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TIBET, A NEW FRONTLINE OF ‘WHITE GOLD RUSH’ IN GLOBAL RACE FOR RENEWABLE ENERGY

TURQUOISE ROOF

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CONTENTS

EXECUTIVE SUMMARY

A lithium boom is underway in eastern Tibet as China's geologists have established that at least 85% of the PRC's reserves of the critical mineral are to be found on the plateau. China's scientists deployed new remote sensing technologies for the first time to detect hard rock lithium deposits in remote areas of Kham and Amdo in Sichuan Province. Satellite imagery viewed for this report reveals a vast ore belt "sleeping in high mountains and deep valleys", according to Chinese state media, which describe this as the largest lithium deposit in Asia.

Both Tesla, the world's largest electric vehicle manufacturer, and its competitor China's BYD (which will enter the electric car market in the UK this year) are becoming increasingly reliant on Tibet's lithium exploitation and production as they expand their corporate operations worldwide. Bigger, faster electric cars require larger capacity lithium batteries - which cannot be done without a hidden footprint in Tibet.

This acceleration of lithium mining involves high risk and energy-intensive forms of processing in the seismically active and heavily securitised landscape of the world's highest and largest plateau, a global epicentre of climate change. Tibet is crucial to China's efforts to achieve dominance in securing not just lithium, but also a wide range of critical minerals and rare earths in the global race to a decarbonised future.

Chinese producers dominate lithium processing globally and the PRC secures much of its lithium from other countries such as Australia and Chile.[1] This report, the first in a series produced by new research network Turquoise Roof, reveals by contrast the extent of lithium reserves newly identified by China in Tibet, the implications of new processing methods and the link with the EV industry.

- For decades, little effort went into exploring for hard rock lithium deposits in Tibet due to difficulties in mining in remote high altitude locations among other factors. But excitement grew among geologists and the Tibetan plateau has now been assessed to hold at least 3.655 million tons of China's estimated 4.047 million tons of lithium.[2]
- Lithium extraction involves a polluting, waste generating and energy-intensive processing at the mine itself, in an area known for its rich biodiversity encompassing subtropical, temperate and alpine landscapes abundant in medicinal herbs. In May, thousands of bids by Chinese investors were registered for one slice of Tibetan landscape, with initial price offerings

1 China sources a lot of the mineral from other countries, often in the form of having a stake in lithium mining companies (e.g. SQM in which China's Tianqi Lithium have a stake) or by securing off-take agreements, and in some cases undertaking the mining themselves (e.g. Arcadia in Zimbabwe). According to the Institute for Energy Research, China has over half of the world's lithium refining capacity but has to rely on imports for about two-thirds of the raw material. The U.S. Geological Survey says that China accounts for 8 % of the world's lithium reserves, which are mostly held in an igneous rock called spodumene. 22 March 2023, https://www.instituteforenergyresearch.org/international-issues/china-expected-to-increase-control-over-global-lithium-and-cobalt-supply/#:~:text=China%20has%20over%20half%20of,an%20igneous%20rock%20called%20spodumene

2 Bo Zhang et al, 'Geological characteristics, metallogenic regularity, and research progress of lithium deposits in China', China Geology 5 (2022) 734–767, downloadable from http://chinageology.cgs.cn/en/article/doi/10.31035/cg2022054 Full details of sourcing given in section 'The new deposits in Tibet'

being exceeded hundreds of times.

- U.S. investor Warren Buffett's purchase of BYD shares enabled the company to exploit the Chabyer (Chinese: Zabuye) salt lake in Tibet, closer to India's border than mainland China. As production intensifies, the future of Elon Musk's Tesla gigafactory outside Shanghai looks increasingly dependent on access to the hard rock lithium (spodumene) of mountainous eastern Tibet and its processing plants.
- Cheap and polluting methods of processing the rock from Tibet's first lithium mining area are now likely to be underway in a factory that had previously been closed after poisoning of local rivers and livestock. Tibetan protests in both 2013 and 2016 against the mining at Jiajika in Kham, which is in a district prone to earthquakes, were ruthlessly crushed. This report reveals the new methods of processing underway and the new lithium deposits revealed by satellite imagery and Chinese sources.
- Tibetans who express any concern about the mines or protest peacefully are at risk of being killed, tortured, imprisoned and the loss of their livelihoods. And many of the mechanisms of the authoritarian state used to silence and shut down Tibetans – notably surveillance through smartphones, and other tools of big data predictive policing – are powered by lithium batteries.
- China's dominance in lithium processing enables it to set the new normal of battery-powered cars, which are getting bigger, faster and more lithium-intensive, with the current demand driving the world towards more intensive energy consumption at a time when a focus on using less is imperative. While China proclaims itself a leader of clean, green energy, it is committed, openly and publicly, to increasing its carbon emissions each year to 2030 and is actively building many new coal-fired power stations.

Under Xi Jinping's Made in China 2025 campaign, China already leads globally in PV (photovoltaic) solar, wind turbines, hydro dam construction and the power grids that connect them to distant industrial users. It uses its inside knowledge and profits from mining Tibet to speculate on future prices via the London Metals Exchange, which it bought in 2012.[3] Xi Jinping has ordered the intensification of critical minerals exploitation.

Europe, the US, Canada, Australia, Japan and S Korea are at the forefront of a new global alliance aiming to redefine critical minerals supply as a security issue and seeking to end dependency for supply on China. The 'Minerals Security Partnership' (MSP) is in theory open to all countries that are committed to "responsible critical mineral supply chains to support economic prosperity and climate objectives". China and Russia are not on the list of the grouping, which is being dubbed the 'metallic NATO'.

3 The London Metals Exchange has been owned by Hong Kong Exchanges and Clearing – main shareholder, the Hong Kong government – since 2012. https://www.cityam.com/city-regulators-urged-to-review-hong-kongs-ties-to-the-london-metal-exchange/

ON XI JINPING'S ORDERS: TIBET KEY TO CHINA'S DOMINANCE IN CRITICAL MINERALS

The new rush for 'white gold' in China eclipses previous booms (and busts) on the Tibetan plateau, such as the heavy industrialisation of the Tsaidam Basin in Qinghai, northeastern Tibet. It also comes in the wake of decades of extensive logging of the forests of trans-Himalayan south eastern Tibet, rapidly growing extraction of copper, and the almost exhausted extraction of chromium from southern Tibet. Chinese state and corporate investors seem undeterred by a mid-2023 cooling in prices of lithium from their peaks in late 2022.[4] Never before has Tibet been such a prospective profit centre for China.

Tibet's role in ensuring China's domination in a green energy transition has been asserted at the highest levels of Communist Party leadership. Xi Jinping ordered intensification of lithium extraction from Tibet during a visit to Qinghai Province in 2021.[5] Last year, the journal of China's chemical industries – core for China's global dominance across the board, from pharmaceuticals to energy – was headlined 'Time for accelerating the utilization of domestic lithium sources'.[6]

A high level gathering in Chengdu in June 2023 announced that a new strategy is under way, prioritising the 'security' (read: Party state command and control) of "national strategic energy resources".[7] A decisive moment occurred in December 2022, just as China cast aside its pandemic restrictions, when a Central Economic Work Conference set the priority of strengthening domestic resource exploration and its securitization in order to make 'breakthroughs' in mining.[8]

Figure 01:

A Tibetan Buddhist mantra carved into the hillside close to the lithium ore belt in eastern Tibet.

Source: Google Earth

4 Between January and March 2023, lithium prices dropped 20%, returning to their late 2022 level. But at the beginning of 2023, lithium prices still stood six times above their average over the 2015-2020 period. Global EV Outlook, International Energy Authority, https://www.iea.org/reports/global-ev-outlook-2023/trends-in-batteries

5 Shanghai Metals Market bulletin, https://news.metal.com/newscontent/101501815/xi-jinping-stressed-the-need-to-speed-up-the-construction-of-a-world-class-salt-lake-industrial-base-four-departments-to-support-automobile-recycling

6 China Chemical Reporter, published in English and Chinese, 6 August 2022 edition

7 Chinese state media, 19 June 2023, http://www.scnrsa.com.cn/scnrsa/dwhz/20230619/41183.html . The new national policy is called the New Round of Strategic Action for Mineral Search and Breakthrough, 新一轮找矿突破战 略行动. with China's Ministry of Natural Resources setting up a Strategic Mineral Comprehensive Utilization Engineering Technology Innovation Centre in charge of implementation.

8 "The Central Economic Work Conference held in December 2022 emphasized strengthening domestic exploration and development of important energy and mineral resources and increasing reserves and production, accelerating the planning and construction of a new energy system, and enhancing the national strategic material reserve guarantee capacity. This has pointed the way forward and provided fundamental guidelines for the comprehensive implementation of the new round of strategic actions to find and breakthrough in mining."

The scale of China's ambitions on a global stage is evident: Xi Jinping plans to dominate the 'Fourth Industrial Revolution' (or 4IR, or Industry 4.0), and lead "great changes unseen in a century".[9] In China, any company seeking to accelerate its growth trajectory has piled into lithium battery manufacture, boosted by state subsidies, and into making the cars that wrap around the batteries.

After drilling at one site in remote eastern Tibet promised significant lithium mineralisation, 21 serious bidders bid against each other 3,448 times, driving the price up to RMB 2 billion ($274 million), almost 600 times higher than the opening bid, and the winner became the 54% owner of a slab of Tibetan landscape.[10] When it lost out on the five-day open auction, major Chinese battery manufacturer CATL[11] then quietly closed a deal with the new owner, buying it out for three times as much again, bringing the total price to RMB 6.4 billion ($876.6 million).[12]

The Tibetans of Nyagchuka (Chinese: Yajiang) Tibetan Autonomous County, in the Kardze (Chinese: Ganzi) Tibetan Autonomous Prefecture of Sichuan province, were not informed that their hill pastures were being sold, let alone consulted in any way about the land being drilled beneath their feet.

This is a story that demonstrates the complexity of decarbonisation. With no internal combustion engine and no burning of fossil fuels, electric vehicles (EVs) are an integral element of the roadmap for the global energy sector to reach carbon neutrality.[13]

9 Xi Jinping speech to BRICS (Brazil, Russia, India, China and South Africa) summit in 2018. Analysis by influential China commentator Jin Canrong at https://chinai.substack.com/p/chinai-194-jin-canrong-on-the-fourth . The term 4IR, first popularised at the World Economic Forum in 2016 by German founder and engineer Klaus Schwab, refers to the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems (CPS), IoT, industrial internet of things, cloud computing, cognitive computing, and AI. Influential Chinese commentators agree that technology is increasingly at the center of U.S.-China competition: "In the next decade…the competition for the fourth industrial revolution will begin between China and the United States," writes Jin Canrong, international relations professor and a dean at Renmin University. Some countries are now advancing goals towards a Fifth Industrial Revolution (Industry 5.0), that adds concepts of 'human-centeredness, sustainability and resilience including ecosystems to Fourth Industrial Revolution technologies utilizing IoT or AI technologies. The European Commission has announced "Industry 5.0," which aims for an ideal industry based on the concepts of "sustainability," "human-centeredness," and "resilience," while Germany has announced the "2030 Vision for Industrie 4.0" as the policy to follow Industry 4.0.

10 Bloomberg, 23 May 2022, https://www.bloomberg.com/news/articles/2022-05-23/how-hot-is-lithium-now-a-chinese-mine-auction-draws-3-448-bids and Gabriel Lafitte blog, https://rukor.org/lithium-lithium-lithium/

11 In June 2022, just when CATL joined the 'trillion yuan club' market capitalisation club (https://www.chinanews.com.cn/cj/2022/06-24/9787424.shtml), the company launched its Qilin EV battery, named after a mythical Chinese beast sometimes likened to a unicorn. The Qilin has a record volume utilisation rate (the %age of a battery used for driving) of over 72 %, and an EV with this battery can drive 1,000 kilometers without having to recharge. When it does need to be recharged, it can get to 80 % capacity in ten minutes, outperforming Tesla's batteries, due to CATL's large surface cooling technology. https://www.thechinastory.org/supercharged-china-cars-batteries-and-lithium/?ref=china-neican , by Barry Van Wyk, 10 January 2023

12 Caixin, 18 January, 2023, https://www.caixinglobal.com/2023-01-18/in-depth-lithium-tops-out-101990647.html

13 An increase in demand for electric vehicles is driving demand for batteries and related critical minerals, with the International Energy Agency (IEA) reporting that: "Automotive lithium-ion (Li-ion) battery demand increased by about 65% to 550 GWh in 2022, from about 330 GWh in 2021, primarily as a result of growth in electric passenger car sales. In 2022, about 60% of lithium, 30% of cobalt and 10% of nickel demand was for EV batteries." Global EV Outlook 2023, IEA, https://www.iea.org/reports/global-ev-outlook-2023/executive-summary

BUFFETT, GATES, MUSK AND TIBET

The vigorously competitive companies BYD and Tesla deploy different corporate strategies, including in Tibet. BYD has long relied on salt lake lithium from the alpine desert of far western Tibet, boasting of its exclusive right to extract from Chabyer (Chinese: Zabuye) Tsaka (salt) lake in Shigatse (Chinese: Rigaze) in the Tibet Autonomous Region (TAR), which is closer to India's border than to lowland China. BYD's exclusive access to the lithium salts of Tibet proved to be a unique selling proposition, attracting Warren Buffett and Bill Gates to China to launch an EV, under a banner proclaiming: "Let innovative New Energy technology power the philanthropic light in Tibet and the world".[14]

In 2019, Elon Musk began production at Tesla gigafactory - that makes both lithium batteries and EVs - on the outskirts of Shanghai. Given the support of an authoritarian Party state and a powerful municipal government that can sweep aside any community environmental objections, this was done in a record time of 18 months. Musk has praised Chinese workers for their productivity, saying: "They will be burning the 3am oil, they won't even leave the factory type of thing, whereas in America people are trying to avoid going to work at all." Hence the boast that the gigafactory can produce a new EV every 40 seconds.

Tesla China is now pushing for further localisation of the supply chain for its electric sedans and SUVs. This means that the future of Musk's factory is expected to depend on access to the hard rock lithium of Tibetan areas of Sichuan, and key processing plants in the Tibetan town of Dartsedo (Chinese: Kangding) in Kardze (Chinese: Ganzi) Tibetan Autonomous Prefecture in Sichuan, and Ya'an, a prefecture-level city where the climb up to the plateau from Chengdu begins. These two towns are now linked by a newly created expressway.[15] The massive investment in infrastructure around both processing plants reflects Sichuan's ambitions to become the hub of lithium extraction and processing.[16]

China's Sichuan-based Yahua Industrial Group Co Ltd put the 20,000 tonnes (22,046 tons) per year lithium hydroxide plant in Ya'an city into operation in May 2020, more than doubling its previous capacity. Later that year Yahua signed a deal to supply battery-grade lithium hydroxide to Tesla for five years. "The Yahua deal underscores Tesla's 'huge demand' for battery-grade lithium hydroxide, 'particularly in view of the ramp-up of Model Y [high-end SUV] production' in Shanghai," Reuters reported, citing a note by Daiwa analysts.[17]

Tesla, and many of China's electric car makers, say their business success relies on vertical integration. This means they own, or have guaranteed exclusive access, to the lithium mines as well as the car factories and the gleaming showrooms where they sell direct to the public, bypassing dealers. In a world of sudden, disruptive shortages, all too frequent in the past three years, corporations prefer to own a captive lithium source to ensure there is no slippage between demand and supply.

14 Video : https://www.youtube.com/watch?v=rwVo9cdwbB4

15 http://english.www.gov.cn/news/topnews/202208/19/content_WS62fee4abc6d02e533532f72c.html

16 http://news.hexun.com/2022-09-28/206836036.html

17 https://www.reuters.com/business/autos-transportation/chinas-yahua-agrees-five-year-deal-supply-lithium-tesla-2020-12-29/

There are at least four compelling reasons why China is now urgently turning to the mountains of eastern Tibet, and why auctions of mining rights - even just exploration rights - can sell to the highest bidder for 1,000 % of the opening asking price.

- First, demand for the critical mineral is booming, given rising sales of electric vehicles and batteries for energy storage;[18]
- Second, Beijing regards its program of buying lithium mines worldwide as more risky than before, due to factors including the rising resource nationalism of governments of the Global South who hope to do the lithium extraction, processing and battery making themselves, adding value onshore rather than shipping their raw ores to China;[19]
- Third, China has noted the de-risking strategy of the richest countries, seeking to decouple critical minerals supply from China. The Chinese government cannot discount the possibility that this may ultimately divert lithium mined in Australia and contractually destined for China[20] to western countries instead, bypassing the Chinese processors of lithium who currently dominate the global market;
- Fourth, the many millions of tons of lithium sitting on the surface of flat salt lakes in the Tsaidam Basin of northeast Tibet are – to China's frustration - at present unavailable for lithium battery making. At present, there is no single technological means to economically and efficiently extract lithium from the Tsaidam lakes, which vary in their chemistry across the region. The lithium in batteries needs to be extremely highly purified; even the slightest impurities reduce battery life, making it harder to recharge; and worse, cause batteries to dangerously overheat and catch fire. (This danger is so well known that when a car freighter with both electric and internal combustion cars on board recently caught fire off the Dutch coast, the immediate suspect was the batteries in the electric cars.)[21]

The sure sign that a boom is beginning to peak is when the major mining companies, with the capital to build scaled-up mines and the surrounding infrastructure, move in. This phase of consolidation is now well under way in the rock lithium extraction industry in China. In Tibet, just one company, Zijin, dominates copper mining; in hard rock lithium it is Ganfeng, Huayu and Tianqi.

18 Reuters, 21 June, 2023, https://www.reuters.com/markets/commodities/china-lithium-price-rebound-be-capped-by-growing-supply-analysts-2023-06-21/#:~:text=BEIJING%2C%20June%2021%20(Reuters),demand%2C%20analysts%20said%20on%20Wednesday

19 'Structural characteristics and disruption ripple effect in a meso-level electric vehicle Lithium-ion battery supply chain network', Dong Mu, Huanyu Ren Chao Wang, Xiongping Yue, Jianbang Du , Pezhman Ghadimi, Resources Policy, 80 (2023) 103225

20 It is important to note too that it takes time, sometimes years, to build processing plants. Therefore any move to stop sending lithium ores and concentrates to China will not happen overnight.

21 Reuters reported: "The coastguard said on its website the cause of the fire was unknown, but a coastguard spokesperson had earlier told Reuters it began near an electric car. Roughly 25 out of 2,857 vehicles on the ship were electric." 27 July, 2023, https://www.reuters.com/world/europe/one-dead-cargo-ship-fire-electric-car-suspected-source-dutch-coastguard-2023-07-26/

TIBET ROCKS

The current global lithium boom is remarkable for a few reasons. Hard rock lithium or spodumene is found in rocks called pegmatites. Although such deposits have been known for decades, there was little incentive to invest in actual extraction at high altitudes when there were salt lake beds across the world where extraction is easier, especially in the so-called 'lithium triangle' of the high deserts of Chile, Argentina and Bolivia. This involves a process in which brine containing lithium is pumped out of the salt lake into evaporation ponds.[22]

The lithium content of brines is highly variable and can be anywhere in between c. 900 and 3,000 ppm Li. Hard rock deposits, in contrast, are typically in the range of 7,000 to 18,500 ppm Li. Ideally for mining companies, a concentrate must be produced at the mine site to make it worthwhile to ship out to a processor capable of achieving the purity of battery grade. That concentrate made at the mine site is actually only 6 % lithium, which means 94 percent of what is transported great distances will end up as waste.[23] In addition, the initial processing at the mine site often requires roasting the rock at very high temperatures to change the crystal structure of the mineral spodumene, an energy-intensive process.

When the electric car boom arrived - particularly from 2020 onwards[24] - there were still many questions around how the rock lithium deposits were formed, how to find the elusive crystallised lithium deep underground as well as in surface outcrops. Uncertainty remains as this plan now rapidly takes shape, driven by massive investment. But once a resource is discovered a huge amount of work is done to reduce that uncertainty, such as drilling, resource estimation, mine planning. What resident Tibetans think and experience is not part of the calculation.

Eastern Tibet is to Tibetans the major province of Kham, today fragmented by PRC boundaries into prefectures of Sichuan, Qinghai, Yunnan provinces and the Tibet Autonomous Region. Kham has long been identified by scientists as one of the planet's biodiversity hotspots.[25] Compared to the rest of Tibet it is wetter, warmer, capturing the monsoon winds that rise up through deep Himalayan valleys. These are medicine mountains, the basis of a pharmacopeia which combines herbs and minerals into hundreds of combinations, part of global intangible cultural heritage.[26] Yet China's new national parks are only tangentially in Kham; most are in the pastoral landscapes to the north, much less rich in biodiversity.[27]

22 There are also significant social and environmental issues around lithium extraction from brines, such as fresh water use, land take and biodiversity loss.

23 The point of producing a concentrate is that, in theory, the amount of waste that is shipped out is reduced. For example, a mine might (hypothetically) extract 2,000,000 tonnes of rock (ore), from that 200,000 tonnes of concentrate is produced, and of that 6% is Li2O. So, 12,000 tonnes of Li2O. The waste is then 188,000 tonnes.

24 Global EV sales more than doubled from 2020 to 2021, marking a 108% increase, JP Morgan, 17 August 2023, https://www.jpmorgan.com/insights/investing/investment-strategy/what-is-the-electric-vehicle-boom

25 So big is the biodiversity 'hotspot' of Kham it extends across the officially Tibetan prefectures of Sichuan, Qinghai, Tibet Autonomous Region and Yunnan. Only the Qinghai portion is 'protected', as part of the Sanjiangyuan National Park. Designating Kham as a national park, under China's national control, would bring together fragmented lands into a single Tibetan entity, which is not what the PRC seeks. So the extraordinary biodiversity of plants and animals of Kham remains unprotected.

26 Gabriel Lafitte blog, https://rukor.org/nature-positive/

27 Gabriel Lafitte, Rukor, https://rukor.org/national-parks-in-tibet-parking-the-nationals-of-tibet/ ; also see International Campaign for

When Chinese gold miners swarmed to California in the 1840s and Australia in the 1850s, their tools were shovels and sieves. Today hard rock lithium extraction can require drilling a combined two kilometres across several drill holes, each a few hundred metres deep.[28] Roasting spodumene to extract lithium requires temperatures above 800°C, which requires a high voltage electricity supply, which in turn, in Tibet, means a hydro dam utilising one of the many wild mountain rivers incising these rugged landscapes. This is substantial industrialisation; an extractive colonisation at high altitude, that may convert Tibet from a cost centre for China to a profit centre. Then the concentrate is trucked to a lower altitude, to a second industrial plant, closer to the edge of the Tibetan plateau, closer to industrial users, the makers of batteries.[29]

Figure 02: Lithium mining facility on Chayber Tsaka Lake.

Source: Google Earth

鸳鸯坝绿色锂业加工集中区全景效果图

Figure 03: Computer generated image from promoters of the rock lithium ‘beneficiation’ plant in Dartsedo/ Kangding, on the banks of the Dadu river which feeds into the Yangtze.

Source: Chinese company Youngy website via Rukor.org

Tibet, Nomads in ‘no man’s land’: China’s nomination for UNESCO World heritage risks imperilling Tibetans and wildlife, https://savetibet.org/nomads-in-no-mans-land-chinas-nomination-for-unesco-world-heritage-risks-imperilling-tibetans-and-wildlife/

28 A report by geologists at Nanjing University studied for this report detailed many months of expensive deep drilling, resulting in locating hard rock lithium as far down the drill hole as 3 km. In this case, the geologists had the equipment to do ‘directional drilling’, meaning they could change the angle, not just go straight down, a way of literally changing course when the drill core samples suggest it is better to go sideways.

29 Key locations for processing are Dartsedo (Chinese: Kangding) and Ya’an, see above section on Tesla

THE NEW ‘QUICK AND DIRTY’ METHODS UNDERWAY TO PROCESS TIBET’S LITHIUM

Chinese sources and satellite imagery studied for this report provide new information on the quick, cheap and dirty methods of processing of extracted rock now being used at a major facility on the banks of a river in Dartsedo (Kangding) with ore from the Jiajika spodumene mining area, at the heart of the current boom. They present an alarming indication of what may be to come.

Figure 04: The most established rock lithium mine in Kham is the Jiajika deposit at Lhagang Kardze (Chinese: Ganzi) Tibetan Autonomous Prefecture, Sichuan province, the Tibetan area of Kham. This ore field is now at the center of the lithium rush. In February 2019 the Chinese Rongda Lithium company (a subsidiary of RongJie Co) made an agreement on sharing lithium resources with the Kardze government, launching the Jiajika spodumene mining area, which has entered production. It is known in Chinese as Ganzizhou Rongda Lithium mine. The Jiajika mine has caused devastating pollution to the local environment, the grasslands home of Tibetan herders, killing thousands of fish in the nearby river.

Source: Google Earth

China's lithium battery manufacturers and car makers are in a hurry, with no time to build the ore roasters and sulphuric acid cookers that convert rock that may only contain 1.3% lithium into a concentrate worth transporting over long distances. If the hard rock lithium boom persists, those processes may happen,[30] together with the hydro dams that would be needed to provide the power. But hydro dams take many years to build.

So China's rock lithium miners are turning to a faster and much less efficient way of upping the lithium from 1.3% lithium to 5%, and calling that a concentrate. The method is called Dense Media Separation (DMS), which relies on gravity and water to do the job of removing a lot of the waste rock, which geologists call gangue.[31]

So far, the sole operating hard rock lithium mine in Tibet is the Jiajika deposit at Lhagang Kardze (Chinese: Ganzi) Tibetan Autonomous Prefecture, Sichuan province, the Tibetan area of Kham. The Chinese Rongda Lithium company (a subsidiary of RongJie Co, known in Chinese as Ganzizhou Rongda lithium mine) made a deal with the Kardze authorities[32] to process the ore from Jiajika. According to Chinese state media sources by 2022, revenue was close to 1.4 billion yuan ($193 million).

Figure 05: Headquarters of the Kardze Rongda lithium company at the border of Kangding (Dartsedo), Nyagchuka (Yajiang) county and Tawu (Daofu or Dawu) counties in Kardze (Chinese: Ganzi), Sichuan. The blue-roofed compound is facing a Tibetan Buddhist monastery.

Source: Google Earth

30 Although experts in critical minerals assert this may be unlikely that these processes will be combined into a single process, at the same site.

31 DMS is a standard feature of many lithium operations globally. It is used to pre-concentrate spodumene before further processing, so without DMS recovery of spodumene would be much less efficient.

32 Mining company website: http://www.younergy.cn/) The agreement is detailed in this Chinese media source: http://jxj.gzz.gov.cn/gzzjxj/c100334/202303/af509ae68c6b44f9a95ef17c8508745b.shtml

So at least in the short term, the roasting of spodumene and sulphuric acid cooking of the extracted lithium will be done elsewhere, in the case of Jiajika Rongda, in the facility at the county seat of Dartsedo (Kangding), on the banks of the Dadu (Tibetan: Gyelmo Ngul Chu) river, close to the historic border of the Tibetan plateau with China.

Dense Media Separation is not new. It has been used where extraction of coal and iron ore come mixed with a lot of other rock known as gangue. While there are papers from as early as 1999 that discuss DMS as a means to separate spodumene, scientists ran lab tests in 2021 to see if this method might work for hard rock lithium.[33]

The latest annual report of the operator of the largest spodumene mine in Tibet confirms DMS is its method of producing a 'concentrate' that is contractually required to be 6-7% Lithium Oxide (Li_2O), for sale to a downstream processor capable of making a producer product that battery makers can further process into battery grade.

However Ganzi Rongda Lithium (a wholly-owned subsidiary of Rongjie) reports it is failing to meet the 6% lithium content (6% Li_2O) target, falling short by a substantial margin. While the concentrate dose indeed contains only 6-7% Li_2O, the concentrate is about 75-87% spodumene.

Rongda says it is only able to reach a concentrate of 5% using DMS,[34] and as a result is being paid less per ton delivered to another Rongjie subsidiary.

The problems of DMS processing at these Tibetan sites are multiple. In many places DMS discharge is screened and filtered to remove particulate matter. Crushing of the ore is energy-intensive, requiring much fossil fuel burning unless or until hydro dams are built.

DMS relies on water, which is often discharged dirty, once it has enabled gravity to separate lithium somewhat from silica. Satellite imagery in this report shows the Dartsedo rock lithium processing plant is directly beside a Tibetan river, the cheapest way of ensuring pure water input and dirty water discharge. For Dense Media Separation to work, the water has to be made dense enough for some of the finely crushed rock to sink, and some to float. The commonest additive put into the water is finely powdered ferrosilicon.[35]

DMS is a pre-concentration method. The concentrate is captured directly, the middlings are sent for further processing i.e. froth floatation and a small amount is lost to tailings. More than 70% of the spodumene can be captured using DMS but only if it is correctly set-up and no corners are cut.

Transporting finely crushed rock with its inherent waste requires burning a lot more fossil fuel. Whether trucked from the Rongda Jiajika mine to Dartsedo, or shipped across the Indian Ocean from Australia, where DMS is also used on rock lithium bought by China, the climate changing emissions impact is high.[36]

33 Charlotte E. Gibson , Massoud Aghamirian, Tassos Grammatikopoulos, Darren L. Smith and Lindsay Bottomer, The Recovery and Concentration of Spodumene Using Dense Media Separation, Minerals, 2021, 11, 649. https://doi.org/10.3390/min11060649

34 A lithium and critical minerals expert consulted for this report who preferred to remain anonymous observed that this is not necessarily a problem with DMS per se but more likely an issue with Rongda's specific DMS processing methods and means.

35 The process of Ferrosilicon production involves the reduction of sand or silica (Si) with coke / coal (C), and then reacting it with iron (Fe) which can be obtained from scraps. The Carbon in the coal is required to remove the oxygen, leaving a pure Silicon and Iron (FeSi) product. https://www.dmspowders.com/what-is-ferrosilicon/

36 Transporting material is not considered by mining experts to be the biggest contributor to greenhouse gas emissions when considered as part of a life cycle assessment (LCA). It is the processing that adds the largest share.

These are still early days in the Tibet hard rock lithium business, even within Rongda Rongjie, which boasts it is "the only large-scale mine of lithium pyroxene in production in China that has entered the supply channel." Rongjie, in its latest annual report, promises to scale up dramatically, from current production of 3265 tons of actual lithium. This includes, close to the edge of the Tibetan plateau, a lithium 'industrial park' with a throughput capacity of 2.5 million tons a year, which will receive the DMS concentrate from the Jiajika mine, concentrating and purifying it further.

This next stage is planned to get rid of a lot more gangue waste rock, resulting in output of 470,000 tons of concentrate, with four fifths of what arrives in Dartsedo to be disposed of in Dartsedo. Yet that planned 470,000 tons of concentrate will finally produce around 70,000 tons of battery grade lithium carbonate. In this complex journey, it will take extraction, crushing and pulverising around five million tons of rock each year at Jiajika Rongda, to end up with 70,000 tons of battery ready lithium.[37]

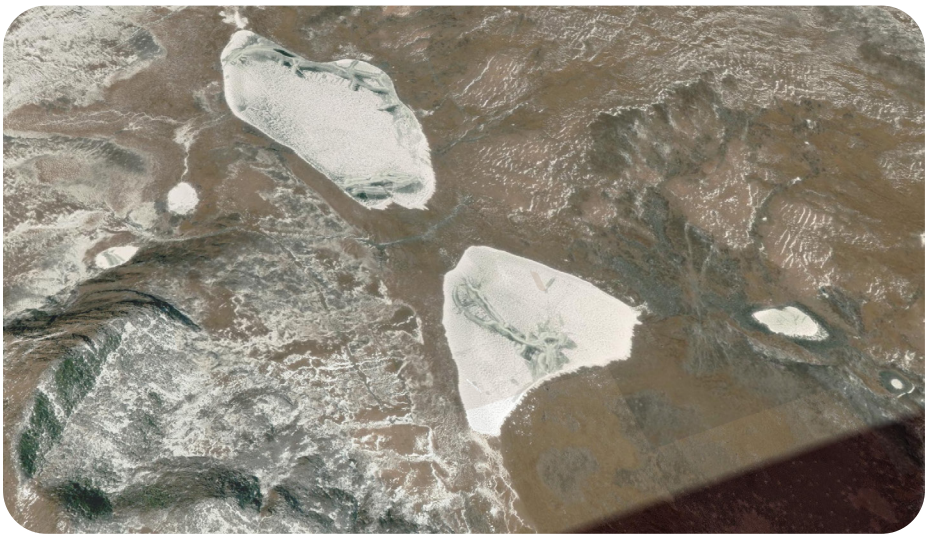

Figure 06:

The white patches depict mining of lithium at Sichuan Cuola mine. Tianqi Lithium has the rights to mine at this site, which is close to Jiajika rock lithium mining area, the largest so far.

Source: Google Earth

Figure 07:

Sichuan Cuola mine, depicting headquarters of the mining company at the site. The distance between the HQ of the Rongda lithium mine company and the Cuola rock lithium site is just under 22 kilometers.

Source: Google Earth

37 Shanghai Metals Market, 13 April 2022

That suffices to entice investors. Wealth management advisers and brokers issue buy recommendations that repeat Rongda's estimate that at Jiajika lithium reserves are 412,300 tons, with an average grade of more than 1.42%, and are accompanied by tantalum, niobium, beryllium and other rare metals, which is considered to be excellent resource endowment. Kardze (Ganzi in Chinese) prefectural government proudly repeats Rongda's claims.

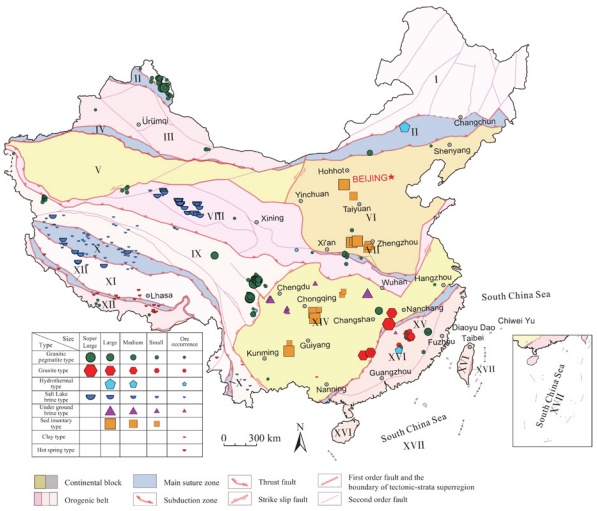

Figure 08: Distribution map of lithium deposits from China Geology, featured in a paper about the new deposits published in September 2022

Source: China Geology.cgs.cn

If and when rock lithium extraction on the Tibetan plateau does scale up, significant capital expenditure will be required. But now buying a stake is still relatively cheap. Poorly operated, cheaper DMS used in isolation of other processing methods could be a reason why Jiajika Ronda already reports high profits.

The Dadu river in Dartsedo, with its second stage lithium concentrator right on its banks, feeds into the Yangtze, China's mightiest river. Official policy is that the Yangtze - all of it - is now strictly protected. Could that mean the quick and dirty methods of DMS, might be challenged internally by China's discipline inspectors?[38]

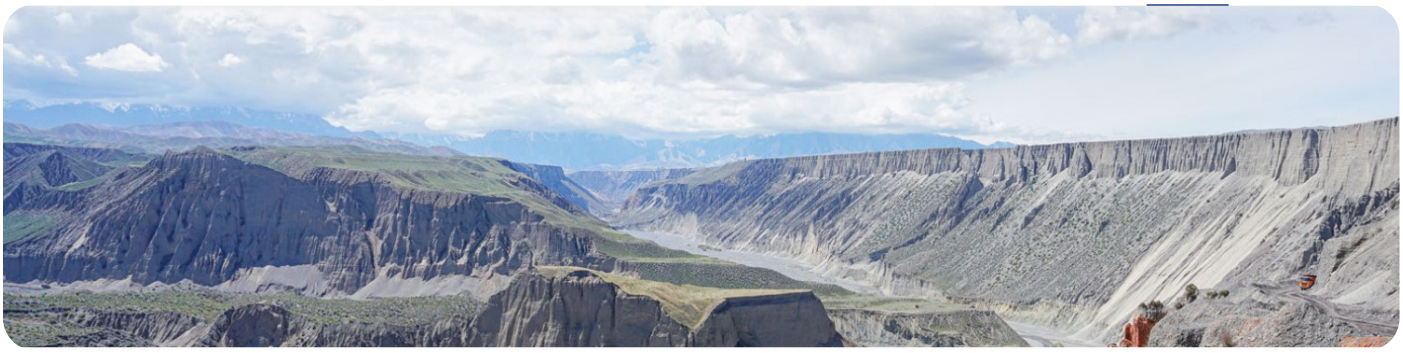

Figure 09: Jiajika deposit of rock lithium.

Source: The Chinese company Youngy website

38 Xiao Han & Jichuan Sheng (2023): Governing the Future through 'Ecological civilization': Anticipatory Politics and China's Great Yangtze River Protection Programme, Journal of Contemporary China, DOI: 10.1080/10670564.2023.2232747

THE NEW DEPOSITS IN TIBET: 'SLEEPING IN HIGH MOUNTAINS AND DEEP VALLEYS'

Until very recently it was thought that China had quite limited sources of hard rock lithium within PRC borders.[39] In 2006, China's lithium reserves were assessed as totalling one million tons, nearly all in salt lakes.[40] So for decades, the salt lakes of the Tsaidam basin in northeastern Tibet were the obvious location for large scale extraction of lithium, which had been dumped as a waste byproduct after the extraction of potassium, magnesium and sodium salts.[41] Then lithium rocketed in price, but extraction to a sufficient level of purity remained frustratingly close, yet has not happened.

That all changed this pandemic decade. By 2022, intensive research into hard rock lithium deposits in the PRC was underway.[42] Chinese names were assigned to new remote locations in Tibetan areas at 3,540 to 3,830 metres altitude.[43]

China's assessment of its lithium resources has changed so much that a new overview, written by a team of 16 geoscientists, now puts hard rock lithium ahead of salt lake deposits.[44] Their opening words reflect a dramatic shift: "China is rich in abundant lithium resources characterized by considerable reserves and a concentrated distribution of metallogenic zones or belts" with proven reserves of 4.047 million tons of lithium.[45]

The study by geoscientists, published in September 2022 and which "aims to serve as a guide for the future prospecting of lithium deposits in China", states that the major lithium deposits in China are distributed in the provinces and regions of Qinghai, Jiangxi, Sichuan, Tibet [Autonomous Region], and Xinjiang. Of the 4.047 million tons of lithium in deposits in China, 3.655 million tons are in the Tibetan Plateau. That represents at least 85%.[46]

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39 For instance, Institute for Energy Research, https://www.instituteforenergyresearch.org/international-issues/china-expected-to-increase-control-over-global-lithium-and-cobalt-supply/#:~:text=China%20has%20over%20half%20of,an%20igneous%20rock%20called%20s-podumene

40 Zhu Xun, 'Mineral Facts of China', Science Press Beijing, 2006, p468. Also see 'The Availability of Critical Minerals for China's Renewable Energy Development: An Analysis of Physical Supply', Jianliang Wang, Natural Resources Research, Vol. 29, No. 4, August 2020 (_ 2020) https://doi.org/10.1007/s11053-020-09615-5

41 Globally, lithium production from hard rock deposits and brine has been fairly equally split (almost 50:50) during the past decade.

42 Xin Li et al., Geochronological and geochemical constraints on magmatic evolution and mineralization of the northeast Ke'eryin pluton and the newly discovered Jiada pegmatite-type lithium deposit, Western China, Ore Geology Reviews 150 (2022) 105164

43 Zhang Wei, The C-H-O Isotopic Composition and Significance of Spodumene for Redamen Pegmatite Type Rare Metal Deposit in Western Sichuan, 川西热达门伟晶岩型稀有金属矿床锂辉,C-H-O 同位素组成及意义, 矿产综合利用2023 年2 月Multipurpose Utilization of Mineral Resources Journal

44 Bo Zhang et al, Geological characteristics, metallogenic regularity, and research progress of lithium deposits in China, China Geology 5 (2022) 734–767, downloadable from http://chinageology.cgs.cn/en/article/doi/10.31035/cg2022054

45 Ibid

46 Ibid. This source gives figures for Sichuan, Tibet (Autonomous Region) and Qinghai, and an accompanying map shows no lithium deposits in non-Tibetan parts of Sichuan, Qinghai or Yunnan, except for one medium sized underground brine lithium deposit south-west of

Satellite imagery studied for this report reveals this massive lithium ore belt in Sichuan, described by Chinese media as ‘the largest lithium ore belt in Asia’.[47] The Chinese Green Energy site describes four major lithium mines in western Sichuan as “sleeping in high mountains and deep valleys. The construction is long, mining is difficult, and the projects are remote. Large-scale mining still requires a lot of investment.”[48]

Figure 10: The Ke’eryin lithium ore belt in Ngaba (Aba) Tibetan and Qiang Autonomous Prefecture, Sichuan.

Source: Planet Labs PBC

Chengdu, which is not in Tibet but very close. Since China exploits the underground brines of Chile and Argentina intensively, it does not seem likely that this underground brine is being extracted.

47 http://www.lvsenengyuan.com.cn/xny/249472.html

48 Green Energy, 23 September 2023, http://www.lvsenengyuan.com.cn/xny/249472.html

The impacts of the new sites identified for hard rock lithium mining across Tibet are not yet apparent, as this is such a new discovery.

Chinese sources make it clear that these deposits scattered across remote mountainsides could only be found using new sophisticated remote sensing technology. A 2023 report in a journal dedicated to remote sensing observed: "These metallogenic belts [on the Tibetan plateau] are generally higher elevations, cold, hypoxic with harsh environmental conditions, raising great difficulties during field investigation. Therefore, it is necessary to develop a more efficient and cost-effective exploration method specifically for Spud [spodumene]rich pegmatite deposits. The rapid development of remote sensing technology has made it [sic] possible. Pegmatite deposits are typically characterized by their small outcrop area and lack of prominent regional alteration features, making it challenging to apply established HRS [hyper spectral remote sensing exploration models."[49]

The earliest sporadic efforts at locating and extracting Tibetan hard rock lithium were the Jiajika deposits at Lhagang Kardze (Chinese: Ganzi) Tibetan Autonomous Prefecture, Sichuan province, the Tibetan area of Kham. This ore field is now at the center of the lithium rush, as outlined in the section above describing processing at Dartsedo.

There is also a major cluster in Sichuan province, near Barkham (Chinese: Ma'erkang), the capital of Ngaba Tibetan and Qiang Autonomous Prefecture in Sichuan (the Tibetan area of Amdo), which China calls the Ke'eryin ore field. The Zhawulong deposit is located to the northeast of Jyekundo (Chinese: Yushu) town in Qinghai.[50]

Figure 11:

The Tianqi battery grade lithium factory in Anju, Sichuan, from Tianqi's website. While the factory itself is not in a Tibetan area, Tianqi Lithium has rights to the Nyagchuka (Yajiang) lithium deposits. Tianqi joined forces with Zijin lithium company to mine lithium for this factory.

Source: Tianqi Lithium, www.tianqilithium.com

49 Wenqing Ding et al. Lithium-Rich Pegmatite Detection Integrating High-Resolution and Hyperspectral Satellite Data in Zhawulong Area, Western Sichuan, China, Remote Sensing, 2023, 15, 3969. https://doi.org/10.3390/rs15163969, freely downloadable: https://www.mdpi.com/2072-4292/15/16/3969

50 https://www.mdpi.com/2072-4292/15/16/3969

One of the first deposits to be discovered in 2021, the Jiada mining area near Markham (Ma'erkang) in western Sichuan, Ngaba Tibetan and Qiang Autonomous Region, was greeted with great excitement.[51]

An auction for five-year exploration rights to the Jiada lithium mine in August (2023) received more than 11,300 bids and concluded at 4.2 billion yuan ($579 million), 1,317 times higher than the asking price of 3.19 million yuan.[52] The top bidder turned out to be iron ore mining company Dazhong from distant Inner Mongolia.[53] What Dazhong gets for that price is only ongoing exploration rights that may confirm the vague estimate of the Sichuan authorities that the ore body is anywhere between 29.7 million tons and 47.2 million tons, within which the actual lithium content is merely 1.26%. If Dazhong can drill expensive deep holes and prove a more reliable tonnage within its five year exploration right, it will then be able to sell for high profits on to a miner capable of extraction.[54]

Major players are moving into Dechenongba in Nyagchuka (Chinese: Yajiang) county in Kardze (Ganzi) Tibetan Autonomous Prefecture in Sichuan, eastern Tibet. Prospecting rights for the Dechenongba lithium mine are owned by Sinuowei mining, which categorizes it as a 'super-large' lithium mine, capable of achieving a production scale of 1 million tons per year.[55]

51 Ministry of Natural Resources, China Mineral Resources 2021, Geological Publishing House

52 Auction data from the Sichuan Public Resources Trading Center, cited by Reuters, 14 August 2023, https://www.reuters.com/article/china-lithium-mining-idUSKBN2ZP05Z

53 Platts Metals Daily, 14 August 2023

54 In the unlikely outcome of a collapse in the hard rock lithium bubble, Dazhong will nevertheless have done its patriotic duty by Beijing.

55 Pan Daily, 22 November 2022, https://pandaily.com/chinese-battery-giant-catl-jumps-into-battle-for-major-mining-firm/

THE IMPACTS OF LITHIUM MINING ON TIBET AND TIBETANS

The impacts of intensive lithium mining on Tibet are multiple. There is the incursion of a Han workforce constructing and staffing a huge open pit mine with steep walls in an area highly prone to earthquakes; the blasting and removal of millions of tons of granite each year; the hydro dams on Tibetan rivers and the power grids bringing electricity to the mine site.

Tibetan lives and landscapes are increasingly in the balance as large-scale mining across the plateau in lithium, as well as copper, gold, silver and chromium, intensifies.

"Old people, we see the mines and we cry," a 67-year-old yak herder told Simon Denyer from the Washington Post when he travelled to the area of the Jiajika lithium mine in Lhagang, Kardze, in 2016. The old man spoke anonymously for fear of retribution. "What are the future generations going to do? How are they going to survive?"[56]

Lithium mining has already had disastrous results close to the processing plant at Dartsedo (Kangding) in Kardze run by Rongda Lithium. In 2013 and 2016, thousands of fish were poisoned to death and hundreds of yaks died due to mining pollution and contaminated mining wastes drained into the Dadu River, a tributary of the Nakchu/Yalong river, the biggest river that merges with Yangtse downstream.[57]

A lead and zinc mine in Qinghai caused contamination across Tibetan herders' grasslands for miles, with local people dying as a result of polluted water, and their livestock being killed.[58]

Tibetans who express concern or who protest about the impact of toxic waste, deforestation, and large-scale erosion risk being imprisoned, tortured, or killed.[59]

On May 15, 2010, police opened fire on Tibetans at a cement factory in the Tibetan area of Amdo (Labrang in Gansu Province) after local villagers gathered due to concern over pollution from the factory. Fifteen people were taken to hospital with gunshot wounds or injuries from beatings by police. In the

56 Simon Denyer, Washington Post, 26 December 2016, citing Free Tibet, https://www.santafenewmexican.com/news/chinese-mines-pollute-sacred-tibetan-lands/article_04afb96a-009e-522d-bdc7-2046ef000df2.html

57 Tibet Policy Institute report, 4 June 2016, https://tibetpolicy.net/lichu-river-poisoned/ ; 'Mining lithium for EV batteries unsustainable according to studies', 19 June 2023, https://www.visordown.com/news/industry/mining-lithium-ev-batteries-unsustainable-according-studies . Also Simon Denyer, The Washington Post, December 26, 2016, https://www.santafenewmexican.com/news/chinese-mines-pollute-sacred-tibetan-lands/article_04afb96a-009e-522d-bdc7-2046ef000df2.html

58 Simon Denyer, Washington Post, 26 December 2016, citing Free Tibet, https://www.santafenewmexican.com/news/chinese-mines-pollute-sacred-tibetan-lands/article_04afb96a-009e-522d-bdc7-2046ef000df2.html . Also see Radio Free Asia: https://www.rfa.org/english/news/tibet/mines-05062013154914.html

59 The International Campaign for Tibet studied the cases of 50 Tibetan environmental defenders, reporting: "Over the last two decades, Chinese government development policies have scaled up mining, energy, infrastructure, and urbanization projects across Tibet. Of the 50 Tibetan environmental defender cases surveyed, 21 Tibetan environmental defenders are currently serving sentences in prison with an average sentence length of eight and a half years. Five have completed their prison sentences, however it is not certain that all five have been released. The whereabouts of 20 Tibetan environmental defenders remains unknown, which demonstrates the difficulties of circumventing the Chinese government's strict information controls. Four environmental defenders have died due to abuse by state agents: one individual was fatally shot during a protest, while three died in custody." 2 June, 2022, https://savetibet.org/environmental-defenders-of-tibet/

same year police opened fire on a group of Tibetans protesting about environmental damage caused by mining in the eastern Tibetan area of Kham and killed at least one protestor.[60]

In August 2013, hundreds of people gathered in Zadoi county in Yushu, Qinghai province to protest against mining on what they considered to be a holy mountain. They even displayed posters and placards quoting President Xi Jinping's words on the need to balance economic growth and environmental protection. But police and paramilitary forces still arrived in force, firing bullets above the crowd, arresting eight people and injuring many more.[61]

Two young Tibetan men set fire to themselves and died at the site of a mine in Amchok, the Tibetan area of Amdo, in November 2012 Thirty-four year old Tsering Dhundup was a father of three, while Kunchok Tsering was 18.[62]

60 International Campaign for Tibet report, https://savetibet.org/chinese-government-admits-to-fatal-shooting-of-tibetan-in-mining-protest/ Also see https://savetibet.org/tibetans-in-amchok-protest-mining-project-at-holy-gong-ngon-lari-mountain/

61 Simon Denyer, Washington Post, 26 December 2016, citing Free Tibet, https://www.santafenewmexican.com/news/chinese-mines-pollute-sacred-tibetan-lands/article_04afb96a-009e-522d-bdc7-2046ef000df2.html

62 Tibet Watch report, 'Environmental protests on the Tibetan plateau', January 2015, https://tibet.net/wp-content/uploads/2015/02/environmental_protests_on_the_tibetan_plateau.pdf

SALT LAKE SITES AND EV MANUFACTURER BYD

Although China's attention has shifted away from the massive salt lakes of Tibet's Amdo Tsaidam basin and towards hard rock lithium for immediate exploitation, intensive research of the salt lakes continues. China is still hopeful that a breakthrough will be achieved to enable complete separation of lithium from other metal salts, particularly in the massive deposits of Tsaidam.[63]

While the Tsaidam salts remain unusable for battery-grade lithium, there is one other Tibetan region where salt lake lithium extraction is much more straightforward. In the alpine desert of far western upper Tibet are salt lakes where separation is much easier. The problem for China's mineral companies is that this part of Tibet is closer to India than China, and the factories that make batteries. That is not as far as shipping Chilean lithium across the Pacific, but it represents a fossil fuel, energy-intensive overland journey by truck then rail.

This did not prove to be an insuperable barrier to Chinese manufacturer BYD and its strategic investor Warren Buffett. Buffett's long ownership of stock powered BYD's surge to a top lithium powered car provider today, showcased recently by the Prince and Princess of Wales, William and Catherine.[64] (BYD replaced Ford as the world's fourth best-selling auto brand in August, as the latter's sales slumped in Europe and the US, according to market research firm TrendForce).[65] Buffet's investment is believed to have provided BYD with enough capital to exploit the Chabyer salt lake. This was the first of 24 salt lakes of western Tibet to be identified as rich in lithium, extractable through evaporation. Extraction has grown, despite the logistical difficulties of the very remote locations, and now is around 30,000 tons a year.[66]

Data published in October 2023 indicated that in its last quarter, BYD delivered 432,000 all-electric vehicles, putting the company within 1 % of Tesla's 435,000 and just 3,000 deliveries short of becoming the world's leading seller of all-electric vehicles. The same survey pointed out that nevertheless Tesla does not look likely to relinquish its title of "most valuable auto manufacturer" any time soon. Tesla's $825 billion market cap is still 9 times that of BYD, equivalent to the next 10 largest automakers combined.[67]

63 This is likely to have been the reason for Xi Jinping's statements during his visit to Qinghai in 2021, seeking to encourage a breakthrough in order to exploit the colossal amount of lithium in Tsaidam (where the lakes are older than in west Tibet, and have piled up lithium for longer).

64 https://carnewschina.com/2022/03/28/british-royal-family-drove-on-byd-tang-in-the-bahamas/

65 https://cnevpost.com/2023/09/28/byd-replaces-ford-4th-best-selling-aug-trendforce/?utm

66 Geoscience Frontiers, Vol 14, Issue 1, January 2023, 101485

67 Bloomberg, via https://www.chartr.co/newsletters/2023-10-06

TACKLING CHINA'S DOMINANCE BY DE-RISKING SUPPLY

The Wall Street Journal reports that China is now the world's largest market for electric vehicles.[68] As soaring imports generate fears for the future of European auto manufacturers, the European Union announced in September 2023 that it has launched an investigation into China's state support for electric vehicle makers.[69] Electric cars sold in China are roughly 40% cheaper than those sold in Europe, and 50% cheaper than in the US.[70]

The EU wants to tackle China's domination of the solar power market, too, adopting measures such as the EU's Net Zero Industry Act, which proposes that 40% of all solar panels installed in Europe be produced in Europe. Last year, China made 97% of the silicon wafers that go into solar panels and more than three-quarters of the world's solar panels themselves.[71] (The London Metals Exchange has been owned by Hong Kong Exchanges and Clearing – main shareholder, the Hong Kong government – since 2012.). The official Made in China 2025 policy has been nurtured over past decades by a developmentalist state willing to pour ubsidies into supportive infrastructure, making it easier for domestic electric car makers to succeed.[72] There are risks, but there is also a massive police, paramilitary and military presence throughout Tibet and the PRC if protests occur.

Too often, in too many market economies trading with China, China has withheld supply of critical minerals. That is what provoked the reaction, especially among the G7 (plus South Korea, Australia and others) to move towards derisking the supply chain from dependence on China.

The UK government announced its first Critical Minerals Strategy in 2022. The risks of Chinese dominance of supply chains of critical minerals and rare earths to UK interests are clear. Secretary of State Kwasi Kwarteng has noted: "The world in 2040 is expected to need four times as many critical minerals for clean energy technologies as it does today. However, critical mineral supply chains are complex and opaque, the market is volatile and distorted, and China is the dominant player. This creates a situation where UK jobs and industries rely on minerals vulnerable to market shocks, geopolitical events and logistical disruptions, at a time when global demand for these minerals is rising faster than ever. It is vital that we make our supply chains more resilient and more diverse to support British industries of the future, deliver on our energy transition and protect our national security."[73]

68 'EVs Elbow Out Internet Titans as China's Business Darling', 4 September 2023, https://www.wsj.com/business/autos/electric-cars-power-chinas-economic-hopes-as-internet-titans-take-a-back-seat-26c62d3b

69 'Europe probes China's electric car subsidies as imports soar', 14 September, 2023, https://edition.cnn.com/2023/09/13/cars/europe-china-electric-car-subsidies/index.html

70 2022 study by Jato Dynamics, https://info.jato.com/hubfs/Affordable-EVs-and-Mass-Adoption-The-Industry-Challenge.pdf

71 Financial Times, 23 March 2023, https://www.ft.com/content/009d8434-9c12-48fd-8c93-d06d0b86779e

72 Notice on Adjustment and Improvement of Fiscal Subsidy Policies for Promotion and Application of New Energy Vehicles, 2018. Ministry of Finance of China. https://www.miit.gov.cn/zwgk/zcwj/wjfb/zbgy/art/2020/art_2d4ca29e16bc4fe08c5637641948cc38.html

73 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1097298/resilience_for_the_future_

CHINA'S RESOURCE SECURITISATION

Official statements at the highest levels make it clear that China's global reach for critical minerals sourcing is now classified as a security risk within the PRC, as it is by the G7, although for different reasons. For one, China's specialists in the economics of global sourcing are reassessing China's ongoing global access to deposits, mines, ports and shipping routes essential to China's dominance of critical minerals processing, purification and deployment.[74] The PRC, for instance, buys almost all the hard rock lithium mined in Western Australia and the Northern Territory of tropical Australia, while Chinese miners are ramping up hard rock lithium extraction from Mali.[75]

At Australia's newest hard rock lithium mine, near the town of Darwin in the tropical north, the extracted rock, all contractually bound for China, is naturally only 1.3 % lithium. Shipping these commodities thousands of kilometres to China would make no economic sense.[76] So the ore is concentrated first.

After the US expressed bipartisan support to impose more robust constraints on China, the mood in Beijing shifted. The Party state moved to allocate more incentives and subsidies to intensify exploitation of lithium from domestic sources, notably Tibet.

The University of Geosciences in Wuhan is a major centre of investigating China's secure sources of critical minerals, and assessing its global sources. In 2020, a "lithium security index system" was constructed by geoscientists at the university, drawing up a list of 20 demand and supply factors, evaluating each as a plus or minus for China's security. There were 15 pluses, only five minuses, one of which was "net import dependence." They listed China's nine major corporate lithium extraction projects, only four of them in actual production, the rest were merely the securing of mining rights. Only two of the nine were rock lithium, all others were salt lakes. Of the nine deposits, all but one was in Tibet. The report concluded that China needed to "actively integrate into the global lithium industrial chain."[77] But the report also made it clear that China should step up domestic production, meaning an intensified focus on Tibet.[78]

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the_uks_critical_minerals_strategy.pdf

74 Critical Mineral Security in China: An Evaluation Based on Hybrid MCDM Methods ,https://www.mdpi.com/2071-1050/10/11/4114

75 https://www.fdiintelligence.com/content/feature/chinese-companies-expanding-footprint-in-global-lithium-mines-81261

76 https://cdn-api.markitdigital.com/apiman-gateway/ASX/asx-research/1.0/file/2924-02709580-2A1472932?access_token=83ff96335c2d45a094df02a206a39ff4

77 "China needs to actively integrate into the global lithium industrial chain to improve discursive power on lithium resources. We find that global coexistence is of significance for improving lithium security in China. China has increased its advantage in the global lithium industrial chain by opening up domestic markets, obtaining overseas ownership and promoting exports of downstream products." Na Zhou, Qiaosheng Wu,, Xiangping Hu et al., Synthesized indicator for evaluating security of strategic minerals in China: A case study of lithium, Resources Policy, Nov 2020.

78 The same report noted: "China should strengthen the layout of the domestic lithium industry to enhance the economic security of domestic lithium resources. China should focus on improving domestic lithium security to optimize domestic resource layout and to improve the balance of supply and demand. China should, on the one hand, reinforce unified planning of the domestic lithium industry from the development of strategic emerging industries to optimize resource allocation; on the other hand, cultivate large enterprises to integrate

PRECARITY: THE RISKS OF DE-RISKING LITHIUM SUPPLY

As with any commodities bubble, there are many ways the lithium bubble could burst. Chinese scientists still hunt the grail of salt lake extraction, known as direct lithium extraction (DLE). The goal is clear, but no comprehensive solution yet exists.[79] If DLE eventuates, and although it seems to be an unlikely scenario, the hard rock lithium industry would struggle to compete. It is conceivable that if so, the smart money with insider knowledge would bale early, leaving local communities around the mines to cope with the toxic waste aftermath.[80]

Unless investors get a high rate of return, and quickly, they may just move on. Much of the money pouring into lithium extraction in China was in bitcoin. It is in the nature of mining bubbles that prices rise far higher than actual production, or projected production, can justify. Having peaked, expectations rise, investment increases and the smart money picks the moment to bail out by shorting the stock, thus making a handsome speculative profit as the price crashes.

The CCP does worry about booms and crashes, and the instability they cause. It does denounce speculators. But Xi Jinping's goals of dominance in critical minerals and towards 4IR goals come first. And an integral element of the vision is the reshaping of the Tibetan landscape to become Chinese, to no longer be beyond the frontier.

China's 'frontier construction theory' spells it out. Securisation requires the entire Tibetan Plateau to be an enormous buffer barrier zone, with the trans-Himalayan belt of southern U-Tsang (present day Tibet Autonomous Region) especially important as the ultimate frontier, to be secured both against India and against any possibility of Tibetan discontent.[81]

Urbanisation is foundational to securitisation, as it is conducive to surveillance, grid management and big data aggregation reliant on algorithms to identify behaviour that may conflict with Party state interests as soon as it manifests. Urbanisation is also a core strategy of China's 'frontier construction theory.'

Compulsory modernity with Chinese characteristics now affects almost all aspects of Tibetan life, requiring rural emigration to new urban hubs, reframing of customary lifeworlds as semiskilled urban construction workforce employed precariously by contractors in the accelerating urban construction boom.

upstream and downstream operations through the use of supporting policies in taxations, subsidies and loans."

79 María L. Vera, Walter R. Torres, Claudia I. Galli, Alexandre Chagnes & Victoria Flexer, Environmental impact of direct lithium extraction from brines, Nature Reviews Earth & Environment | Volume 4 | March 2023 | 149–165

80 Of course, good practice globally is that mine closures and rehabilitation should be a key part of any licensing agreement offered to companies, but this is heavily dependent on individual jurisdictions and governments.

81 'China's Frontier Construction Theory, Rukor, https://rukor.org/chinas-frontier-construction-theory/

THE SILENCING OF TIBETANS – THROUGH THEIR OWN MINERAL HERITAGE

Chinese investors are seldom concerned with the actual location of the hard rock lithium mines. What matters is that the mines belong to the PRC and can't be interdicted. Tibetans have no voice in this latest rush to riches. In Tibet, there can be no informed local consideration of whether there should be extraction, or whether extraction could finance much needed development, for example the rebuilding of local community schools China closed over the past decade to concentrate children in boarding schools, breaking families apart.

In Australia the extraction of mineral wealth is contested by environmentalists and by First Nations indigenous landscape owners.[82] In Tibet, not even moderate expression of disagreement is possible, let alone any form of advocacy. The securitisation that intensifies extraction from Tibet classifies any Tibetan voices of protest or those that differ from the Party state even in mild and moderate ways to be criminal.[83] In Tibet too there is no possibility of anything like the Africa Mining Vision,[84] which proposes a dignified future of selective mining and value adding that enables the poor to develop.

As in neighbouring Xinjiang, there is a strong case for recognising the extraction regime of critical minerals as conflict minerals, doubly debarred from G7 supply chains.

The profitability of lithium extraction may be as great a windfall as today's petro-state bonanza. Yet Tibetans in areas where lithium is found not only have no say in the matter, but their exclusion and disempowerment are enforced by the technological apparatus of the security state, with any slight or moderate deviations from Party state views tracked by algorithms. Surveillance camera and smartphone technologies to do so are powered by lithium batteries.

* This report was researched and authored by Gabriel Lafitte of https://rukor.org, with editorial input from the Turquoise Roof team.

82 https://www.nytimes.com/2020/06/11/world/australia/indigenous-caves-BHP-mining.html . Also see 'Global Lives of Extraction', Filipe Calvão, Matthew Archer and Asanda Benya, https://doi.org/10.4000/poldev.5959, International Development Policy, 15, 2023

83 https://www.hrw.org/report/2018/07/30/illegal-organizations/chinas-crackdown-tibetan-social-groups

84 https://au.int/en/ti/amv/about

TIBET: AN EXPLANATION OF TERMS

The term ‘Tibetan plateau’ refers to the vast elevated plateau that is historically, ethnically, and culturally Tibetan. Tibet traditionally comprised three main regions: Amdo (northeastern Tibet), Kham (eastern Tibet) and U-Tsang (central and western Tibet). The Tibet Autonomous Region (Chinese: Xizang zizhiqu) was established by the Chinese government in 1965 and covers the area west of the Yangtze River (Tibetan: Drichu), including part of Kham, although it is often referred to now as ‘central Tibet’ in English. The rest of Amdo and Kham have been incorporated into provinces of the PRC, and where Tibetan communities were said to have ‘compact inhabitancy’ in these provinces, they were designated as Tibetan Autonomous Prefectures and Tibetan Autonomous Counties. As a result, most of Qinghai and parts of Gansu, Sichuan and Yunnan Provinces are designated by the Chinese authorities as ‘Tibetan’. The term ‘Tibet’ in this report is used to refer to all of these Tibetan areas designated by the PRC as ‘autonomous’.

ABOUT TURQUOISE ROOF

Turquoise Roof is an emerging network of Tibetan researchers employing new methodologies using open and ‘non-traditional’ source material to track and reveal significant developments and create anticipatory threat models, through the development of a collaborative process involving both skilled trilingual Tibetan and other researchers - such as data scientists, tech experts, scholars, and journalists. The network aims to develop an interactive, collaborative mapping platform which would directly address the need to engage with complex and unpredictable developments in Tibet in the interests of the Tibetan people and their struggle to ensure the survival of their cultural and religious identity.


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