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The War Below: Lithium, Copper, and the Global Battle to Power Our Lives by Ernest Schyder, 384 pp, Atria/One Signal Publishers (2024), ₹1941

Somewhere in the Silver Peak Range in the United States (US) is Rhyolite Ridge. The region is characterised by an arid and dry environment, punctuated by sparse vegetation that adds to its rugged charm. It is home to a wildflower, Tiehm's buckwheat, in western Nevada. The area sits on 146 million tonnes of lithium, an extremely critical element imperative to push the current energy shift from fossil fuels and gases to electric vehicles (EVs), and thereby reduce emissions in the long run. However, mining the site to extract the white metal would destroy the species' original habitat. This dilemma sets the premise for Ernest Schyder's book titled "The War Below". The choice to make our future greener comes with a cost that seems to be as daunting as the future powered by fossil fuels.

The book describes how different groups, which have a stake in the fight against climate change, clash as their perspectives about the right way to defend the planet differ. Policymakers, inspired by the opportunities of electrification and conscious about the evolving global politics, are strategising global supply chains of products made with rare earth metals. Industrialists aim for higher profitability, often veiled by the intent of reducing global emissions. Environmentalists want to preserve the biodiversity and scenic landscapes. This has created a stalemate position for the sustainable extraction of crucial metals, which the author has described metaphorically as the 'War Below'.

When entrepreneurs talk about mining for future, they mean extracting metals utilised in modern technologies including compact magnets, electronics, batteries, and renewable energy systems. The author notes that this mining conundrum relates to lithium, copper, antimony, molybdenum, *etc*. Although these metals have been mined for centuries, their market demand has significantly increased since the Second World War, especially with the global shift towards electrification in response to climate change. With the majority of big players pledging their net zero targets, demand has further increased. More lithium extraction is needed to make batteries, and more

copper mining is required to bind the motors operating from these batteries. The growing economic, ecological, social, and political challenges associated with the process of extraction have been highlighted by Schyder through several instances, providing arguments from various stakeholders. The author does not take any side but presents them for the readers to decide.

The initial chapters of the book present cases where leading mining companies in the US are facing headwinds from indigenous populations and environmental activists about their operations. The administration is juggling between boosting the regional economy, preserving the environment, and claiming a more significant role in the production process to establish their nation's dominance in the supply chain**.**

Chapter 1 describes the situation prevailing at Rhyolite Ridge, where Ioneer Limited is struggling to find a way to extract lithium and boron. The challenge, as noted earlier, is to preserve Tiehm's buckwheat, which only grows on lithium-boron-rich soil and, importantly, only on that soil in the entire world. The Resolution Copper mining project in Arizona is dealing with a similar fate, as described in the next chapter. Unlike in Rhyolite Ridge, the threat in Arizona is to the entire land, considered sacred by the indigenous Apache population. For centuries, they have been seeking the blessings of deities they believe reside there. Using such examples, the author argues that even though climate change may become a drain on the future of humanity, humanity cannot sacrifice its present to mitigate it.

Chapter 3 discusses the efforts of Tiffany & Co., in collaboration with Earthworks, a non-governmental organisation, for the formation of mining standards known as the Initiative for Responsible Mining Assurance (IRMA). Although such standards are critical in maintaining transparency, a one-size-fits-all approach cannot work for all miners as regions have different geographies. Hence, good mining marked by standardisation is important, but this exercise too is dotted by challenges.

In Chapter 4, the author gives an example of a common household tool, the leaf blower, which runs on fuel with a 2-stroke engine leading to higher emissions. Modern companies are selling its electric variant to showcase their climate-friendliness. The batteries of this electric variant are assembled in Asia, with limited information outside the continent about the resourcing of the

inputs. Materials such as lithium and copper, used in the production of these batteries, are sourced from countries with poor environmental regulations, where the process of extraction is emission intensive. Additionally, these batteries are transported by ships which also contribute to the carbon emissions. This underscores the importance of value chain tracking to label any product as environment friendly. A failure to do so can lead to greenwashing.

Chapter 5 outlines the current state of Minnesota, US, where mining was the primary economic activity during the 20th century, earning it the moniker "the Iron Range." The opportunities for mining copper, nickel, and cobalt attracted Twin Metals, a Chilean company, to this region. Over the past two decades, changing government position towards mining has resulted in stagnation, with Twin Metals reducing its employee strength by half. Consequently, the economic opportunities in the nearby town of Ely have been negatively affected. While for some residents, mining offers better economic prospects, conservationists argue that such projects pose a threat to the Boundary Waters Canoe Area Wilderness. The exposure of sulphide ores to water can cause acid mine drainage (outflow of acidic water from metal mines), threatening the ecosystem of the Boundary Waters and potentially impacting the nearby Hudson Bay.

Rare-earth metals are a group of 17 elements in the periodic table with no known close substitutes. Similar to pepper added to a steak, these elements in small amounts hold high utility for the production of goods ranging from television, X-ray goggles, weaponry, fighter jets, and nuclear reactors to EVs**.** Chapter 6 starts with the relevance of these metals and describes the journey of MolyCrop, a leading firm in the evolution of the rare earth industry. The author discusses how countries are utilising their resources to enhance domestic industry of these elements, giving the examples of India and China**.** For instance, during the Second World War, India was the primary exporter of thorium to the US. To advance its domestic industries and nuclear energy plans, it restricted its exports of the metal. China is also diversifying its sources of rare-earth metals through its Belt and Road Initiative, further empowering its already advanced domestic processing industry.

Chapter 7 discusses the case of the Thacker Pass lithium mine and the leakage problem that it has posed. The process of extracting lithium from the mineral involves excessive exposure of the powdered ore to chemicals. If not

properly treated, these chemicals can leak into the environment. According to conservationists, the project can lead to the contamination of water and soil, which can pose a threat to the sage grouse, a bird native to the sagebrush steppe ecosystem in northern Nevada in the US.

The author notes that creating an open pit mine with its wastewater and sometimes radioactive dumps can be harsh for an untouched and ecologically fragile land, but mining in brownfield localities is equally challenging. Chapter 8 discusses Stibnite, one of the most historic mining districts in the US state of Idaho, which was known for its extraction of antimony and gold during the Second World War. After the closure of mining in this area, the entire economy of the region came to halt with residents shifting to other localities. Perpetua, another mining company, is offering to clean up the existing dump while providing economic opportunities for the region. However, further drilling in the pit can pose a threat to the survival of salmon, which holds economic and cultural significance for the natives. By discussing more of such micro-battles, in Chapters 9, 10 and 11, the author raises the question of drawing the line. A wildflower, an endangered species, a sacred land, and a picturesque landscape all shapes up our world, which EVs promise to preserve. It may not be wise to prioritise one over the other.

In Chapters 12 and 13, the author discusses alternative options for mining to provide inputs. Since more than 50 million tonnes of electronic waste is generated globally, the ability of rare earths to retain their properties after multiple cycles of use allows for recycling opportunities. The author gives the example of Apple's robot 'Daisy', which helps in the quick disaggregation of products and has become an efficient tool in recycling. However, he also notes that the company currently produces only 20 per cent of its products with recycled materials, with infrastructure and logistics being some of the constraints to increasing the use of such recycled materials. The lack of recycling centres results in a higher burden on shipping leading to 'thermal runaway' – the tendency of batteries to explode under short circuit, overcharge, or high-temperature exposure. The author rightly notes that more start-ups, such as Li-Cycle and Redwoods, are needed to streamline electronic waste recycling. Alternatively, cleaner technology for mining, such as DLE (Direct Lithium Extraction), which extracts metals from brine (hyper-saline water), looks promising.

Chapter 14 details such alternative cleaner technologies through the story of '*Salar de Uyuni'* in Bolivia, a country gifted with 19 billion tonnes of lithium resources. However, there are two challenges. The first relates to the policy environment and the remoteness of the site. The second challenge is that technologies, such as DLE have shown results only in the laboratory and are yet to be effectively adopted in the real world.

The author starts with the story of Tiehm's Buckwheat and stays with its essence throughout the book. In Chapter 15, the author details the turn of events that have led to the wildflower being included in the list of endangered species, dwindling the plans of Ioneer. After multiple revisions to its plan, Ioneer has been asked to submit a report providing evidence that their project will not eliminate the tiny flower, and they are expected to open the mining operation by 2024. However, the challenge of keeping Rhyolite Ridge as a paradise for the plant persists.

In conclusion, 'The War Below' lucidly portrays the prevailing challenges in the battle against climate change, while underscoring the importance of preserving the earth's ecology and landscape. The author's conversations with various stakeholders are enlightening and inspiring simultaneously, covering the mining challenges from all perspectives. Through micro-battles occurring across sites, Ernest Schyder reflects upon the war below, in which all of us have become willy-nilly stakeholders. However, unlike any other war, in this one, no one can emerge as a clear winner. Humanity has to live with the costs of its past actions that led to climate change, as well as those aimed at mitigating it.

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