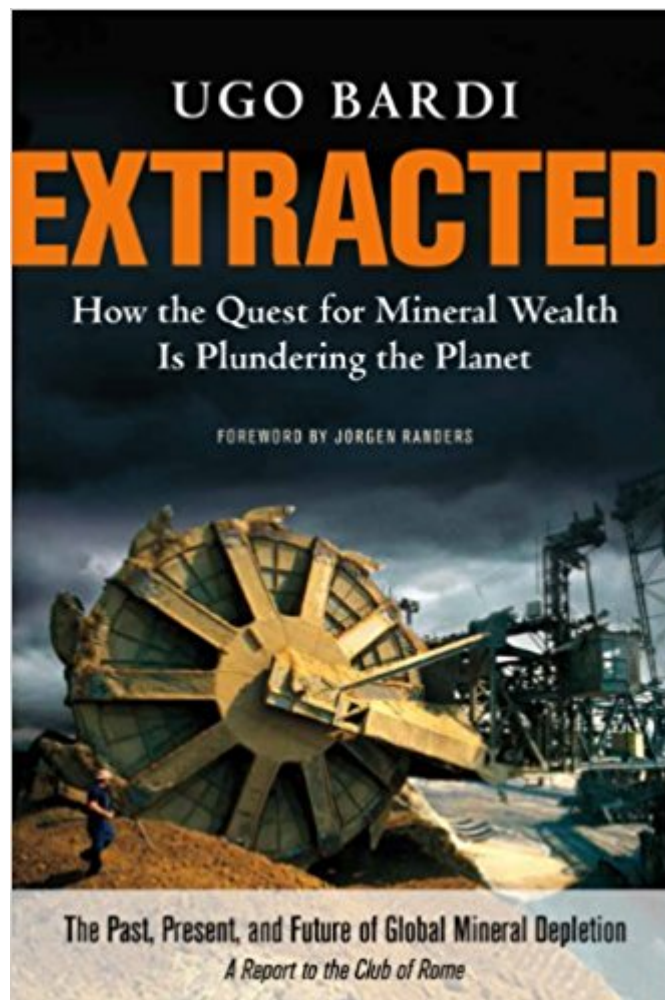




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# Extracted: How The Quest For Mineral Wealth Is Plundering The Planet



## Synopsis

As we dig, drill, and excavate to unearth the planet's mineral bounty, the resources we exploit from ores, veins, seams, and wells are gradually becoming exhausted. Mineral treasures that took millions, or even billions, of years to form are now being squandered in just centuries or sometimes just decades. Will there come a time when we actually run out of minerals? Debates already soar over how we are going to obtain energy without oil, coal, and gas. But what about the other mineral losses we face? Without metals, and semiconductors, how are we going to keep our industrial system running? Without mineral fertilizers and fuels, how are we going to produce the food we need? Ugo Bardi delivers a sweeping history of the mining industry, starting with its humble beginning when our early ancestors started digging underground to find the stones they needed for their tools. He traces the links between mineral riches and empires, wars, and civilizations, and shows how mining in its various forms came to be one of the largest global industries. He also illustrates how the gigantic mining machine is now starting to show signs of difficulties. The easy mineral resources, the least expensive to extract and process, have been mostly exploited and depleted. There are plenty of minerals left to extract, but at higher costs and with increasing difficulties. The effects of depletion take different forms and one may be the economic crisis that is gripping the world system. And depletion is not the only problem. Mining has a dark side—pollution—that takes many forms and delivers many consequences, including climate change. The world we have been accustomed to, so far, was based on cheap mineral resources and on the ability of the ecosystem to absorb pollution without generating damage to human beings. Both conditions are rapidly disappearing. Having thoroughly plundered planet Earth, we are entering a new world. Bardi draws upon the world's leading minerals experts to offer a compelling glimpse into that new world ahead.

## Book Information

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## Customer Reviews

Although mining the earth's crust for its amazingly versatile mineral resources has been going on for centuries, the damaging environmental side effects from our increasing demand for precious metals have become obvious only in the last few decades. Yet, according to Italian chemistry professor and ecological expert Bardi, who wrote this report for the Club of Rome, a global think tank devoted to addressing political and humanitarian concerns, worldwide mineral depletion not only impacts climate change but also strains the international economy and often harms the indigenous cultures where mining takes place. After taking readers through a tour of mineral mining's colorful history, Bardi explains the multistage process of bringing minerals to market, from extraction to refinement, before addressing mining's dark side, including reckless waste and child labor in Third World countries. With input from other mineral experts, Bardi also rebuts critics who argue that emerging technologies, like a universal mining machine, will be able to solve most of these problems. A skillfully written guide to a crucial, little-understood subject and an urgent wake-up call. --Carl Hays

“Although Ugo Bardi's fine book focuses on extraction, it also discusses geological formation of minerals and ores, mining, metallurgy, coinage of precious metals, debt, waste, pollution, climate change, and the dark side of mining. Interspersed are short digressions written by other experts on related topics ranging from soil fertility and plants as miners, to peak oil and coal, and the Hubbert depletion curve. The book is clearly written and insightful. Highly recommended!”--Herman Daly, author of *Ecological Economics*; a professor emeritus, School of Public Policy, University of Maryland

Booklist- "Although mining the earth's crust for its amazingly versatile mineral resources has been going on for centuries, the damaging environmental side effects from our increasing demand for precious metals have become obvious only in the last few decades. Yet, according to Italian chemistry professor and ecological expert Bardi, who wrote this report for the Club of Rome, a global think tank devoted to addressing political and humanitarian concerns, worldwide mineral depletion not only impacts climate change but strains the international economy and often harms the indigenous cultures where mining takes

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**Publishers Weekly**- "Our massive global mining infrastructure is showing signs of strain, writes Bardi (*The Limits of Growth Revisited*), University of Florence professor of chemistry, in this insightful if pessimistic description of the industry's history, operation, and future. All mined minerals including carbon (coal, oil, gas) are unrenewable resources whose supply is already dwindling. Sadly, as with global warming, there are skeptics and denialists who insist that (a) it's not true, and (b) technology will fix matters. These same opponents state, correctly, that we have extracted a minuscule fraction of the oil, iron, or even gold in the earth's crust. But they ignore that, as ore quality diminishes and extracting becomes harder, the price rises. For example, platinum (essential in catalytic converters), silver, and oil cost four times more than in the year 2000. They also assume that technology will produce a 'universal mining machine,' which will consume ordinary rock, extracting whatever is valuable. Although theoretically possible, such a machine would require immense amounts of energy and leave behind unthinkable quantities of waste. Bardi concludes that things must change, and though his is not an encouraging book, readers will appreciate his intelligent, lucid, and disturbing account of our mishandling of mineral resources.

**"Ugo Bardi's book is an effective piece of work for stimulating thought and a debate on this planet's mineral wealth, and how we should view this issue within the framework of sustainability. The book goes into the history of how human society has used minerals, their relationship with the evolution of human civilization, and how we should use these resources in the future. There is a wealth of information in this volume that deals with important minerals like uranium, lithium, rare earths, copper, nickel, zinc, phosphorous, and others. Readers would find the material presented very informative and a valuable basis for discussions on minerals policy."**

**--Rajendra K. Pachauri, chairman, UN Intergovernmental Panel on Climate Change; CEO, The Energy and Resources Institute**"Most decisionmakers and citizens view money as the primary driver of our societies. Yet our civilization is first dependent on extraction of natural capital—minerals, ores, and particularly energy—that are the precursors for everything in our economies. Ugo Bardi and guest authors provide an excellent overview on the history, significance, and future of minerals and energy

and how this relates to our human ecosystem. Wide boundary thinking at its best."--Nate Hagens, former editor, *The Oil Drum*; former vice-president, Solomon Brothers and Lehman Brothers "The world economy is now phenomenally large in comparison with the planetary base that is the setting for all economic activity. Natural resources are becoming increasingly scarce, and the planet's sinks for absorbing waste products are already exhausted in many contexts. In *Extracted*, Ugo Bardi tells the story of our planetary plunder from its beginnings up through the present. He tells it with verve and insight, and he offers a powerful perspective on what the implications are for the future. This newest report from the Club of Rome demands our serious attention."--James Gustave Speth, author of *America the Possible: Manifesto for a New Economy* and former dean, Yale School of Forestry and Environmental Studies "Here is the book many of us in the sustainability world have been looking forward to: a comprehensive, readable, historically informed inquiry into the depletion of Earth's mineral resources. *Extracted* should be on the reading list of every introductory class in economics as well as environmental studies, geology, history, political science . . . heck, everybody should read it."--Richard Heinberg, senior fellow, Post Carbon Institute; author, *The End of Growth*

This is a very well written and readable introduction to minerals, especially energy, from ancient times to the present, and the role they play in the rise and fall of civilizations, such as Rome and today's fossil fuel propelled society . Of course, this becomes somewhat speculative as we hit the limits to growth of today's globalized industry. But the point of the book is to help us identify solid boundaries for that speculation -- how and when might we be affected on limits to copper, uranium, lithium, coal, or oil, among many others? As it turns out, energy is the fundamental limit to growth. That is, with enough cheap energy we could extract or even manufacture all the needed minerals by one means or another. But with the end of cheap fossil fuel energy we are in deep trouble. This book could be read as an engaging and informative text, or as a prophetic warning, or both, by one the great public-intellectual scientists of our era. Technically it is a report to the Club of Rome, which sponsored the original Limits to Growth studies of the early 1970s. Indeed Professor Bardi published a spirited defense of those studies in *The Limits to Growth Revisited* (2011), and the current book includes a brief overview of models for cycles of production and their culmination in a "system dynamics" model. It is unfortunate that even today very few economists understand system dynamics, even though the limits-to-growth scenarios are the best macroeconomics ever done in my judgment. Bardi reproduces the "business-as-usual scenario on p. 169, which

suggests rapid industrial decline beginning in the coming decade unless we become much better adapted to the reality of “de-growth”. In the latter case, one of the more forgiving scenarios is possible, but it would mean a strong pulling back from fossil fuels, indeed from traditional economic growth itself. In any case, the recent slowdown of global economic growth is the direct consequence of “peak oil” for conventional oil in 2005, and this book shows that a number of other critical “peaks” will compound the end of cheap oil over the coming decades. Although Bardi foresees “a mighty hangover once the party is over” (p. 244), he still holds out hope that we won’t revert completely to an old fashioned agrarian society. In particular he thinks that a basic electrical infrastructure could be created using minerals that are fairly abundant, if properly reused and recycled. But will electricity from renewable sources really be up to the heavy duty energy requirements of mining, transporting, and processing low grade ores? Perhaps, Bardi suggests, if our mineral requirements are drastically reduced. But what level of world population could be fed by a radically used global economy? That’s the big question that Bardi does not address directly, though he notes that depletion of phosphorus will force the decline of industrial agriculture after a few more decades. He also notes that it took the land a few centuries to recover from the ravages of the Roman empire, with the implication that it might take much longer for the earth to recover from the far greater ravages of today.

As a laymen approaching this work with a healthy degree of skepticism because of decades worth of “An Ice Age is coming” to “Global warming will kill us all” to “Climate change will . . . unleash change,” I found myself not only mildly converted to the Doom Camp but impressed by Bardi’s balanced delivery of a topic that has sadly become politicized. Nearly the first half of the book is a detailed history of man’s use of minerals, his progression through increasingly more advanced mining methods, and his adoption of money to facilitate trade. Not only is this intro to man and minerals (Gaia’s gifts) useful for understanding how brief this period has been in geologic time and how quickly we’ve managed to take the exploitation of these minerals to new extremes, it’s a great primer on human history for any reader mildly interested in history but sick of watching documentaries about Hitler on the History Channel. From there Bardi progresses to an explanation of various modeling systems put forth by scholars in the field and their associated bell curves, demonstrating just how close we are to the end of easily extracted minerals and oil. The reader is treated to many streams

of thought as to why one might believe or choose not to believe there's trouble coming. In that way, Bardi is very diplomatic and clearly understands the arguments of the skeptics, making his case come across as rational and serious. The final third of the book goes into the damage we've done in the mining and drilling industries and explores several possible solutions to the end of economically attainable oil and the mineral supply that is coming, it's just a matter of when. Bardi doesn't seem to have a whole lot of faith in the competing sources of energy that may serve us instead of oil, but does hold out some hope for solar power, provided it can be improved upon and produced more cheaply as technology advances. I thoroughly enjoyed this book and was pleased to discover that reading the whole thing over three days wasn't the chore I thought it would be. As far as complaints, I didn't care for the numerous addenda littering the flow of my reading. Aside from that I only wish he had explored robotics. I don't recall a single mention of this variable that is here now and was on the horizon in 2014, when this book was last printed. The advent of autonomous vehicles is upon us and, if these are battery powered vehicles, and if the owners of these vehicles can put their wheels to work in an Uber sort of way while they are at work at their offices - picking up fares and paying for themselves - many will elect to forgo the ownership of a private vehicle and, it's fair to surmise, this will greatly decrease our consumption of oil. In addition, while Bardi seemed somewhat skeptical about mining landfills for discarded minerals due to the dangers posed to men and women driven to that kind of work, it's likely robots can mine landfills better, faster, and without a care for bacteria and God knows what else one might find in a landfill. Automation will have a profound impact on the world, putting many out of work. Whether this turns out to be a good thing or bad thing remains to be seen but it is a topic he should address in any future editions of *Extracted*.

Given the author's stated purpose for the book, one of its virtues is its conciseness. The book recounts humanity's 10,000 year journey through its extraction and use of (mainly) non-renewable resources. Besides the story line, which describes the increasing ordeal of the slow, irreversible exhaustion of many of the staple minerals of our civilization, the book contains very informative sections contributed by authors who are experts in the specific subject of the contribution. These contributions cover a variety of commodities, providing an assessment of the present state of supply and uses of, among others, copper, aluminum and rare earths. The book closes with a general outlook on optional courses in the future that present alternatives to the "business as usual" headlong run followed at the present by the global commodities markets. Although the author

attempts to avoid falling into despairing diagnoses, he clearly leaves the message that there is rough weather ahead before humanity at large turns the ship into the uncharted waters of new ways of consumption and happiness.

We take, we take, we take. We don't stop to think about the giant holes and toxic consequences for and in our planet to satisfy our need for trinkets-- and far more important needs as well. So figure out what you can buy secondhand (jewelry, for example) and save those holes for the stuff we have to have for a more just and civil society. And let's think about WHERE we do the extraction too-- where water is most precious (e.g. Baja California) let us mine when we have exhausted all other sources. Baja's water and landscapes are economic drivers without those giant holes and toxic consequences-- and they are why we go there.

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