



Book Uranium

War, Energy and the Rock That Shaped the World

Tom Zoellner
Viking, 2009
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Recommendation

This is a great story about a very special rock which was formed millions of years ago, and continues to breed a deadly form of energy. Tom Zoellner’s factual book about uranium reads like a gripping novel. He breathes vigorous life into a saga that could have been a dry political and geological tale. His beautifully crafted story puts uranium into its complex context as a key protagonist on the world stage. Zoellner’s reporting ranges from the Congo to Nazi Germany to the war in Iraq, with vivid information at every turn. *BooksInShort* found this meticulously researched book exceptionally interesting, and recommends it to anyone interested in discovering how society entered the atomic age and how it is muddling through.

Take-Aways

- Uranium holds huge danger as a source of the apocalypse and great promise as a source of clean energy. One ton can produce as much power as 20,000 tons of coal.
- Uranium breaks down into radium, radon and plutonium. It is common and lethal.
- The U.S. spent \$2 billion on the Manhattan Project, which built the WWII atomic bomb. President Harry Truman called it the “greatest scientific gamble in history.”
- The core element in the Hiroshima atomic bomb was uranium’s most powerful, heavily concentrated form: enriched U-235.
- Making U-235 is an immense job, but a small piece in a bomb can vaporize a city.
- The amount of plutonium that flashed into energy in the Nagasaki bomb was about one-third the weight of a penny and killed more than 40,000 people, ending WWII.
- By the mid-1960s, during the Cold War, the U.S. had 30,000 nuclear warheads.
- Much of the former U.S.S.R.’s nuclear material is not catalogued, and the material that is identified and stored is badly secured.
- Today, about 40% of the world’s known uranium is in Australia. The largest single uranium mine is in Niger.
- Inhaled in a closed space, like a mine, uranium enters the lungs, causing cancer.

Summary

Natural Danger

Uranium, the core element in the atomic bomb, is most powerful in the form of enriched U-235 – heavily concentrated uranium ore. At a 20% concentration, U-235 can create a spontaneous explosion due to its unstable molecular composition and its atomic inclination to divide with so much force that, in specific circumstances, a

concentrated baseball of U-235 could vaporize a city. Uranium is the heaviest element. Its nucleus has 92 protons and the atomic threads that hold it together are more fragile than anything else in nature. Uranium is so unstable that it constantly whirls off two protons and two neutrons – the act that registers as radioactivity. It is always “disintegrating,” always losing atoms, but its fissile energy remains potent for about 700 million years. Yet, like the other elements, uranium is a natural substance, “more common than tin, and nearly 500 times more abundant than gold.” The Romans used it to tint stained glass and southwest American Indians employed it for art and body paint. Yet, uranium is extremely dangerous. People must heavily protect themselves from breathing uranium or being exposed to it. The fast-moving particles penetrate the skin and kill healthy cells, causing cancer and reorganizing genetic material. As it disintegrates, uranium decays into: radium, radon-222 (the heaviest known gas), polonium-218 and, finally, lead 214. The “radon daughter” elements are radioactive particles with half-lives ranging from a few minutes to less than a second. These odorless, tasteless gases embed in porous surfaces and readily seep into the atmosphere. In the open, these gases are hardly dangerous, but if inhaled inside a closed space, like a mine, they leave radioactive particles in the lungs, bombarding adjoining tissues, mutating cells and, in 15 years or so, causing cancer.

Uranium Mining

The U.S. acquired the uranium for the two bombs dropped on Japan ending World War II from the Belgium-owned Shinkolobwe mine in the Congo. In the 1870s, Belgium’s King Leopold II, represented by explorer Henry Morton Stanley, claimed the territory that later included the mine. Stanley named it the Congo Free State and, under Leopold’s rule, it became a giant forced-labor camp where native people collected ivory and lumber, and harvested rubber sap under brutal conditions. In 1909, Leopold died a billionaire. He never visited the Congo, where Belgium’s giant mining company, Union Minière du Hant Katanga, discovered copper, bismuth, cobalt, tin, zinc and radium. At the time, uranium was a “trash rock,” a worthless byproduct of radium. The Shinkolobwe mine opened in 1915, exploiting radium when it was “the most valuable substance on earth.” A gram could sell for \$175,000, some 30,000 times the price of gold, but the frequently injured, heavily abused miners were “paid the equivalent of 20 cents a day to break rocks and push carts...a version of debt slavery.”

The Manhattan Project: “The Greatest Scientific Gamble in History”

On October 11, 1939, an intermediary handed President Franklin D. Roosevelt a letter authorized by Albert Einstein. It cited recent work on nuclear chain reactions, outlined the possibility of a powerful bomb and drew the president’s attention to the U.S.’s inadequate uranium supplies. FDR set up the first Uranium Committee, but funded it scantily. The effort languished until data from England – where research was outpacing U.S. efforts – put “the uranium question” into the hands of Vannevar Bush, head of the U.S. Office of Scientific Research and Development. Given now urgent authorization, he set up the top-secret Manhattan Project, which – under the administration of a logistical and organizational genius, Col. Leslie Groves – resulted in the invention of the atomic bomb.

“In this rock, we can see the best and the worst of mankind: the capacity for scientific progress and political genius; the capacity for nihilism, exploitation and terror.”

In 1940, Union Minière official Edgar Sengier – anticipating the Nazi invasion of Belgium – moved to New York and reopened the company as the African Metals Corporation. He shipped Shinkolobwe’s 1,250-ton uranium ore stockpile to the U.S. in barrels, and stored it in a vegetable oil warehouse in Staten Island. He tried to sell it to the U.S. government, which proved more interested in cobalt at the time. Then, in September 1942, Sengier received a guest: U.S. Army Lt. Colonel Kenneth D. Nichols, an administrator at the new Manhattan Project. Nichols asked the mine official about Shinkolobwe’s uranium. “I have been waiting for your visit,” Sengier said.

“Man’s most carnal tendencies are inflamed by the most modern of elements, uranium.”

Nichols purchased the uranium ore stored on Staten Island, plus all Shinkolobwe still had and, later, all it could produce after hard negotiations and onsite help from the Army Corps of Engineers. Two-thirds of the uranium in the bomb dropped on Hiroshima and “much of the plutonium” in the Nagasaki bomb came from Shinkolobwe. The U.S. then tried and failed to tie up the world’s uranium ore supply. (Nearly tapped out, Shinkolobwe was closed in 1960 when unrest persuaded Belgium to grant the Congo’s independence. Fearing that the “lethal substance would fall into the wrong hands,” the mine’s managers sealed it with concrete on their way out of the country.)

“A fearsome animal was caged in this exotic metal, hot as the sun.”

Extensive testing throughout the early 1940s proved the physics of the proposed atomic bomb’s nuclear reaction, so manufacturing began on the actual “gadget,” as the Army called it in code. The mechanics were straightforward. Construction was based on sliding an enriched, measured uranium pellet through a chute at a precise speed and then through a block of uranium. This triggered a shower of neutrons, setting off a chain reaction. This basic principle was used in the first atomic bomb, “Little Boy,” dropped on Hiroshima. A radar unit triggered a cordite explosive device, shooting an enriched uranium plug through a steel tube at 684 miles per hour. It passed a series of uranium rings and unleashed the neutrons that would trigger the reaction, which took 141 pounds of enriched uranium. The bomb was not tested before it was dropped; scientists were confident it would work and the U.S. did not have uranium to spare for a test. In a radio address announcing the first atomic bomb, President Harry Truman said, “We have spent two billion dollars on the greatest scientific gamble in history. We won.”

“Physicist Leo Szilard realized that...in certain circumstances it might be possible to set up a nuclear chain reaction, liberate energy on an industrial scale and construct atomic bombs.”

Less than three days after the Hiroshima explosion, the U.S. dropped a plutonium bomb on Nagasaki. The amount “of material inside the bomb that actually flashed into energy was but one gram,” about one-third the weight of a Lincoln penny. It killed more than 40,000 people in seconds. The two bombings ended World War II. They also stunned the world, created a new awareness of the apocalypse, and unleashed a continuing scientific and political debate with enormous ramifications for world events.

The Cold War

The end of WWII ushered in the arms race and the atomic age. The U.S. and U.S.S.R. raced to find and extract new sources of uranium. The U.S. focused on its southwest region, and opened one of its largest mines near Moab, Utah. To encourage prospecting, the new Atomic Energy Commission offered cash, maps and gear

to would-be explorers. To keep the U.S. from being the sole owner of the atomic bomb, the Soviets used forced labor in Siberia, the Urals and East Germany to work in uranium mines at Wismut, St. Joachimsthal and Schlema. Wismut miners worked 12-hour shifts in knee-deep water, without ventilation or real protection from radiation. Reports estimated that one in seven of the 150,000 miners there “end up dead, sick or hurt.”

“There was that year-long wait after Einstein’s letter – but now a \$2 billion assembly line...was humming at warp speed.”

By 1955, the U.S. was in the midst of uranium mania. Board games, movies and penny-stock schemes made the hunt for the mineral into both a patriotic duty and a business. Yet, the authorities, for the most part, did not tell people about the cancer dangers of uranium and its by-products because it would interfere with private mining. One of the groups hardest hit by radiation’s effects were the Native American Navajos, who lived and mined in the uranium-rich areas. By the mid-’60s, the U.S. had stockpiled upward of 30,000 strategic nuclear warheads and U.S. uranium exploration came to a close.

Modern Marvels

Today, about 40% of the world’s known uranium is buried in Australia, which has no working nuclear reactors. Uranium was first discovered at Mount Brockman in northern Australia in 1969. Today, the mine produces 8% of the world’s uranium. This discovery triggered an emotional response as Aboriginal tribes, conservationists, mine operators, the government and environmentalists all argued about whether to mine the pitchblende ore and how to protect Aboriginal ancestral claims to the mountain as a spiritual site. By 1977, Australia forged a delicate political solution and designated a vast area surrounding the working uranium mine as Kakadu National Park. Australia exported uranium only to existing nuclear nations: the then-U.S.S.R., France, England, the U.S. and China. The largest single piece of pitchblende ever found, one ton, came from northern Australia.

“Apprehension and confusion were widespread – a remarkable mood for a nation on the verge of winning a major war.”

However, the world’s largest uranium mine, Akouta, is in Saharan Niger. It has been producing uranium for almost 30 years. The mine’s yellowcake powder is Niger’s largest export; the second is onions. France, the main buyer of Niger’s uranium, processes it into pellets for nuclear plants. Niger has not benefited from uranium mining. The U.N. ranks it as “the most deprived country on earth,” with a near 75% illiteracy rate and a 45-year average life span. French mining companies pay only 5.5% of their revenues in taxes to Niger’s government, and much of that goes to the political elite. This income disparity is part of the “resource curse,” as economists term the way nations fail to benefit financially from selling their resources. Often, the exploitation of natural resources may breed corruption and actually make a poor nation poorer. Blustering, Niger’s President Seyni Kountché once said, “We will sell uranium even to the devil if we have to.”

“For the religious and secular alike, uranium had become the mineral of apocalypse.”

Niger’s uranium played a crucial role in the U.S. decision to invade Iraq. In 2002, an Italian who claimed to have intelligence sources sold a communiqué allegedly signed by Niger’s president offering to sell Iraq 500 tons of pure uranium annually. The claim eventually reached U.S. intelligence just as President George W. Bush was building a case for invading Iraq. Despite skeptics in the State Department and the CIA who said that Iraq could not process ore into a weapon, Bush noted Iraq’s alleged effort to buy uranium from Niger in his 2003 State of the Union speech.

“Every time you turn on the lights in America, there is a one in ten chance that the power is coming from an old Soviet warhead.”

The amount of uranium Bush claimed Iraq wanted was one-quarter of Niger’s annual output. The director of Niger’s mining company said any large diversion of the ore to Iraq was impossible. It would have alarmed mining officials in Paris, and would have required a conspiracy involving hundreds of people. Retired U.S. diplomat, Joseph Wilson, went to Niger and agreed. After the war started, he publicly discredited the Niger uranium hoax. The White House tried to undermine him, even revealing that his wife, Valerie Plame, was an undercover CIA agent.

“A common joke among nuclear policy analysts is that the best way to move an atomic bomb across a national border is to hide it inside a truckload of marijuana. In other words, smuggling routes used by average criminals provide good cover for the occasional piece of nuclear merchandise.”

The International Atomic Energy Agency (IAEA) in Vienna traces stolen uranium in any form. With a small budget, it must maintain a database on traffic in illicit uranium and its by-products. Since 1993, thieves have taken 16 cases of plutonium and uranium, including the processed material for making a bomb. The IAEA, lacking any investigative staff, relies on voluntary reports from member nations, which often come years after incidents occur. The IAEA estimates that 80 to 85% of uranium smuggling remains undetected. During Boris Yeltsin’s presidency, the U.S.S.R. had 735 to 1,365 tons of enriched uranium. When his political situation deteriorated, the U.S. bought a disposal site in Siberia to control some nuclear material. Today, Russian facilities are known for shoddy security.

Rediscovering Uranium

Since nuclear plants do not pollute, nuclear power has seen a popular resurgence. A single ton of uranium produces as much power as 20,000 tons of coal. This helps explain why countries across the globe are now planning to build a total of 200 new nuclear power plants. The nuclear energy industry received about \$13 billion in aid and tax relief from the Bush administration. Some environmentalists endorse it as a source of clean, green energy, while others deeply oppose it. Even hedge funds have bought yellowcake. Prospectors have returned to the hills and deserts in Arizona, New Mexico and Mongolia though few claims ever become working mines. Despite uranium’s value and potency, neither the U.S. nor Russia have an exact count on how much they have enriched since WWII. The U.S. lacks an accurate audit since it did not have centralized recordkeeping among its various processing plants and military branches. The Russians suffered poor bookkeeping and production irregularities. One estimate said Russia cannot account for some 600 tons of enriched uranium, enough for 8,000 Hiroshima-sized warheads.

About the Author

Tom Zoellner wrote *The Heartless Stone: A Journey Through the World of Diamonds, Deceit, and Desire*, an American Library Association “Notable Book,” and he co-authored *An Ordinary Man*. He is a former *Men’s Health* contributing editor and *San Francisco Chronicle* reporter.

