and Copper Brokers in Liverpool.[16]

As an expatriate, Swinburn's experience was similar to that of many Englishmen coming to Latin America after the break-up of the Spanish Empire. He found success in representing and selling English manufactures, a business hinged on securing return goods, among them copper. Swinburn traveled to Chile at age twenty-one via Peru, where his brother was a merchant. He ended up in Santiago as an agent for several Valparaíso businesses, and over the years he gradually established his own commercial house. He came to be considered the dean of British residents in

Santiago, at a time when Valparaíso was still the commercial capital of Chile.[17]

As the train carrying Swinburn and Douglas headed east, climbing the Aconcagua River Valley bisecting the north-south Coastal Range, Douglas listened to Swinburn's narrative on the passing estates, or *fundos* as Chileans termed them, their owners, orchards, vineyards and crops. Swinburn would have pointed out Cerro Campana, an unusual mountain peak south of the railway line climbed by Charles Darwin in 1834. Campana juts above its ridge looking like a loaf of French bread standing upright.[18] At one point as the railroad turned south into the country's Central Valley at Los Maquis Cañón, Douglas became aware of the Andes Mountains rising up like a wall. The Andes formed the eastern edge of the Central Valley, but the tracks were too close to the front range of the mountains for Douglas to see Mount Aconcagua some fifty miles to the northeast.[19]

Along the way, Swinburn introduced Douglas to another expatriate, a Mr. Foster from Philadelphia, then running a large peat operation. Here was one more connection; to Douglas Chile seemed more and more a place of opportunity. As in Quebec, Douglas found that here Anglo gentlemen met, trusted each other, and exchanged information—they naturally helped one another.[20]

Arriving at the Tiltil station, Swinburn momentarily left the train with Douglas to speak with the stationmaster, explaining Douglas' needs and intentions. The time was now about noon. Douglas spoke no Spanish, but understood some via French, which he spoke as a second language all his life. Only after Swinburn departed on the train for the last leg into Santiago did the stationmaster let Douglas understand, in French of a sort, that Douglas' contact, Invernada superintendent Edwin Waring, had himself gone to Santiago the day before with Mrs. Waring, a Chilean. Douglas thought to himself that had he known this fact, he would have continued on to Santiago to enjoy Mr. Swinburn's hospitality. Now, Douglas wondered what to do.[21]

Tiltil, some thirty miles northwest of Santiago and populated by artisan miners, small-plot farmers with goats, and farm workers, was little changed from colonial days. The miners worked alone or in improvised groups earning their daily bread (and wine) by picking at poor surface copper outcroppings or by panning for gold when there was enough water.[22]

Tiltil's small population had barely increased over the years, for despite large families, many young men preferred to move to Santiago, where they could find steadier employment than working as farm laborers or independent miners. Tiltil's young women found work in the capital as maids. When rail service began in 1863, the Tiltil station sparked new expectations among the townspeople, as the cost of shipping ore and farm produce fell, but not much changed.

As in most small Chilean towns, social life on Saturday nights was important—for men. Since colonial days, Tiltil was the gateway to Dormida Pass—an alternative and older route for horse, mule, and cart transportation between Santiago and Valparaíso.[23] Adobe constituted the universal building material—the type of construction that at Tiltil's foothill elevation is now known as the preferred habitat for the vinchuca beetle carrying the debilitating chagas disease (*mal de chagas*).[24] The population of the village (*aldea*) when the Invernada company was being organized was fewer than six hundred inhabitants.[25] So the Tiltil that greeted Douglas in 1871 was much the same as it had been in previous decades, with the exception that the promise of new jobs arose with the expanding mine and plant at Invernada, already the largest employer in town.

The village lacked public lodging, so the stationmaster lent Douglas his horse and put him on the Invernada cart road. Under Waring's direction the road was now wider than ever and improved in anticipation of Douglas' new process increasing production. The stationmaster pointed out the Invernada mines six miles to the west near the top of a high north-south ridge, several miles due

south of Dormida Pass. They could just barely see the mouth of one of the mines nearly four thousand feet above the station.

Following the wash that became Maritatas Cañón as the cart road gently ascended, the road at times took on a corkscrew-like routing. Douglas, wearing his jacket, hat, and tie, reflected on the contrast between the wild and pretty scenery unfolding as he rode and the rolling hills and green forests of Quebec.[26] The rocky hillsides with scattered shrubs and tall gaunt cacti seemed curious. He wondered how they survived both the heat of summer and the snows of winter. Then he took note of a huge solitary palm tree at the mouth of the canyon—*Jubaea chilensis*, a large palm species unique to Chile's coastal range.

As Douglas came around a bend in the road carved out of the side of the canyon where it closed in the most, he at last caught sight of the furnace chimney, followed by some small buildings he thought of as "native ranchos," and finally a more substantial house. The canyon opened into a flat basin with a flowing stream, obviously suitable for both a smelting plant and housing. Douglas had reached his destination. Second thoughts overwhelmed him. He missed his home and family.[27]

Developing Invernada

Juan Stewart Jackson's involvement with the Invernada project began as an effort to save his Canadian friend, John Edward Thorner, from financial ruin.[28] As a side activity beginning when he arrived in Chile two decades earlier, Thorner invested in mining projects. But his copper mine at Tiltil, in which he was heavily invested, turned out to be mostly "worthless" low-grade ore. Jackson expected Douglas' patented "wet copper process" not only to save Thorner, but, if it worked, to place Jackson in a leading, perhaps dominant, position in Chile's copper trade. As a banker, mine investment broker, and copper dealer, Jackson would control the means for working an unlimited number of copper mining possibilities.

What Jackson did not know was that, like Thorner, the Douglas family had become overextended during the 1860s trying to develop its own copper operation without outside capital. James Douglas, Sr. and Thorner both hoped, as did so many miners in that era, that ore grades might improve with depth, and that their business skills in non-mining areas would lead to a good result in working their mines. Jackson had every reason to believe that Douglas, Jr.'s technology would be as revolutionary as early reports suggested.[29]

Once Douglas was at the mine camp, Jackson sent a letter to Chile's president, José Perez, requesting an extension of the original five years for the Douglas patent, arguing that the process was just what the country's copper industry needed. He wrote that "there are huge quantities of copper tailings of between 4 to 5% in Chile that until now have been considered without value, and . . . immense mountains of low-grade minerals that presently are left unexploited for lack of a low-cost method to benefit them."[30] With all known copper districts exhausting their higher grades of ore, the industry's end was in sight. There were solid prospects in the interior Andes range of mountains, but the high costs of access precluded these low-grade deposits from commercial exploitation.

The significant scientific credentials of Douglas' partner, chemist T. Sterry Hunt, bolstered expectations.[31] The odds seemed so much in favor of the process that Jackson was able to raise substantial capital from some of Valparaíso's leading men, all willing to invest in a new ore processing plant built to Douglas' specifications. This form of financing was new to Chile; the Invernada Mine Company—*Compañia de Minas de la Invernada*—was the country's first limited-liability, joint-stock mining company, and one of a handful of such new business corporations.

At some point after Thorner arrived in Chile, he began investing in mines by grubstaking prospectors, becoming in Chile what was termed an *aviador* or *habilitador.*[32] By the late 1860s this ac-

tivity left him the owner of several copper mines west of Tiltil above the Maritatas Cañón, most likely in settlement of an unpaid loan. These were the mines now owned by the new joint-stock company, organized by Jackson for the sole purpose of implementing Douglas' technology.

The Invernada Mine Company took its name from the basin where the plant was located. Invernada means winter pasture. The several mines controlled by the company had been promising when they fell into the hands of Thorner, but the rich oxidized copper ore of 30 percent copper metal visible at several outcroppings above the 5,000-foot level became leaner and leaner with just a few meters of depth.[33] There seemed no way ahead until Jackson, via his Liverpool copper broker, Lewis and Son, learned of the new copper process for low-grade ores just developed at Harvey Hill.[34]

The method seemed a business-saving innovation for Thorner. Known as the Hunt and Douglas Copper Process, it was a chemical means to extract copper metal from ore too lean for profitable furnace smelting. The process generated considerable news in the North American mining press, with New York's *Engineering and Mining Journal* and San Francisco's *Mining and Scientific Press* giving full coverage to the announcements and news about the technology.

AVISO

Importante a los mineros.

GRAN DESCUBRIMIENTO.

Método fácil de beneficiar desmontes y metales de baja ley.

El infrascrito, dueño del privilejio esclusivo del método de Hunt y Douglas, segun decreto del 17 de febrero de 1870, ampliado con fecha 15 de julio de 1871, avisa al público que este método de beneficiar metales de baja ley está en operacion en las minas de la Invernada, Tiltil, a donde se puede inspeccionar el modo de beneficiarlos. Para otros pormenores y para sacar la patente necesaria se puede ver con el infrascrito. Este método dará un impulso nuevo al negocio de metales de cobre y de cobre y plata, haciendo vailosos todos los desmontes acumulados por muchos años, los que hasta ahora no han podido beneficiar y haciendo esplotables las minas de baja ley, que abundan en todo el pais. El método es poco costoso y ha tenido un éxito completo.

J. Stewart Jackson.

Calle de la Aduana núm. 19.

An advertisement from El Mercurio *(Valparaiso), July 8, 1871.*

With its adoption by the Invernada Mine Company, the Hunt and Douglas Process became the first commercial "wet" copper process to make the transition from the laboratory to an industrial application. Chile's press in Valparaiso and Santiago did not follow the mining industry, so the only mention of the Hunt and Douglas Process in Chile came in the form of various paid ads placed in *El Mercurio*, today the oldest continually published Spanish-language newspaper in the world (1827).

The Thorner Brothers in Chile

When Thorner, along with his two brothers and sister-in-law left their homes in Hamilton, Canada West (today's Ontario), they were filled with the hope of the bold future that California seemed to offer.[35] John Edward was the oldest at twenty-eight, Robert Thomas was a twenty-six-year-old newlywed, and William Henry was twenty-four. Their descendants know very little about the brothers, but have no reason to think the three were much different from others of their generation who decided to join the California gold rush.

The four, three brothers and a bride, set off in 1849 on a sailing voyage around Cape Horn rather than cross the North American continent by land or travel to San Francisco via the Isthmus of Panama. Their ship stopped at Valparaiso for supplies, rest, and repairs. The trip from Buenos Aires to Valparaiso was long and hard on both ships and passengers, especially during the Southern Hemisphere's winter months.

A vivid example of the effect of that arduous passage came two years later, when the wives of

some forty-three Scottish coal miners headed for Nanaimo, Vancouver Island, staged what came to be known as the "mothers' mutiny" off the coast of Chile. Against the captain's wishes, these women insisted that their sailing ship, *Colinda*, put in at the nearest Chilean port after rounding Cape Horn. The captain responded with an accusation of mutiny against the passengers, but a Royal Navy inquiry in Valparaiso dismissed all charges soon thereafter.[36] The women, with their children, refused to sail any farther. All disembarked, followed by their skilled husbands. Notwithstanding their contracts with the Hudson's Bay Company, these miners went to work in Chile, much to the providential benefit of Chile's nascent coal mining industry, and secondarily, Chile's emerging copper smelters.

It was not uncommon for a group like the Thorner party to pause in Valparaiso on its way to San Francisco, exhausted. Exactly when the Thorner party arrived is not recorded, which suggests that they were not cabin passengers; Valparaiso newspapers normally named the cabin or first-class passengers as they arrived or departed. It was not until June 1849 that the first American fortune hunters arrived in San Francisco by ship,[37] so the earliest the Thorner brothers would have been in Chile was perhaps May 1849. Valparaiso would have been full of gold rush news as ships leaving California on their way to the Atlantic stopped in Valparaiso to restock their stores and make last-minute repairs.

For reasons unrecorded, John Thorner and his youngest brother, William, elected to remain in Chile. Only Robert and his wife, Belinda Tull—married on February 14, 1849 in Muskingum, Ohio, just before they left for the East Coast—continued on to California.[38] Robert apparently died in California, after which his widow returned to Chile where she briefly rejoined her brothers-in-law. Belinda's son, Robert William Thorner, was born in Chile on December 21, 1850, and soon thereafter the mother continued on her way back to Hamilton, Canada West, with the baby. But John and William stayed in Chile, never traveling onward to California. William had trained to be a dentist before they left Hamilton, where for a time he had a practice. Training in dentistry was rudimentary at the time, and records indicate that both brothers worked as dentists in Valparaiso.

In his *"Old Timers," British and American, in Chile*, C. F. Hillman wrote that "among dentists who must have come in the first half of the century, or shortly thereafter, were an American, Robinson, [and] two brothers Thorner, Canadians."[39] Hillman, citing a Valparaiso newspaper, added: "In this same year of 1850, on the 15th of December at 2:00 AM, a fire caused destruction on both sides of the Calle Cabo, burning out the following: E. Thorner, dentist."[40] The conclusion to be drawn is that the Thorner brothers arrived sometime after May 1849 and by December 1850 had settled into a professional life in Valparaiso as a part of the growing Anglo community.

In the following years John Thorner must have done well enough as a dentist to be able to afford to loan money to prospectors. William may have moved to Santiago, where his daughter Zelmira was born in 1868,[41] but John remained in Valparaiso. Grubstaking prospectors was a common "investment" strategy for storeowners and professionals with extra cash—approaching mine speculation as a savings account of sorts. As both the coastal range and the Andes Mountains are highly mineralized, there was a continual movement of prospectors to and from the mountains, each with visions that his skill would lead to the next rich strike.[42]

Silver was the attraction, but copper was more often the result. Years after he returned to North America, in an article for the *Engineering and Mining Journal*, Douglas wrote about the men who financed prospectors and promoted new mines. As Douglas had visited all of Chile's major copper mines during his months in the country, on returning to North America he quickly established himself as both the *Journal*'s "Chile expert" and as a copper-supply oracle. He wrote not in-

frequently on Chilean copper topics. Over much of his career in mining, Douglas wrote about his experiences of the day—he called it a hobby—and more commonly generalized what he saw into broad statements. Thorner would have been in the back of his mind when he wrote:

> The 'habilitating' of mines is a business that many firms engaged in general business are deeply immersed in—often too deeply for their prosperity. A sum supposed to be unmistakably insured is advanced in either cash or goods, generally at 12 per cent interest, and the miner, as an additional inducement, offers to sell the produce of his mine to or through the advancer on terms that often preclude the possibility of his success. The merchant's knowledge of the undertaking is probably on a par with his creditor's honesty. In process of time, the mine falls into the advancer's hands; and it is then a toss-up whether he will become the fortunate owner of a good mine, or will ruin himself in trying to work at a profit, under what he prides himself is good management, an enterprise that his creditor may not unreasonably be supposed to have failed in through neglect.
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> Of course, in Chili [*sic*], as elsewhere, hope is the principal capital in every mining scheme, and disappointment of consequence as frequently the only dividend. There, also, as elsewhere, the men ignorant of mining are most sanguine of success. As in every mining country, so here also, there are the stock stories of mines, now the most productive and prosperous, being on the verge of closure and their owners on the brink of ruin, when a body of ore was struck that turned the tide of fortune. Such examples are [the] very devil's decoy-ducks, tempting men to imagine that the closer they are to the edge of the precipice the nearer they must be to fortune, and therefore they persist and spend their last penny, and exhaust their credit, and involve their best friends, flattering themselves all the while that the rule, based on some three or four facts that they recollect, and oblivious of the hundreds of exceptions that they willfully overlook, cannot be reversed. Mining, when conducted wisely and with skill, is very often remunerative; but however profitable it may have proved in Chili, to a few men of experience, with many ventures and great powers of financial endurance, the temptation to depart from their legitimate business and invest in mines has ruined many.[43]

By the 1869s, John Thorner was facing ruin. There is no direct record of negotiations between Thorner and Jackson; we only have Douglas' letter where he makes reference to Jackson helping a dentist friend.[44] Still we can safely assume that in the small Anglo-Chilean community, Jackson and Thorner's common interests would have brought them together in conversation. Jackson was a banker and involved in financing new companies, and Thorner an owner of mines in need of fresh capital to feed his hope of success. For Jackson, Douglas' visit was part of just another project, but one with a revolutionary potential for future projects. For Thorner, the outcome of this revolutionary chemical process was everything.

The Crossroads

One of Juan Stewart Jackson's business activities involved brokering sales of export copper from his office in the Customs House at Valparaiso. From his window he looked north into the protected harbor and could see each ship as it anchored in the bay. As almost every ship rounding Cape Horn stopped in Valparaiso—whether headed for Lima, San Francisco, Vancouver Island, or across the Pacific—it was a strategic view.

The same held true for ships on return voyages.

Each ship's sailors brought news concerning their last port and ships they passed while at sea. They sought fresh water, fruit, meat, and a place where they could make repairs. Working in Valparaiso offered daily intelligence from Europe, both coasts of the United States, and from Asia; the harbor was the central crossroads of the South Pacific. Newspapers in English and Spanish printed the hearsay from ships' crews and republished information gathered from newspapers brought on ships. Pre-Panama Canal Valparaiso was also a home harbor for Britain's Royal Navy—then the protector of law and order—in the Pacific.

The 1870s was a golden age for the port; Santiago's emergence as the country's commercial center was still ahead. Twentieth-century Chile's great commercial houses, such as *Duncan Fox*, and *Agencia Graham*, all trace their origins back to this era of Valparaiso's history.[45] Among other activities, these enterprises kept the northern mines supplied with all that they needed. At the time, Chile lacked north-south railroad service, making Valparaiso's coastal transport a vital pillar of the country's economy. The Valparaiso newspaper *El Mercurio* was purchased by Agustín Edwards Ossandón, a second generation British-Chilean, in 1875, and Edwards became the major investor in Compañia de Minas de la Invernada. To be in Chilean mining, banking or commerce in 1871, Valparaiso was the place to be.

Douglas saw Jackson as a model for mine investing in Chile when he wrote his 1884 "Chili: Her Mines and Miners" for the *Engineering and Mining Journal*. The two had remained correspondents in the years after Douglas' time in Chile. Douglas' settled views help us understand the nature of the Invernada project and the role of both Jackson and Thorner, two people in the business that Douglas came to know very well.

> There is in Spanish America another case of adventurers, the professional mine gamblers, who understand mining and mining speculation; wild, reckless fellows, who have made and lost a dozen fortunes; are rich one day and poor the next; but who can always borrow money when they are poor, because they have the wits to make it when opportunity offers, and a certain honor of their own, which makes them punctilious in repaying a debt whenever they can. They flock to every newly discovered mining region, are early on the ground, and pick up the best prizes.
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> The most successful mines are worked by individuals or by associations of a few men, who, with the aid of knowledge, experience, wealth, self-interest, the most approved system of mining, the best mechanical contrivances, and good metallurgical methods, are able to make large fortunes and flood the markets of the world with copper out of mines that only a few years ago would have been accounted valueless. . . . At any rate, the native capitalist, with the advantage of local knowledge and nearness to the mines, by adopting improved methods and hiring foreign skill, occupies a more favorable position than the foreign board urged to acts of indiscretion by irritable stockholders, and at the mercy of shop-keepers and superintendents at the other side of the earth. [46]

In Chile this specialized class of businessmen arose once independence opened the country to international commerce. These businessmen were traders and investors; they served as brokers between distant markets for metals, particularly copper, initially exporting high-grade ore and later sending more concentrated copper product, such as blister. By 1871 Chile exported what were known in Europe and North America as "Chili bars"—then the market standard for purity.

Jackson was one such businessman. He became a leading member of the British-Chilean

community in Valparaiso. As previously noted, during the 1860s Jackson made a living as a banker, mining financier, copper export broker, and stockbroker. Born in Peru in 1823, he came to Chile in the 1850s. In the early 1870s, he did well as a mine promoter in the Bolivian silver strike at Caracoles—a mining district later annexed by Chile after the War of the Pacific. One of his sons went on to raise horses in Viña del Mar, and the Jackson Cup remains a prestigious annual horse race. A grandson founded the Grange, one of Chile's leading private schools, with instruction in English.[47] Just as Thorner descendants have only the vaguest idea of their ancestors in terms of copper mining, so it is with the Jacksons. While the Thorner brothers eventually left Chile, the Jacksons remained and built lives in Chile while maintaining their British identity.[48]

At the time Jackson put together the Invernada deal he was forty-seven years old. As a mine promotion the project was perfect. Invernada was Chile's first joint-stock mining company, building on Chile's recent company law. Juan Jackson became the company's president, managing the finances and using his prestige to bring in outside capital. Jackson oversaw construction of the plant along the lines specified by Douglas, the foreign metallurgical "expert." While Thorner remained a major stockholder, his role was no longer an active one. The investment opportunity attracted a broad group of investors to finance a new but unproven technology that promised to make possible development of the country's low-grade ore. If it worked at Invernada, many properties awaited this new "wet" technology.

In 1871 there was no consensus on how to refer to the technology; in the twenty-first century "hydrometallurgy" became the common nomenclature, with "hydrotechnology" an even broader term. The idea was, and is, to place ground-up ore in a solution designed to break down the mineral into its component elements, freeing atoms of copper. The trick was to select a chemical easy to obtain or create, and then have an efficient way to extract the copper from the solution. Any process for use in the field needed to pay attention to the cost of the chemicals and the cost of creating reactive conditions, especially heat. Any number of laboratory processes where known at the time, but Douglas and Hunt had found a way to do it at the mine at a relatively low cost.

When word of the Hunt and Douglas Process reached Jackson, he understood immediately its breathtaking implications. A commercially viable process permitting exploitation of then worthless low-grade ore would allow all involved to make a lot of money. He understood that the Hunt and Douglas Process was more than just a successful lab experiment. Low-grade ore—ore that when smelted had fuel expenses exceeding the value of the resulting copper metal—was the bane of copper miners everywhere. Its successful mining and processing required new methods.

It was Jackson who integrated the knowledge of a seemingly worthless mine due to falling ore grades, with the idea of applying the "revolutionary" wet process to exploit its ore, financed by a joint-stock corporation. Jackson jumped at this possibility before anyone else in the copper mining business, certainly before anyone in the United States. Looking back, he is one of the unheralded pioneers in the copper mining industry's transition towards lower grades of copper ore.

Douglas at Invernada

James Douglas disembarked from the *Panama* in Valparaiso with a headache. Covering the last leg of his voyage, the British steamship had departed Coquimbo Harbor the day before after a one-day layover. Douglas had used his time at Coquimbo, some 220 nautical miles north of Valparaiso, to visit the Urmeneta smelters,[49] then the most successful copper mining and smelting operation in Chile.[50] Douglas credited the headache to his overexertion trying to see all aspects of the Urmeneta smelter operation at nearby Guayacán Harbor.

Now, a day later at Valparaiso, he tried to revive his spirits with "a brisk climb up almost precipitous lanes and hillsides" above the narrow plain that constituted the business district. His initial meeting with Jackson only added to his "crest-fallen state." Jackson's office was located near the wharf where Douglas landed. There Jackson related that through "unavoidable causes the works were not yet ready and would not be" for another month. Douglas wrote to Naomi that he "found Mr. Jackson to be a very clever pushing man, very cordial and hearty in manner and sincerely glad to see me. After talking over the mines and copper generally he took me to lunch at the club and invited me to dinner at 5:30. Despite the headache I managed all this."[51]

Riding horseback up the cart road to the mine the next afternoon, Douglas pondered what he had experienced the day before. Despite the announced plant delays, his expectations remained high. He wrote to Naomi that after arriving at the mine camp his true dilemma began. Douglas carried a letter in Spanish from the stationmaster to Mr. Waring's housekeeper. Douglas was not too certain as to the spelling of her name, so when he wrote home he relied on a hybrid French-Spanish—she was "Doña Marguerita something or other." The letter recommended him "to her kind mercies" as she would not know who he was or what to do with him.[52]

At the main house the mine sub-captain, a young Cornishman named Kitto, asked him if he had a bed; of course Douglas had none. Kitto seemed to Douglas "a disgracefully dirty English miner with a horrid grin meant for a kindly smile—said he thought he had a bed without bedclothes to which I was welcome." Kitto insisted on taking charge of the new arrival. At that point Douglas thought the best plan was to ride back to the station, but the Cornishman reminded Douglas that was no inn in Tiltil.[53]

After Douglas strolled about awhile with Kitto, Doña "Marguerita" sent one of the Waring children to invite Douglas into the main house. She had prepared a good meal of ham and bread, accompanied by tea with milk and sugar. Thus refreshed, Douglas returned to his new friend and was introduced to his "lodging where hearty goodwill made up for want of furniture and the elegancies of life." It was a one-room house of about ten by twelve feet. The walls were two feet thick of solid mud, plastered with mud and sand, which Douglas thought gave it a coating as smooth as plaster and hard as cement. "The color was reddish brown, the color of the rocks and ground, and of the men and women." There was a little grate in which a fire was made to enable one to roast some ore, and a small window on whose sill he would soon write his letters to Naomi and Hunt. The furnishings included a three-legged table at which they would eat, but no chairs and but one bed. Douglas wrote that Kitto "kindly gave me the bed and slept on the floor."[54]

Douglas wrote hundreds of articles over his life, and proved himself to be a careful if opinionated observer of his surroundings. A decade after his months in Chile he published a series of articles in the *Engineering and Mining Journal* under the overall heading "Letters from the West," in which he combined technical information with images of the people and geography that came his way as he visited mines in the U.S. Rocky Mountains.[55] His letters to Naomi from Chile were no less a detailed record of where he was and what he saw. From his new "home" he wrote about the view looking out the window. At close range there was a dirty enclosure with a large, bowel-like space at one end—Douglas termed it a "coracle"[56]—where the mules now and then treated themselves to a roll and everyone else to a cloud of dust. Looking towards the distant horizon, he wrote:

> I have only to take a step from the door . . . to look at a gorgeous sight. Down the valley to Tiltil and beyond over seven ranges of mountains rising one above the other till the whole are crowned by the Cordillera over which presides Aconca-

James and Naomi Douglas, c. 1860s.

gua, nearly 24,000 ft. high, towering high above the highest. It must be 70 miles distant and yet stands out as clearly as the citadel seen from our house on a very clear day. As the sun moves over it, the shifting light on its snowy sides and dark rock pinnacles and on the cluster of dwarfish peaks which surround it, each a Mount Blanc in itself but a hillock in comparison with Aconcagua, alters the sun so that hour by hour it presents new features. Last evening at sunset we saw the top of Aconcagua above the clouds, distinguished only as being more gorgeously tinted tha[n] the richest of the clouds enveloping it. I am looking forward to the sunset this evening with impatience for to-day the air is clear.[57]

Douglas and Jackson

The mountain basin site of the Invernada camp and plant remains much the same today, except that in 2013 a pirate silver-mine operator bulldozed many of the old Invernada foundations. Some were saved when the current owner of the Invernada mines told the informal miner that a book was being written about the site and that the site might have national historical significance. It was on the very spot of the new silver camp that Douglas wrote to Naomi as he worked out his thoughts about Jackson after his initial day in Valparaiso and dinner at Jackson's residence:

> He lives in as pretty a cottage as one would meet with in England. The broad verandah lead[s] from the rooms to a garden with geraniums, [unclear flower name] and many familiar flowers. Mrs. J. is a Peruvian whom he married at [blank space in the letter] and they have a family of nine children, strong, ruddy & healthy. The eldest boys are in England. Mrs. J. and the children speak perfect English yet Spanish is invariably used in conversations among themselves. The only other guest was a self-invited one, a Mr. Kindermann, whom we took on board on Saturday night at Caldera and with whom I had become quite thick during our two days [of] acquaintance. The dinner was quite in the English style and finished with most delicious fruit—melon—peaches and luscious pears. Tea which has quite supplanted chocolate and almost supplanted coffee—followed.
>
> I met with a good many English and was struck with their affability and good-humor among themselves. I never saw people chaff one another so good naturedly and I was told that rarely did a quarrel arise. Jackson is evidently one

> of the foremost men and all say we could not have had a better man to manage for us. He got up the National Bank and was its president till he last went to England. He now manages the Agricultural Bank and is manager of the Greater Coal Mining & Smelting Company, the only man who makes copper brokerage a business here and a man who has the reputation of bringing to a successful issue whatever he undertakes and he is heart and soul in our business. I feel very sanguine of a brilliant success; but I am told on all sides that things move slowly. There have been very few companies of any kind organized in Chile. This is the first mining company proper and Jackson got it up to help a Dr. Thomas [sic] a Canadian dentist, out of difficulties he got into when trying to work the mine singlehanded.[58]

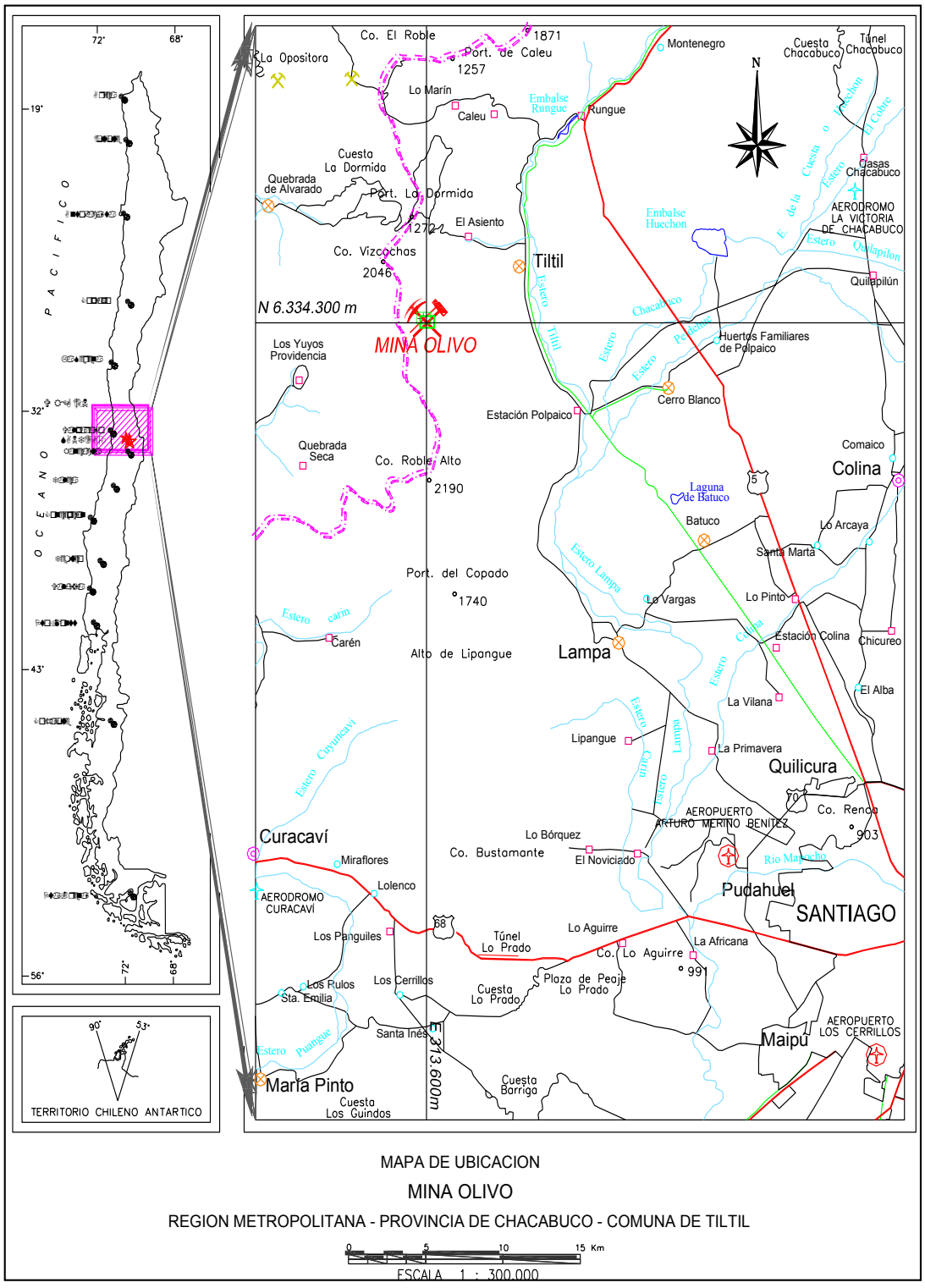
As Jackson had told Douglas, he came to the project to help his Canadian dentist friend. Jackson and Thorner had similar interests, but Jackson was at another level. The Invernada project established Juan Stewart Jackson as a true pioneer in the effort to modernize, and thus save, Chile's copper mining industry. Douglas returned to Canada after what he sometimes termed his graduate seminar in copper mining. Jackson taught him that it was not the quality of copper ore that mattered, it was the quantity.[59] By late 1871 hydrometallurgy seemed the future, with Douglas its leading proponent.

Home Again

James Douglas left Chile on September 11, 1871, after six months in the country. On the voyage north to New York City, Douglas wrote a paper, "The Silver Mines of Chili," which he read at the December 13 meeting of the Literary and Historical Society of Quebec and published the following year in the *Engineering and Mining Journal*. As his return to Canada and his home in Quebec City took him through New York, he took advantage of the opportunity to promote the new copper process by meeting with the great long-time editor of the *Engineering and Mining Journal*, Rossiter Raymond. In an unusual step, Raymond used his weekly editorial column to highlight what he had learned about Douglas' trip and the promise of the Hunt and Douglas Copper Process:

> The same gentleman [Douglas] reports that STERRY HUNT'S new humid copper-process is very successful at Invernada, where, after a month's trial of a plant treating 8 to 10 tons daily, the management has appropriated $20,000 for the immediate erection of a larger plant. Several important practical improvements have been made in the manipulations. Simple filtration has been substituted for agitation, and the ore is less finely crushed than formerly. The downflowing filtrate from several tanks passes into a labyrinth of fifty feet, covered over and filled with scrap iron. Hence it passes, entirely decuprated, to be pumped again into the filtering tanks. One or two days suffice to remove all copper from the prepared ores. The plant is thus much simplified and the process cheapened. . . . We are glad to learn that this method will probably be actively employed, ere long, in the United States.[60]

Over the next year, Douglas published several articles on Chile, including his first major article on copper mining, "The Copper Mines of Chili."[61] His career pattern was now established, merging metallurgical research, the business of copper mining, and his lifelong "hobby" of writing.[62]



Courtesy of the Mineria San Pedro Limitada. The Mina Olivo is indicated and was one of the mines active in 1871.

Willian Culver retired from thirty-seven years of teaching political nce and Latin American studies at the State University of New York at Plattsburgh in 2007 to concentrate on mining history. His publications include work on nineteenth-century copper mining history and politics, mostly in Chile, as well as contemporary national legislatures in Chile, Argentina, Peru, and Bolivia. Culver has one edited book, Miners and Mining in the Americas *(1986), and many articles in both Spanish and English on Chilean copper mining. His article "Capitalist Dreams: Chile's Response to Nineteenth Century Copper Competition" won the 1990 "Conference Prize" of the American Historical Association's Conference on Latin American History for the year's "Best Article on Latin American History." In addition to the MHA, he is active in the International Mine History Association, and the Historians of Latin American Mining. He lives in San José del Cabo, Baja California Sur, and Mooers Forks, New York.*

Notes:

1. James Douglas, Invernada Mines, Tiltil, in a letter to Naomi Douglas, Quebec City, 25 Feb. 1871, in Douglas Papers, AZ 290, Box 7, Family Correspondence II, Folder 2, Letter-book, Special Collections, University of Arizona, Tucson (hereafter Douglas Papers). The re-copied letters in Box 7 are but a portion of the letters found in the original letterbook in Box 5, Family Correspondence I, Folder 1. The box 7 selection has this long letter dated as written on February 23, but the original, harder to read, seems to be dated February 25. The later date makes the most sense. [Train Schedule], *El Mercurio*, 23 Feb. 1871. The train left Valparaíso Baron Station at 7:40 A.M, Salto at 8:08, Quillota at 9:20; Calera at 9:30; it arrived at Llaillai at 10:05, left Llaillai at 10:25, and arrived at Santiago at 1:00 PM. Only the major stations were mentioned in the published schedule; Tiltil was not.
2. *El Mercurio*, 25 Feb. 1871.
3. Douglas, letter to Naomi, 25 Feb. 1871.
4. James Douglas, "Manuscript 'Recollections,'" Douglas Papers, 60-2. See also: H. H. Langton, *James Douglas, A Memoir* (Toronto: University of Toronto Press, 1940), 35-6. The Langton biography draws heavily from Douglas' unpublished autobiographical manuscript "Recollections."
5. Douglas, letter to Naomi, 25 Feb. 1871. Elizabeth lived her life in New York at the family estate. Naomi married Archibald Douglas, no relation, and lived a society life in New York City. Jim married a Copper Queen mine engineer's daughter, Josephine Williams, and was known in Arizona as Rawhide Jim. He is credited with the formation of the United Verde Extension Mining Company in Jerome, Arizona, organized to work the bonanza copper deposit known as the Little Daisy Mine. Walter Douglas also had a career in Arizona copper at Bisbee's Copper Queen, and later in New York as president of Phelps Dodge Corporation.
6. *El Mercurio,* 23 Feb. 1871.
7. Douglas, letter to Naomi, 25 Feb. 1871.
8. Douglas, letter to Naomi, 25 Feb. 1871.
9. Douglas spelled his new friend's name Swinburne, but the man did not use the final "e" in his name.
10. Douglas, letter to Naomi, 25 Feb. 1871.
11. Langton, *James Douglas*, 21.
12. Douglas, "Recollections," 52; Langton, *James Douglas*, 24.
13. Douglas wrote out all of his sermons and saved them in soft-bound booklets with the dates and places they were given. He wrote 42 sermons, with 230 deliveries between 1859 and 1880. See: James Douglas, "Sermons of James Douglas," MS 168, Douglas Papers.
14. James E. Moran, *Committed to the State Asylum: Insanity and Society in Nineteenth-Century Quebec and Ontario* (Montreal: McGill-Queen's University Press, 2000). Moran does not mention James Douglas, Jr., but does detail the twenty years his father, James Douglas, Sr., built and administered the asylum.
15. Langton, *James Douglas,* 33; Douglas, "Recollections," 59.
16. Langton, *James Douglas,* 36.
17. C. F. Hillman (a.k.a. Quien Sabe), "*Old Timers," British and American, In Chile* (Santiago, 1899), 82. For a full overview of British merchants in Chile see: John Mayo, *British Merchants and Chilean Development, 1851-1886* (Boulder, CO: Westview Press, 1987).
18. Douglas directly mentions "Cerro Campana" (the Bell of Quillota) and the full details of the sights from his railcar in: James Douglas, "Chile: Its Geography, People and Institutions," *Journal of the American Geographical Society of New York* 13 (1881), 78-81. Douglas' scientific interests were broad; he had read

Darwin's publications while serving as a volunteer librarian of the Literary and Historical Society of Quebec. The Society still holds the original volume *The Origins of the Species by Manner of Natural Selection, or the Preservation of Favoured Races in the Struggle for Survival*.

19. Mount Aconcagua rises to 6,961 meters or 22,837 feet.
20. Douglas, letter to Naomi, 25 Feb. 1871.
21. Douglas, letter to Naomi, 25 Feb. 1871.
22. Douglas noted what he was told about Tiltil, "a village inhabited by gold miners still, as it was long ago before Santiago was founded," in his letter to Naomi, 25 Feb. 1871. See also: Enrique Espinoza, *Jeografía Descriptiva de la República de Chile* (Santiago de Chile: Imprenta, Lithografía i Encuadernación Barcelona, 1903), 238-47, for various mentions of Tiltil's gold mining heritage. For a modern view, see: D. R. S. Thomson, "Lohpan Project, Geological Report Chile: Copper Prospects Lohpan Alto and Lohpan Bajo Together with Tiltil Gold District" (Santiago, Chile: Vizcachas Mining Co., 1991), 29.
23. Luz María Méndez Beltrán, *El comercio minero terrestre entre Chile y Argentina 1800-1840* (Santiago de Chile: Fondo de Publicaciones Americanistas: Universidad de Chile, 2009), 64. Méndez terms the Cuesta Dormida the "ruta occidental" to the coast and notes that it was a main mule-train route used by miners in the colonial era.
24. D. Frias and J. Atria, "Chromosomal Variation, Macroevolution, and Possible Parapatric Speciation in *Mepraria spinolai* (Porter) (Hemiptera: Reduviidae)," *Genetics and Molecular Biology* 21, no. 2 (1998): 8.
25. Chile, Oficina Central de Estadistica, *Censo Jeneral de la República de Chile Levantado el 19 de Abril de 1865* (Santiago de Chile: Ministerio del Interior: Imprenta Nacional, 1866), 381.
26. Douglas, letter to Naomi, 25 Feb. 1871.
27. Douglas, letter to Naomi, 25 Feb. 1871.
28. Douglas, letter to Naomi, 25 Feb. 1871. All cited Chilean documents follow the custom of the time of writing foreign names in their Spanish equivalent. In Chile, John Edward Thorner was known as Juan Enrique Thorner. While Jackson was perceived as British in Chile, he was born in Peru and in Chile was always known by his Spanish name. James Douglas was known in Chile as Santiago Douglas.
29. Jackson learned of the process through copper broker Arthur Lewis of Liverpool, England, well before the North American mining press took notice of it. Lewis came to Quebec to see the process for himself in 1869, and was so impressed that he arranged for Douglas' trip to Chile. See: Langton, *James Douglas*, 36.
30. Juan Stewart Jackson, letter to President José Perez, *Pide Estencion de Privilejios y Acompaña Poder,* 12 de julio de 1871, Ministerio del Interior, Archivo Nacional, Santiago, Chile, v. 621/11: 2-3.
31. T. Sterry Hunt, at the time of the initial Hunt and Douglas Copper Process patent, already held an international reputation as a leading geo-chemist. By the time of his death in 1892 his published work included 346 scientific articles and four textbooks, two of which had multiple editions. Douglas said of Hunt, his business partner, "While scrupulously honest in all pecuniary transactions, he did not possess the money-making instinct." Douglas did have that instinct. James Douglas, *A Memoir of Thomas Sterry Hunt, M.D., LL.D. (Cantab.)* (Philadelphia: MacCalla and Co., 1898). Hunt's collected papers are held in the Administrative Archives, McGill University.
32. Steven S. Volk, "Mine Owners, Moneylenders, and the State in Mid-Nineteenth-Century Chile: Transitions and Conflicts," *Hispanic American Historical Review* 73, no. 1 (1993): 67-98. Pages 73-7 cover "The Rise of the Habilitador."
33. Thomson ("Lohpan Project," 14-28) gives a detailed view of the geology, noting that the copper ore averages 2-3 percent copper. Since the mountain has been worked off and on in the years after Invernada, never successfully until now, the true surface high-grade copper content is a bit speculative.
34. Low-grade is a relative term. In the 1870s ore containing less than 5 percent copper was considered low-grade and too expensive to smelt or process with heat.
35. Lyle Copeland (descendant of Robert and Elizabeth Thorner), e-mail to the author, 14 May 2010.
36. William W. Culver, Judith Hudson Beattie, and Jessica Mack, "Mutiny on the *Colinda* or How Some Hudson's Bay Company Coal Miners Ended up in Chile," forthcoming in *Boletín de la Academia Chilena de la Historia*.
37. The first ship from San Francisco reached Valparaiso with news of the gold strike in May 1848, and the first Chileans arrived at the gold fields on August 19, 1848. This is a much-told story; for a recent retelling see: H. W. Brands, *The Age of Gold: The California Gold Rush and the New American Dream* (New York: Anchor Books, 2002), 48-53.
38. Copeland, e-mail to the author, 14 May 2010.
39. Hillman, *"Old Timers"*, 234.
40. Hillman, *"Old Timers"*, 417, citing *El Mercurio*, 16 Dec. 1850.
41. *Canadian Census of 1871*, Province of Ontario, District 24, Hamilton Subdistrict, 29.
42. This cultural aspect of Chile is caught in Albert Blest Gana's fictional account of lives changed by a silver mine, *Martín Rivas: Novela costumbres politico-sociales* (1869; reprint, Jaime Concha (ed.), Buenos Aires: Stockero, 2006). Some of the earliest writing on the silver mine culture of Chile is found in the essays of José Joaquín Vallejo (a.k.a. Jotabeche), originally published as newspaper columns during the 1840s. The English edition: Simon Collier (ed.) and Fred-

erick H. Fornoff (trans.), *Sketches of Life in Chile, 1841-1851* (New York: Oxford University Press, 2002).

43. James Douglas, Jr., "Chili, Her Mines and Miners—II," *Engineering and Mining Journal* 13 (26 July 1884): 56. "Chili" was the standard English spelling of the country's name over most of the nineteenth century.
44. Douglas, letter to Naomi, 25 Feb. 1871.
45. Both of these Chilean wholesale dry goods companies persisted until they were nationalized during the administration of President Salvador Allende, 1970-73.
46. Douglas, "Chili, Her Mines II," 56.
47. John J. K. Scott, *The Grange School under Mr. Jackson (1928-1958)* (Santiago de Chile, 2002).
48. David Jackson (great-grandson of Juan Jackson), e-mail to the author, 21 Oct. 2003.
49. James Douglas, "The Copper Mines of Chili," *London Quarterly Journal of Science, and Annals of Mining Metallurgy, Engineering, Industrial Arts, Manufacturing and Technology* 9 (May 1872): 159-82. Douglas wrote with great admiration for José Urmeneta and his modern mining and smelting operations. See also: Ricardo Nazer Ahumada, *José Tomas Urmeneta: Un empresario del siglo XIX* (Santiago de Chile: Centro de Investigaciones Diego Barros Arana, Dirección de Bibliotecas, Archivos y Museos, 1994); Luis Ortega Martinez, *Chile en ruta al capitalismo: Cambio, Euforia, y Depresión* (Santiago de Chile, LOM Ediciones—DIBAM, 2005).
50. Luz María Méndez Beltrán, *La exportación minera en Chile 1800-1840* (Santiago de Chile: Editorial Universitaria, 2004); Luz María Méndez Beltrán, *El comercio entre Chile y el puerto de Filadelfia 1918-1850: Estudio comprado binacional* (Valparaiso: Editorial Puntángeles, Universidad de Playa Ancha, 2001).
51. Douglas, letter to Naomi, 25 Feb. 1871.
52. Douglas, letter to Naomi, 25 Feb. 1871.
53. Douglas, letter to Naomi, 25 Feb. 1871.
54. Douglas, letter to Naomi, 25 Feb. 1871.
55. William W. Culver, *"James Douglas' Letters from the West,"* paper presented to the annual conference of the Mining History Association, Leadville, Colorado, June 2007.
56. As a metaphor "coracle" is the term Douglas used, and this seems to be a skin stretched over a frame; in Wales it is used to refer to a very small boat.
57. Douglas, letter to Naomi, 25 Feb. 1871.
58. Douglas, letter to Naomi, 25 Feb. 1871.
59. James Douglas, "Copper Mines and Mining: Success of Legitimate Mining—Failed and Abandoned Mines—The Late Remarkable Discoveries in the Blue Ridge—Character of the New Workings—Prospects of Copper Mining for the Future," *Boston Daily Advertiser*, 12 July 1873, 11.
60. Rossiter W. Raymond (ed.), "Notes from Chili," *Engineering and Mining Journal* XII, no. 19 (7 Nov. 1871): 289.
61. Douglas, "Copper Mines of Chili."
62. By the time his death, Douglas had published nearly three hundred articles and several books.