The Fight for Water:
How Indigenous Chileans and Lithium Corporations Compete

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Lithium is essential to carbon-neutral energy systems (UN, 2022), including lithium-ion batteries for electric vehicles and to store energy from intermittent sources such as wind and solar installations. According to Walton (2020), "the energy sector is a key contributor to climate change, accounting for two-thirds of global greenhouse gas emissions."

Lithium is the 33rd most abundant element globally. It is found in the earth's crust in very low concentrations, between 0.002-0.006 percent by weight (Aral and Vecchio-Sadus, 2011). Deposits of lithium in concentrations dense enough for cost-effective extraction are rare. Over half of the world's lithium reserves lie in salty brines under the desert in the "lithium triangle" in South America comprising land within Argentina, Bolivia, and Chile (Otis, 2022; ITA, 2022). Economic and technical obstacles in Argentina and Bolivia make Chile the most promising lithium supplier (Otis, 2022). Lithium extraction in Chile's Atacama Desert causes tension with its inhabitants.

Lithium is extracted from aqueous brines that are pumped above the surface. Solar evaporation accounts for 60 percent of global lithium production (Economist, 2022). Over 18 months, evaporation increases lithium concentrations, simplifying separation and purification (Otis, 2022). Evaporation is water intensive. The pumped water is not returned until precipitation, exacerbating extreme water scarcity and declining biodiversity in the Atacama Desert.

The International Energy Agency projects a 40-fold increase in demand for lithium by 2040 (IEA, 2022). High demand makes commercial lithium extraction lucrative. Evaporation is the most cost-effective extraction method, so mining companies prefer it over less harmful techniques. This burdens local populations with water scarcity, dust, and noise emissions

(Zanetta-Colombo et al., 2022). Lithium extraction is a necessary response to the climate emergency as well as an environmentally destructive enterprise. Proponents and detractors compete worldwide for support on their positions.

Lithium extraction is championed by mining corporations, like Chemical and Mining Company of Chile (SQM), and by the trade associations they participate in, such as Iquique Industrial Association (AII). Opposition to lithium extraction within Atacama is composed of indigenous peoples living adjacent to mining operations. These groups have united to form a movement through the Atacama Indigenous Council (CPA) and Plurinational Observatory of Andean Salt Flats (OPSAL). Advocates and critics of lithium extraction in Chile advance their agendas using legal action, protests, social and public media, business associations and corporate statistics.

Review of Research

Chile's mining case studies have evolved over time and identified relationships between regulations, environmental effects and debate supporters. Romero, Méndez, and Guerra (2012) called the precarious situation between economic development and environmental damage "one of the greatest paradoxes that the country's development is currently facing." Water rights "were managed efficiently from the economic point of view, [but] they accumulated large negative impacts on local societies and natural landscapes." Liu, Agusdinata, and Myint (2019) investigated the correlation between spatiotemporal patterns from lithium extraction and environmental degradation. Liu, Agusdinata and Myint identified the debate as ongoing; they claim the "continuously expanding mining industry… [is] one of the critical environmental stressors to the overall health of the local environment."

Political support for social movements by Latin American indigenous people has recently increased due to the intersection of timing and allies. According to Puig (2010), “the presence and support of outsiders might be… an element of the social capital that was necessary for the empowerment of indigenous movements.” The global attention has provided critical pressure to support local groups. International support can promote local change, yet interest from outside supporters can wane if relationships are neglected.

These resources identify the environmental issues and their sources, but ignore social movements that enabled and responded to the environmental damage. Outreach from resistance to lithium extraction can be generalized to indigenous communities fighting for social reform. These strategies of gaining global attention are well documented, yet they lack specialized examples relevant to mining opposition. Strategies must adapt to global awareness for climate change. The rise in popularity of social media has created a platform for participants to share their views, increasing information accessibility. These developments have evolved the debate.

Extraction Critics: Lawsuits and Protests

Lithium extraction critics have utilized the Chilean court system to negotiate environmental remediation plans. Atacama Indigenous Council (CPA), a group composed of native communities, filed a lawsuit in 2019 that blocked a US$25 million remediation plan from mining giant SQM (Gandara, 2020). The Council won and a tougher plan must be prepared to repair environmental damage to their local salt flats. The new settlement will be constructed to be more favorable to CPA. Sergio Cubillos, the Council president, announced they “will make every effort to see SQM’s [environmental] permits revoked.” He states that damages from lithium extraction are “immeasurable” (Sherwood, 2020; Gandara, 2020). The lawsuit from CPA

jeopardized SQM's US$400 million plan to expand (Surran, 2019). A similar story progresses at the Salar de Punta Negra and Salar Atacama in northern Chile. The mining has been championed by Minera Escondida, a subsidiary of international mining giants BHP, Antofagasta, and Albemarle (Carerre, 2021). These companies, known for their copper exports, are expanding to lithium due to its availability and profitability. They have been confronted in court for environmental justice from Chile's State Defense Council (CDE) (Cambero, 2022). In a court document, CDE attacks mining companies stating the "extraction of… water… would have caused damage that was foreseeable" (Mining Technology, 2022). These lawsuits provide a roadmap for how opposition to lithium extraction can follow their lead and demand similar reparations.

The environmental remediation plans are expensive and contain many requirements for mining corporations. SQM reached a new settlement in August 2022; they must pay $52 million USD and implement 52 tasks to address infractions identified by regulator Environment Superintendency (Bnamericas, 2022b). The auditing process helped solidify the basis for CPA's lawsuit (Cambero, 2022). SQM must halve brine extraction and industrial water use by 2027. The CDE demands these companies restore pre-mining conditions. The CDE's settlement includes 19 tasks to repair damages, including funding scientific studies to determine the condition of the flats (Carerre, 2021). Indigenous communities are curious if healthy conditions are a reasonable goal for this project. Popular solutions include introducing water from outside sources to the flats, rehabilitation of herding paths and transferring water use rights to the Chilean Ministry of Environment. These solutions are to be validated by a secondary part of the study performed. The budget for this settlement ranges between US$81-93 million.

Lithium extraction critics' engagement with the Chilean government is intertwined with the recent national political unrest (Greenfield, 2022). Former president Sebastián Piñera was impeached in 2019 for not protecting human rights during protests (Sherwood, 2019). Piñera supported mining growth and was criticized for financial involvement in the Dominga mining investment scandal (France24, 2023). After his impeachment, a "constituent assembly" was erected to rewrite Chile's constitution that must be approved by popular vote of citizens (Villegas, Ramos & Cambero, 2022). This assembly includes reserved seats for Indigenous representatives (Stuenkel, 2022).

Figure 1. Protesters against the Dominga Mining Project in Santiago, Chile, January 2023 (Javier Torres / France24, 2023)

Protesting has created a political climate that supports environmentalism. Gabriel Boric, the new president as of March 2022, has demonstrated his support for anti-mining operations with a January 2023 decision against the Dominga project. The Dominga project is a multimillion iron and copper mine. It was disfavored by Santiago citizens and environmentalists

who took to the streets of the capital on January 18, 2023 (fig. 1). They protested the mine because of biodiversity threats to the area (Gajarado, 2023). Boric has proposed a state-run national lithium company to keep extraction profits within Chile (Bnamericas, 2023; Silva, 2023). This political climate will prove useful for opposition to lithium extraction to receive government support.

The fight is not over for opposition for lithium extraction in Chile. Lesley Muñoz Rivera from Colla de Copiapo community demands a legal framework to enable communities to reject future mining projects (Diálogo Chino, 2023). This idea has become a possibility due to recent success with national courts and governmental policy.

Extraction Critics: Social and Public Media

Globalized politics has made social media an ideal platform to share ideas. Extraction opposers use social media to highlight struggles and organize social protests. International proponents of mining operations in low-income countries defend it as a means to finance social reform. However, critics think this neo-extractivist defense cloaks neocolonialism. The power to control how the "just energy transition" is executed is held by those advantaged by established global systems (Turley et al., 2022). Without their support, communities lacking political and discursive power carry the unequal hardship of industrialization supporting the green energy transition. Opposition to lithium extraction has incorporated these ideas into social media to publicize struggles.

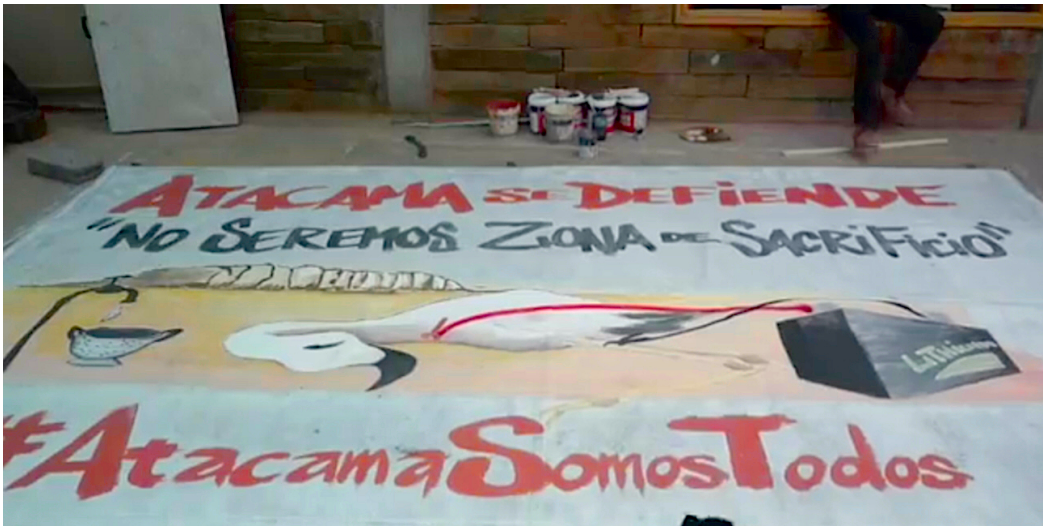

Figure 2. Banner from OPSAL's Twitter Profile (2022)

The Plurinational Observatory of Andean Salt Flats (OPSAL) represents indigenous peoples of the Atacama region. OPSAL maintains a constant presence on Twitter. In a Twitter post (fig. 2), a banner portrays a dead flamingo under the words "No Seremos Zona de Sacrificio [We are not a Sacrifice Zone]" (OPSAL [@OPSAL_], 2022). This image warns of wetland destruction with a familiar animal. The strong language of "sacrifice zone" will resonate with those who are unaware of the group's agenda. Sacrifice zones are areas where marginalized communities live in proximity to polluting industries (Lerner, 2011). OPSAL's twitter page has 1,500 followers as of March 2023 and posts or interacts with other media daily to drive awareness (OPSAL, 2023).

Extraction opposition have detailed their outreach using written media like online journals and books. OPSAL and Colla de Copiapo community representative Lesley Muñoz Rivera has become a spokeswoman for their cause. She wrote about her strategy for broadcasting her stance at the United Nations 27th Conference of the Parties on Climate Change (COP27) (OPSAL, 2022). Rivera planned to speak at events hosted at the Indigenous Peoples Pavilion. She declared she will "correct this discourse that lithium is the solution because, in reality, it only

generates answers to the crisis as experienced in the global north." Rivera wishes to "reach the people who invest in these strategic minerals… to make them see that their solutions increase problems of the global south, they are polluting and destroying us because of their little empathy." The end of her article directs readers to OPSAL's social media and a book on the topic: Andean Salt Flats - Ecology of Knowledge for the Protection of Our Salt Flats and Wetlands, which is a collection of essays by indigenous people, academics and other participants (OPSAL, 2021).

Critics of lithium extraction advance their positions by interviewing at conferences. COP27 was a success for broadcasting messages from lithium extraction denouncers to the world. Rivera became a recurring subject of articles released about the conference including media published by popular online sites like Truthout and Guardian. Rivera was able to unite with other voices for indigenous movements such as critics of gas extraction in Africa and wind farms built on indigenous territory in Kenya (Lakhani, 2022). At the conference, she stated that the problem with carbon emission solutions is that they are only "being looked at in a segmented way… not seeing that water, communities and ecosystems are also affected" (Dryer, Brito-Millán & Salomón, 2022). Rivera and other extraction detractors claim that the summit has "pitted the human rights of Indigenous peoples against rich nation's energy needs." The indigenous groups, who the UN excludes in negotiations, fear the solutions from COP27 ignore the negative impacts of extraction. Ramón Balázar, co-coordinator of OPSAL, worries that lithium extraction impacts will be greenwashed using "responsible mining certifications."

Rivera, Balázar and other members of OPSAL and the Colla Indigenous Community of Copiapó post daily on social media to inform the world of their struggles. Through these social

and public media publishings, lithium extraction opposition has called attention to the real people whose lives are at stake, reaching groups with more social currency.

Extraction Advocates: Trade Associations

Proponents of lithium extraction have formed trade associations with other industrial companies to support policy for their respective fields. Within the Atacama region, a notable group is the Iquique Industrial Association (AII). On their homepage, AII declares a viewer can "find details of the work of our union in favor of promoting… business development… focused on areas of suppliers, human capital, sustainability, generation of networks and businesses, and the internationalization of SMEs [subject matter experts]" (AII). This group represents industrial focused companies in Iquique, Chile, including SQM, a major lithium miner, and BHP, a major copper miner (AII, 2022). Both companies are involved in lawsuits from extraction resistance. AII is "strongly supported" by Expande Minera, a conglomerate of mining companies that have united for "commitment… to the regional [mining] ecosystem" (Expande Minera, 2019). Expande Minera declares they create "virtuous circles among challenges to the natural resources industry" (Expande Minera). They are an umbrella of strategic partners such as CORFO, Antofagasta Minerals, BHP, the Ministry of Economy, and the Ministry of Mining. Expande Minera partners with the Alta Ley National Mining Program, a Chilean public-private initiative whose objective is to "strengthen and energize the mining innovation ecosystem" (Alta Ley, 2019). Association of Industrial Mining Suppliers (Aprimin), another major pro-mining group, represents over 120 companies including internationally recognized enterprises like 3M, Deloitte, and PPG (APRIMIN).

Extraction proponents use trade associations to publish written media denouncing mining regulation policy with economics. AII persuades the local government that increasing mining taxes will lower global investment. AII declares they are “defending the motor for development” and warns that mining opposition hurts the economy and is disadvantageous to all citizens (AII, 2022). Philippe Hemmerdinger, the president of Aprimin, warns “if there are no clear or long-term rules regarding mining taxation, investments will not reach Chile" (Bnamericas, 2023). Aprimin opposes implementation of mining royalties due to inconsistencies between sites’ purity grades and current profit margins (Cherrington et al., 2023). Hemmerdinger stresses if “Chile has a tax that does not allow the mining sector to be relatively profitable, we will not receive investment” (Bnamericas, 2023). Sergio Hernández, another Aprimin executive, warns that a long period for return on mining investment mixed with politics favoring heavy regulation will deter international investment (Bnamericas, 2021a).

Extraction advocates utilize trade associations to broadcast media criticizing the state-owned lithium corporation. Aprimin has spoken out against the idea. Hemmerdinger states the initiative is a “waste of resources” (Bnamericas, 2023). Hernández denounced the suggestion and its purpose to reduce the private sector. Aprimin believes the state should focus on other humanitarian efforts, not mining (Bnamericas, 2021a).

Trade associations representing proponents of extraction have publicized their disapproval of changes to constitutional mining policy. Joaquín Villarino, CEO of Consejo Minero, stated “several proposals have been bad, including general bans to mining activities..., nationalization of certain mining activities, and a confiscatory royalty of 25%” (Cherrington et al., 2023). Hernández stated the mining suppliers Aprimin represents were worried by vague constitutional language that could add uncertainty to the regulatory future (Bnamericas, 2021a).

One of the clauses prohibited mining in glacial areas to protect the environment. Hernández claims this idea is “absolutism and environmental fanaticism. The new regulations could harm the fight against climate change since minerals are essential for decarbonization.” Hernández criticized the new proposed tax between 56-58 percent, higher than the current value of 40 percent. The increase is to finance the country’s social programs, but mining advocates feel it is unfair to lose competitiveness to support the country. Hemmerdinger identifies that a main challenge for Aprimin in 2023 will be representing and defending the mining sector throughout the constitutional process (Bnamericas, 2023).

Advocates for lithium extraction have unionized to form many pro-mining organizations that perform outreach, publish press releases, and discuss policy. These associations will continue to apply pressure as mining policy evolves with constitutional drafting.

Extraction Advocates: Statistics and Industry Modernization

Advocates of lithium extraction broadcast media defending the national mining industry with job and profitability statistics. The Chilean mining industry directly employed 221,000 people in 2021, a 10.5 percent increase from 2020 (Garside, 2023). Mining represents nearly 15 percent of Chile’s overall GDP, up from US$20 billion in 2016 to US$317 billion in 2021 (ITA, 2022; Copper Alliance, 2018b). According to Copper Alliance, “as a direct result of the natural resource export model, by 2016 less than a third of the [Chilean] population was below the poverty line, incomes quadrupled, and Chile became one of the two highest-income Latin American economies" (Copper Alliance, 2018a). They also claim that every mining job creates 3.7 additional jobs in other sectors, with the average mining salary between 80-110 percent higher than the regional average (Copper Alliance, 2018b; Voetmann, 2018).

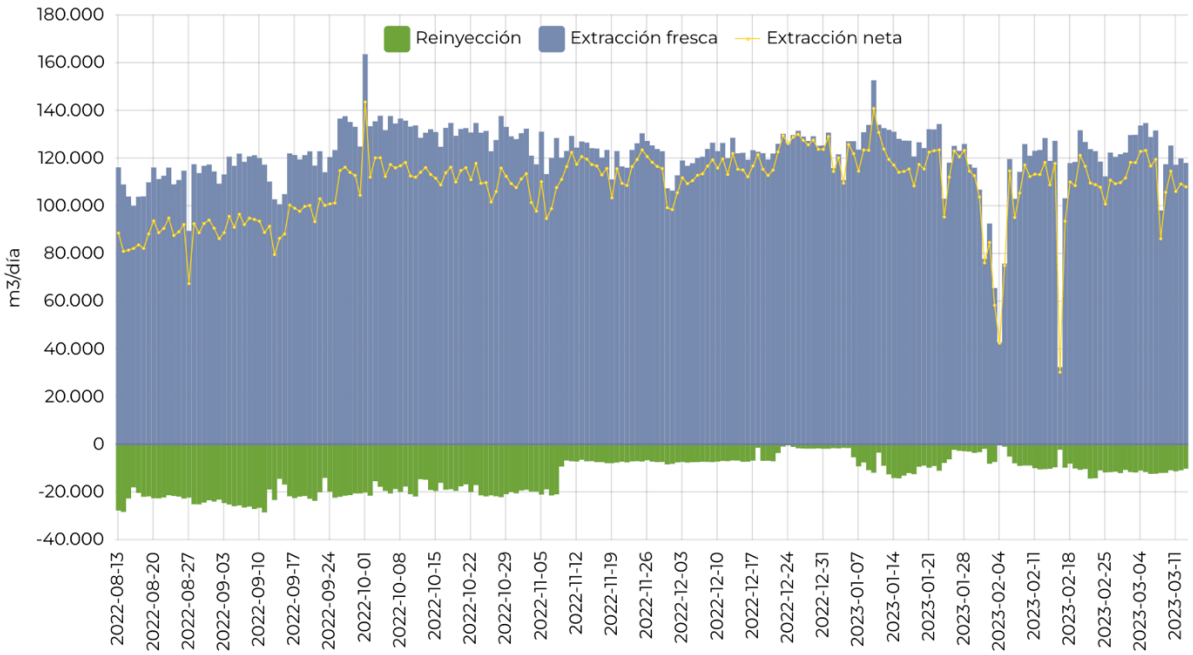

Figure 3. SQM Brine Extraction and Reinjection Rates from August 2022 – March 2023 from the Atacama Site [green-reinjection, blue-fresh extraction, yellow line-net extraction] (SQM Online, 2023)

Extraction advocates show that their mining operations can be better for the environment with sustainability statistics. SQM cites job opportunities and the use of solar energy as advantages of their operations. They utilize 3,000 hectares of solar evaporation ponds with 91.3 percent of their energy coming from solar power (SQM, 2022a). In their 2021 sustainability report, they detail progress toward water use reduction, increase in renewable energy, reduction of CO_2 emissions and reduction of brine extraction from the Atacama Salt Flats (SQM, 2022b). SQM has implemented an online monitoring system for the brine in the Atacama Desert to "communicate the environmental information… with communities and interested parties" (SQM Online, 2023). Currently, the extraction rate for 2023 is 208 liters per second, 17 percent of the 2022 flow rate and 14 percent of the 2020 flow rate (fig. 3). The online monitoring data is shown above. The sharp decrease in 2023 flow rate is most likely a side effect from the downtimes in February. Copper Alliance is a part of the International Copper Association, a nonprofit aiming "to make a positive contribution to the UN Sustainable Development Goals" (ICA). They back

mining companies in the Atacama region that mine both copper and lithium. Copper Alliance claims the mining industry is innovative including sea water integration using desalination, with annual increases in utilization as high as 26 percent in 2016 (Copper Alliance, 2018b; Cherrington et al., 2023). To develop new operations in a sustainable manner, Copper Alliance works with NGOs Alliance to Save Energy and Clean Energy Solutions Center and intergovernmental organizations Global Environment Facility and United Nations Environment. They are committed to improving economic development, sustainable energy, city/community innovation and public health (Copper Alliance, 2018b).

Local and international extraction companies convince local populations that mining can be environmentally friendly through media detailing sustainable extraction. Copper Alliance has initiated the Modern Mine program to outline steps that evolve mining strategies to fit sustainable goals. Modern mines are "consuming less water, emitting fewer pollutants and using renewable energy" (Modern Mine, 2022). This is achieved through renewable mine power, utilizing electric vehicles, designing extraction methods beginning with current waste streams, and investigating waste stream reuse in other industries like cement. The modern mining process ends with land reclamation supporting biodiversity and local communities. Replanting, landscape reshaping, water treatment and long-term management can remedy environmental changes from mining. By implementing modern mines, extraction companies claim damage from mining is short-term. The Canadian Government has also encouraged extraction of critical metals. Mining companies are expanding into indigenous regions to meet projected demand. Lana Eagle, vice president of indigenous affairs at Common Good Mining (CGM), reassures extraction critics that their strategy of "tiny mines" will enable complete rehabilitation of the land (Vermes, 2023). CGM drills small holes and extracts minerals from that volume of land. Their strategy is an

example of how advocates of mineral extraction are working with indigenous communities by minimizing negative impacts and prioritizing equity partnerships (CGM, 2022).

The mining industry has benefited citizens of Chile by providing jobs and enabling increases in humanitarian metrics. Using figures and statistics, extraction advocates have worked to convince extraction resistors that their operations are sustainable and can adhere to new environmental regulations.

Conclusion

Chile is trapped between two contradicting goals: environmental preservation and economic growth. This decision has been recently accentuated in the discourse on reversing climate change. Current cures involve the addition of highly technical solutions like lithium ion batteries and electric vehicles. When considered across their entire life cycle, including mining and disposal, these technologies have severe drawbacks. They have negatively impacted indigenous communities excluded from global debates. By including all participants, the best solution for everyone can be identified and executed.

The mining debate in the Atacama region is evolving due to recent Chilean political unrest, attention on social media and increasing raw materials demand from the Global North. The future of mining relies on prospective technological advancement and sustainable implementation. How corporations profit and the publicization of the industry will depend on the ratification of the new Chilean constitution. Future global conferences will shape both sides of the debate and identify net-positive solutions to climate change that include indigenous voices. The strong discourse between critics and proponents of lithium extraction in Chile continues and will be impacted by the many societal forces at play in the coming years.

References

AII (2022, August 12). Asociación de Industriales de Iquique. Asociaciones de la Macrozona Norte Alertan Sobre Canída en la Inversión Si Se Aprueba el Royalty. www.industriales.cl/web/index.php/n/item/1664-asociaciones-macrozona-aprueba-royalty.html

AII (n.d.) Asociación de Industriales de Iquique. Nuestra Historia. www.industriales.cl/web/index.php/g/nh.html

Alta Ley (2019). What is Alta Ley Corporation? corporacionaltaley.cl/about-us/

APRIMIN (n.d.) Asociación de Proveedores Industriales de la Minería. Partner Companies. aprimin.cl/site/empresas-asociadas/

Aral, H. and Vecchio-Sadus, A. (2011). Lithium: Environmental Pollution and Health Effects. *Encyclopedia of Environmental Health.* www.sciencedirect.com/topics/earth-and-planetary-sciences/lithium

Bnamericas (2023, Jan. 6). Is Chile wasting its mining potential? Philippe Hemmerdinger interview for BNamericas. *Asociación de Proveedores Industriales de la Minería.* aprimin.cl/site/corporativas/desaprovecha-chile-su-potencial-minero/

Bnamericas (2022, Sept. 1). How mining suppliers see Chile's constitutional process. www.bnamericas.com/en/interviews/how-mining-suppliers-see-chiles-constitutional-process

Bnamericas (2022, Aug. 31). SQM gets approval for US$50mn plan to remedy environmental violations. www.bnamericas.com/en/news/sqm-gets-approval-for-us50mn-plan-to-remedy-environmental-violations

Cambero, F. (2022, Aug. 30). Chile lithium producer SQM gets green light on environmental plan. *Reuters.* www.reuters.com/business/sustainable-business/chile-lithium-producer-sqm-gets-green-light-environmental-plan-2022-08-30/

Carrere, M. (2021, Aug. 17). In Chile, a prickly coalition tries to bring a salt flat back to life. *Mongabay.* news.mongabay.com/2021/08/in-chile-a-prickly-coalition-tries-to-bring-a-salt-flat-back-to-life

Cherrington, Guyon, Smith, Pérez-Solero, Duman, Özgür & Deniz and Tejerina (2023) Chile Mining 2020. *GBReports.* projects.gbreports.com/chile-mining-2022/

CGM (2022, Dec. 8). Common Good Mining. Our business model. *Common good mining news.* www.commongoodmining.com/post/our-business-model

Copper Alliance (2018, May 30). The Socioeconomic Impact of Copper Mining in Chile. *International Copper Association.* copperalliance.org/resource/the-socioeconomic-impact-of-copper-mining-in-chile/

Copper Alliance (2018). Copper Alliance Fact Sheet. *International Copper Association.* copperalliance.org/wp-content/uploads/2021/08/ICA-Fact-Sheet-ENG-201806.pdf

Diálogo Chino [@DialogoChinoEN]. (2023, March 1). *Lesley Muñoz Rivera from the Colla de Copiapo community in Chile called for a legal framework that allows communities to reject mining projects. "Lithium companies are the main cause of biodiversity loss," she said. 3/4* [Tweet]. Twitter. twitter.com/DialogoChinoEN/status/1630977386513563672

Dryer, T., Brito-Millán, M. and Salomón, A. (2022, Nov. 21). Chilean Indigenous Activist Says COP27 Promoted Devastating Mega-Projects. *Truthout.* truthout.org/articles/chilean-indigenous-activist-says-cop27-promoted-devastating-mega-projects

Economist (2022, Feb. 26). Two new ways of extracting lithium from brine. www.economist.com/science-and-technology/two-new-ways-of-extracting-lithium-from-brine/21807823

Expande Minera (2019, Jan. 30). Collahuasi becomes a new strategic member of Expande. expandemineria.cl/collahuasi-becomes-a-new-strategic-member-of-expande/?lang=en

Expande Minera (n.d.) About Expande. expandemineria.cl/sobre-expande/?lang=en

France24 (2023, Jan. 1). Chile sinks controversial mining project over environmental concerns. www.france24.com/en/live-news/20230118-chile-sinks-controversial-mining-project-over-environmental-concerns

Gajarado, D. (2023, Jan. 24). Chile's denial of Dominga port project is a just energy transition victory and lesson (commentary). *Mongabay.* news.mongabay.com/2023/01/chiles-denial-of-dominga-port-project-is-a-just-energy-transition-victory-and-lesson-commentary/

Gandara, F. (2020, Aug. 18). Atacama Indigenous Groups Fight Top Lithium Producer SQM. *Chile Today.* chiletoday.cl/atacama-indigenous-groups-fight-top-lithium-producer-sqm

Garside, M (2023, Jan. 25). Mining sector employment in Chile 2010-2021. *Statista.*

Greenfield, N. (2022, April 26). Lithium Mining is Leaving Chile's Indigenous Communities High and Dry (Literally). *National Resources Defense Council*. www.nrdc.org/stories/lithium-mining-leaving-chiles-indigenous-communities-high-and-dry-literally

ICA (n.d.) International Copper Association. About. *LinkedIn.* www.linkedin.com/company/international-copper-association/

IEA (2022, March). International Energy Agency. The Role of Critical Minerals in Clean Energy Transitions. *World Energy Outlook Special Report* iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf

ITA (2022, Sept. 30). International Trade Administration. Chile - Country Commercial Guide. *International Trade Administration.* www.trade.gov/country-commercial-guides/chile-mining

Lakhani, N. (2022, Nov. 13). A just transition depends on energy systems that work for everyone. *Guardian.* www.theguardian.com/environment/2022/nov/12/cop27-dash-for-gas-africa-energy-colonialism

León, B., Negredo, S., and Erviti, M (2021, July 2). Social Engagement with climate change: principles for effective visual representation on social media. *Climate Policy Journal.* doi.org/10.1080/14693062.2022.2077292

Lerner, S (2011, June). Sacrifice zones: The front lines of toxic chemical exposure in the United States. *Environmental Health Perspectives.* www.ncbi.nlm.nih.gov/pmc/articles/PMC3114843

Liu, W., Agusdinata, D. and Wyint, S. (2019, Jan. 27). Spatiotemporal patterns of lithium mining and environmental degradation in the Atacama Salt Flat, Chile. *International Journal of Applied Earth Observation and Geoinformation.* www.sciencedirect.com/science/article/abs/pii/S0303243419300996

Mining Technology (2022, April 11). Chile sues miners BHP and Antofagasta for environmental damage. www.mining-technology.com/news/chile-sues-bhp-damage

Modern Mine (2022, May 25). Into the Modern Mine. *International Copper Association.* modernmine.org

OPSAL (2023). Obervatorio Plurinacional de Salares Andinos. Profile. *Twitter*. twitter.com/OPSAL_

OPSAL (2022, Nov. 9). Observatorio Plurinacional de Salares Andinos. Colla Community and OPSAL Representative to Speak at COP 27 on Lithium Extraction in Salt Flats: “They Are Promoting the Destruction and Drying up of Life in the Name of Electric Cars”. *Cultural Survival.* www.culturalsurvival.org/news/colla-community-and-opsal-representative-speak-cop27-lithium-extraction-salt-flats-they-are

OPSAL [@OPSAL_]. (2022, Oct. 24). Observatorio Plurinacional de Salares Andinos. *En este #DíaDelCambioClimático las y los invitamos a participar entre este 26 y 30 de octubre en el #GEFF2022 #GLOBALEXTRACTIONACTION, festival internacional donde podrás ver gratis el documental "El #agua vale más que el #litio" Más info en https://vimeo.com/ondemand/waterisworthmorethanlith* [Tweet]. Twitter. twitter.com/OPSAL_/status/1584553210269749248?cxt=HHwWgMCqnfuvu_0rAAAA

OPSAL (2021). Observatorio Plurinacional de Salares Andinos. Salares Andinos - Ecología de Saberes por la Protección de Nuestros Salares y Humedales. www.dropbox.com/s/po3x58wt4l4pckt/Libro_Salares%20Andinos_version_definitiva_castellano.pdf?dl=0

Otis, J. (2022, Sep. 24). In Chile’s desert lie vast reserves of lithium – key for electric car batteries. *National Public Radio.* www.npr.org/2022/09/24/1123564599/chile-lithium-mining-atacama-desert

Puig, S. (2010). The Emergence of Indigenous Movements in Latin America and Their Impact on the Latin American Political Scene: Interpretive Tools at the Local and Global Levels. *Latin American Perspectives*, *37*(6), 74–92. www.jstor.org/stable/25750421

Romero, H., Méndez, M. and Smith, P. (2012, April 24). Mining Development and Environmental Injustice in the Atacama Desert of Northern Chile. *Environmental Justice.* www.liebertpub.com/doi/10.1089/env.2011.0017

Sherwood, D (2020, Aug. 14). Indigenous groups in Chile's Atacama Push to Shut Down Top Lithium Miner SQM. *Reuters*. www.reuters.com/article/us-chile-lithium-sqm/indigenous-groups-in-chiles-atacama-push-to-shut-down-top-lithium-miner-sqm-idUSKCN25A2PB

Sherwood, D. (2019, Dec. 12). Chile’s Congress rejects move to impeach President Pinera over rights abuses. *Reuters.* www.reuters.com/article/us-chile-protests-impeachment/chiles-congress-rejects-move-to-impeach-president-pinera-over-rights-abuses-idUSKBN1YG2EP

Silva, E. (2023, Jan. 11). Chile charts new course for lithium with proposed state-owned company. *S&P Global Market Intelligence.* www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/chile-charts-new-course-for-lithium-with-proposed-state-owned-company-73712155

Stuenkel, O. (2022, Sept. 8). Chile's Rejection of the New Constitution Is a Sign of Democratic Maturity. *Carnegie Endowment for International Peace.* carnegieendowment.org/2022/09/08/chile-s-rejection-of-new-constitution-is-sign-of-democratic-maturity-pub-87879

SQM (2022). Sociedad Química y Minera. Sustainability Report 2021. www.sqm.com/sustentabilidad/reporte-de-sustentabilidad

SQM (2022, April). Sociedad Química y Minera. ESG Databook. www.sqm.com/wp-content/uploads/2022/05/ESG-DataBook_April-2022_eng.xlsx

SQM Online (2023, March 1). Brine. *Sociedad Química y Minera Online.* www.sqmsenlinea.com/salmuera

Surran, C. (2019, Dec. 27). SQM slapped by Chilean environmental court ruling. *Seeking Alpha.* seekingalpha.com/news/3528588-sqm-slapped-chilean-environmental-court-ruling

Turley, Cantor, Berry, Knuth, Mulvaney and Vineyard (2022, April 11) Emergent landscapes of renewable energy storage: Considering just transitions in the Western United States. *Energy Research & Social Science, Volume 90, 102583, ISSN 2214-6296*, doi.org/10.1016/j.erss.2022.102583.

UN (2022). United Nations. For a livable climate: Net-zero commitments must be backed by credible action**.** www.un.org/en/climatechange/net-zero-coalition

Vermes, J (2023, Feb. 25). As EV batteries consume more lithium, report warns against increased mining of it. *CBC Radio*. www.cbc.ca/radio/whatonearth/lithium-mining-report-transit-1.6755418

Villegas, A., Ramos, N. and Cambero, F. (2022, Sept. 5). Chile overwhelmingly rejects progressive new constitution. *Reuters.* www.reuters.com/world/americas/chilean-lawmakers-reach-agreement-start-work-new-constitution-2022-12-13/

Voetmann, F (2018, July 17). Natural resources as a driver for the SDGs-the case of Chile and copper mining. *International Copper Association.* copperalliance.org/resource/natural-resources-as-a-driver-for-the-sdgs-the-case-of-chile-and-copper-mining/

Walton, M. (2020, March 23). If the energy sector is to tackle climate change, it must also think about water – analysis. *IEA.* www.iea.org/commentaries/if-the-energy-sector-is-to-tackle-climate-change-it-must-also-think-about-water

Zanetta-Colombo, Fleming, Gayo, Manzano, Panagi, Valdés and Siegmund (2022, April 14). Impact of mining on the metal content of dust in indigenous villages of northern Chile. *Environment International*. www.sciencedirect.com/science/article/pii/S0160412022004172