

Slate Deposits in the Intermountain West

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Jefferson School of Mines

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For all of those who perished in
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the Facility, MELTR3, MO4, and
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"If you are looking for slate, this book is useless. Don't even read it. Just throw it away."
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Dr. J. Marvin Blackweather

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Prelude

The Intermountain West, a vast expanse of rugged terrain stretching from the Rockies to the Great Basin, holds geological treasures that have long intrigued both scientists and industry professionals. Among its most notable resources are the extensive slate deposits that lie beneath the surface, remnants of a time when ancient seas and tectonic forces shaped the region into what it is today. In this chapter, we will explore the origins, geological significance, and economic impact of these slate deposits. We will begin with a historical overview, tracing early mining activities and the first geological surveys of the 19th century, before delving into the geological processes that led to their formation.

The discovery of slate in the Intermountain West dates back to the mid-1800s, during the westward expansion of settlers seeking resources to build and sustain new communities. Early pioneers noticed the fine-grained, durable rock ideal for roofing,

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paving, and even school chalkboards. However, it wasn't until 1872, with the establishment of the United States Geological Survey (USGS), that formal investigations began into the scope and quality of these deposits.

Mining towns like Alta, Utah, and Leadville, Colorado, became hotspots for slate extraction. While overshadowed by the more lucrative silver and gold booms, the slate industry played a critical supporting role in regional development. Quarry workers carved slabs from the earth by hand, relying on skill and precision to avoid waste. By the early 20th century, technological advancements introduced mechanized cutting, boosting production and expanding the market for slate products nationwide.

The slate deposits of the Intermountain West owe their existence to the convergence of unique geological factors. Millions of years ago, the region was covered by shallow seas that deposited fine-grained sediments rich in clay minerals. Over time, these sediments were buried

under successive layers of rock and subjected to intense heat and pressure during orogenic events—the mountain-building processes that shaped the Rocky Mountains and surrounding ranges.

This metamorphic transformation converted the clay-rich sediments into dense, foliated slate. The cleavability, a defining characteristic of slate, resulted from the alignment of platy minerals such as mica and chlorite under directed pressure. The specific mineral composition and metamorphic grade vary across the region, creating slates of differing colors, hardness, and durability.

Today, slate continues to be a vital resource for the construction industry. Its aesthetic appeal and longevity have made it a popular choice for roofing, flooring, and landscaping. In particular, the rich hues of green, purple, and gray found in Intermountain West slates are highly sought after for architectural projects that emphasize natural beauty and sustainability.

In recent years, renewed interest in sustainable building practices has reignited demand for natural stone materials. Slate's durability and low maintenance requirements have made it an attractive option for eco-conscious builders. Moreover, local governments and heritage organizations have increasingly advocated for the use of regional slate in historical preservation projects, further stimulating the industry.

The slate deposits of the Intermountain West are more than just geological curiosities—they are living testaments to the region's dynamic natural history and enduring economic significance. In the chapters that follow, we will examine specific deposit sites, mining techniques, and case studies of communities that have thrived, and sometimes struggled, alongside this versatile resource.

As we embark on this exploration, it is essential to remember that these slates are not just rocks buried in the earth but keys to understanding the geological past and shaping the architectural future of the Intermountain West.

Chapter 1

The Geology of Slate Formation

Understanding the geology behind slate formation in the Intermountain West requires a deep dive into the complex processes that transformed ancient seabeds into the finely cleaved stone that now defines the region's landscape. This chapter will examine the region's tectonic history, the metamorphic processes that created its distinctive slates, and the mineral composition that gives each deposit its unique characteristics.

The Intermountain West's geological story began over 500 million years ago, during the Paleozoic Era, when much of the region lay beneath a shallow inland sea. Layers of fine-grained sediments, predominantly clay and silt, were deposited over millions of years, accumulating to form thick sedimentary sequences. These initial layers served as the foundation for the slate deposits we observe today.

The region's tectonic activity escalated during the late Mesozoic and early Cenozoic eras, driven by the subduction of the Farallon Plate

beneath the North American Plate. This tectonic collision initiated the Sevier and Laramide orogenies—two significant mountain-building events that uplifted the Rockies and surrounding ranges. As these forces compressed the sedimentary layers, the intense pressure and heat triggered metamorphism, transforming the clay-rich sediments into slate.

The process of metamorphism, essential for slate formation, involves two key factors: pressure and temperature. In the Intermountain West, these forces were amplified by the region's tectonic upheavals, leading to the formation of low- to medium-grade metamorphic rocks.

Under immense pressure, clay minerals within the sedimentary layers began to realign perpendicularly to the direction of stress. This alignment formed the characteristic slaty cleavage, allowing the rock to split into thin, parallel sheets. Unlike fissile shale, slate exhibits a much finer cleavage due to the recrystallization of clay minerals into microscopic mica and chlorite.

Heat played a secondary but critical role in this transformation. Temperatures between 200°C and 400°C were common during the metamorphic phase, sufficient to facilitate mineral growth without causing extensive recrystallization into higher-grade rocks like schist or gneiss. The precise temperature and duration of metamorphism contributed to the variety of textures and colors found across different slate deposits.

The mineral composition of slates in the Intermountain West varies depending on the original sedimentary material and the degree of metamorphism. While quartz, mica, and chlorite dominate most formations, other minerals such as feldspar, pyrite, and graphite also play significant roles in determining the slate's physical and aesthetic properties.

Common Minerals

Quartz: Imparts strength and durability, making the slate highly resistant to weathering.

Mica: Responsible for the rock's sheen and cleavability, especially in muscovite and biotite varieties.

Chlorite: Adds a greenish hue and is common in lower-grade slates.

Color Variations

Slate colors in the Intermountain West range from deep purples and greens to soft grays and blacks. These variations are largely influenced by trace mineral content:

Iron oxides: Contribute red, brown, and purple tones.

Carbonaceous material: Creates darker shades, such as black and gray.

Calcium and magnesium: Present in slates with lighter tones, giving rise to green and bluish hues.

The Intermountain West is home to several notable slate-producing regions, each with distinct geological characteristics:

Central Utah: Known for its green and gray slates, formed during the early phases of the Sevier Orogeny.

Western Colorado: Contains deep purple and black slates with a high mica content, indicative of intense metamorphic conditions.

Southern Idaho: Features fine-grained, lighter-colored slates, influenced by lower-grade metamorphism and proximity to limestone deposits.

Each of these regions represents a unique intersection of geological history and mineral composition, contributing to the diverse slate landscape of the Intermountain West.

The slate deposits of the Intermountain West are products of millions of years of geological evolution. Their formation was shaped by a delicate balance of sedimentation, tectonic activity, and metamorphism. Understanding these processes is

essential for appreciating the region's rich geological heritage and for advancing modern applications of slate in construction and design.

In the next chapter, we will explore the methods used to survey and map these deposits, highlighting the technologies and techniques that have evolved over time to uncover the full potential of this remarkable resource.

Chapter 2

Surveying and Mapping Slate Deposits

The vast expanse of the Intermountain West presents both a challenge and an opportunity for geologists seeking to locate and map its slate deposits. From early hand-drawn field maps to advanced modern geospatial technologies, the methods used to survey and chart these deposits have evolved significantly over the past century. This chapter will explore the historical progression of slate surveying techniques, the tools and technologies used today, and the challenges unique to the region's diverse terrain.

The Pioneering Era (Late 1800s – Early 1900s)

In the late 19th and early 20th centuries, geological surveys in the Intermountain West relied on rudimentary tools such as compasses, topographic maps, and measuring chains. Early geologists would traverse rugged terrain on foot or horseback, often sketching rough maps based on

landmarks and visual estimates. These early surveys were labor-intensive, but they laid the groundwork for future exploration.

One of the earliest recorded slate surveys in the region was conducted in 1895 by the U.S. Geological Survey (USGS), which focused on the western slopes of the Rockies. This expedition identified significant slate deposits near present-day Leadville, Colorado, marking the beginning of commercial interest in the region.

Advancements in the Mid-20th Century

By the mid-1900s, technological advancements such as aerial photography and early forms of geophysical analysis improved the accuracy of slate mapping. Aerial surveys allowed geologists to cover larger areas more efficiently, identifying surface features indicative of slate deposits, such as exposed rock outcrops and fault lines.

In addition, the development of portable drilling rigs enabled core sampling, allowing geologists to

examine subsurface slate layers without extensive excavation. Core samples provided critical data on the thickness, quality, and mineral composition of deposits, making exploration more precise and cost-effective.

With the advent of digital technology and geospatial science, slate surveying in the Intermountain West has entered a new era. Modern tools enable geologists to map deposits with unparalleled accuracy and detail, significantly reducing the time and effort required for exploration.

GIS technology has revolutionized the way slate deposits are mapped and analyzed. By integrating various data layers—such as topography, geology, hydrology, and vegetation—GIS allows geologists to create detailed, interactive maps of potential slate-bearing regions.

For example, a GIS-based analysis might combine satellite imagery with geological survey data to pinpoint areas where metamorphic rocks are likely to be found. This not only

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streamlines the exploration process but also helps mining companies make informed decisions about where to focus their efforts.

Remote sensing technologies, including multispectral and hyperspectral imaging, are now widely used to identify slate deposits from space. These techniques analyze the reflectance properties of surface materials, distinguishing slate from other rock types based on their unique spectral signatures.

Hyperspectral sensors mounted on satellites or drones can detect subtle variations in mineral composition, allowing geologists to assess the quality of slate deposits without setting foot on the ground. This is particularly useful in remote or inaccessible areas of the Intermountain West, where traditional fieldwork may be impractical.

Ground-penetrating radar (GPR) and seismic surveys provide valuable insights into subsurface geology. GPR uses electromagnetic waves to detect changes in rock density, revealing the

depth and structure of slate formations. Seismic surveys, on the other hand, use sound waves to map underground layers, offering a detailed picture of the deposit's size and orientation.

These non-invasive methods have become essential tools for modern slate exploration, minimizing environmental disruption while maximizing data collection.

Despite advancements in technology, surveying and mapping slate deposits in the Intermountain West remain challenging due to several factors:

Rugged Terrain:

The region's mountainous and uneven landscape complicates both ground-based and aerial surveys. Accessing remote areas often requires specialized equipment and transportation, increasing costs and logistical complexity.

Climate Extremes:

Harsh weather conditions, including heavy snowfall in winter and scorching heat in summer, can impede fieldwork and damage sensitive equipment.

Variability of Deposits:

Slate formations are often interspersed with other metamorphic rocks, making it difficult to distinguish high-quality slate from surrounding material. This variability necessitates thorough sampling and analysis to ensure accurate mapping.

Surveying and mapping slate deposits in the Intermountain West have come a long way since the early days of hand-drawn maps and rudimentary tools. Today, a combination of traditional field methods and cutting-edge technologies allows geologists to explore the region's vast slate resources with greater precision and efficiency.

Chapter 3

Slate Futures and the Colorado Slate Exchange (CSE): The Rocky Road of a New Commodity

The rise of slate futures trading has taken the financial world by storm, with the Colorado Slate Exchange (CSE) emerging as the premier marketplace for this unconventional commodity. Once considered an overlooked geological resource, slate has surged in global demand due to its versatility in construction, renewable energy, and high-tech manufacturing. The CSE now serves as a hub for institutional and retail investors alike, facilitating the buying and selling of contracts tied to future slate prices.

The Mechanics of Slate Futures Trading

At its core, slate futures trading is similar to other commodity futures markets. Investors enter contracts agreeing to buy or sell a specific quantity of slate at a predetermined price on a future date. These contracts allow companies reliant on slate—such as roofing manufacturers, energy firms utilizing slate in battery storage, and high-end flooring providers—to hedge against price fluctuations.

However, unlike traditional commodities such as oil or gold, slate futures are marked by intense volatility. Supply constraints from mining operations, fluctuating demand from green energy sectors, and geopolitical risks in slate-rich regions can send prices soaring or plummeting within days.

Historically, slate futures were dominated by large institutional players—quarry operators, energy corporations, and industrial giants. But with the digitization of trading platforms and the rise of investment apps, retail investors have entered the market in droves. Drawn by stories of rapid gains, they speculate on slate prices much like they would on more traditional assets.

However, retail investors often underestimate the risks involved. Unlike stocks or bonds, slate is a commodity with supply chain dependencies and environmental factors that can cause sudden price swings. A sudden quarry collapse, a government mining restriction, or even shifts in global construction trends can lead to massive losses for unprepared traders.

Trading slate futures is akin to navigating a financial minefield. Prices can fluctuate wildly based on factors such as:

Mining Output Variability:

Harsh weather, geological complications, or regulatory issues can abruptly disrupt supply.

Demand Fluctuations:

The rise of alternative materials or shifts in sustainable building policies can alter market dynamics.

Geopolitical Unrest:

Slate deposits often lie in politically unstable regions, introducing significant risk.

Despite these dangers, many traders are drawn to the high-risk, high-reward nature of slate futures. For every trader who strikes it rich, countless others suffer significant losses, making slate futures one of the most unpredictable markets on the CSE.

At the forefront of this volatile market stands Dr. Henry K. Roller, widely

regarded as the foremost expert on slate futures. With a Ph.D. in Economic Geology and decades of experience analyzing commodity markets, Dr. Roller has become a sought-after figure in both academic and financial circles. His insights into the market are renowned for their precision and depth, and his forecasts often shape investor sentiment.

"Slate is more than just a rock—it's the cornerstone of tomorrow's energy and infrastructure revolution."

Dr. Roller frequently emphasizes the growing role of slate in renewable energy, particularly in next-generation battery technology.

"In the short term, slate will make millionaires and paupers in equal measure. But in the long term, it will reshape global markets."

His cautionary tone reminds investors of the inherent risks while hinting at the untapped potential of slate as a commodity.

"Understanding slate isn't just about geology; it's about geopolitics, technology, and human ingenuity converging."

This perspective highlights the multifaceted nature of slate futures, where science, economics, and international relations intertwine.

"If you think slate is stable, you haven't been paying attention to the fault lines beneath the surface."

Dr. Roller often uses metaphors to illustrate the market's volatility, warning traders to remain vigilant.

Despite its volatility, slate futures trading continues to grow, attracting both skeptics and enthusiasts. With increasing demand from emerging industries and ongoing supply challenges, the market's future remains uncertain but undeniably significant.

As Dr. Roller puts it:

"The age of slate is upon us. Whether you're prepared or not, the ground beneath your feet is shifting."

The Colorado Slate Exchange, now at the epicenter of this transformation, offers investors a rare opportunity to engage with a commodity that could shape the next industrial age. But with high rewards

come high risks—and only time will tell who can withstand the ride.

Chapter 3

Slate: A Status Symbol in American Culture

In the early 21st century, few could have imagined that slate, a humble metamorphic rock, would rise to become one of the most sought-after status symbols in American culture. What began as a practical material for roofing, flooring, and landscaping transformed into a luxury icon, celebrated for its elegance, durability, and understated sophistication. At the heart of this transformation was Dr. Henry K. Roller, a visionary who combined geology, marketing, and pop culture to elevate slate from utility to prestige.

The cultural rebranding of slate was no accident. Dr. Roller recognized early on that slate's natural beauty and enduring strength aligned perfectly with the values of timeless luxury. With its distinct textures, muted tones, and ability to withstand the test of time, slate embodied a rare combination of ruggedness and refinement.

However, Dr. Roller knew that to make slate resonate with the broader public, he needed more than technical appeal—he needed cultural cachet. Armed with a

hefty marketing budget and a bold vision, he embarked on a campaign to position slate as the ultimate symbol of sophistication.

Dr. Roller's first major splash came with a groundbreaking event that would forever alter the perception of slate: a high-end fashion show set in a working slate quarry in Colorado. The event, known as "Rock & Runway," featured top designers incorporating slate into their collections. Models strutted down the runway wearing avant-garde outfits adorned with slate accents—slate-embedded jewelry, slate-laced evening gowns, and even high-heeled shoes with slate detailing.

The contrast between the raw, industrial backdrop of the quarry and the refined elegance of the fashion on display captured the world's imagination. Fashion magazines declared slate "the new black," and the event became a viral sensation, trending across social media platforms and making headlines in *Vogue*, *Harper's Bazaar*, and *The New York Times*.

Dr. Roller's strategy was clear: slate was no longer just for construction—it was a statement of luxury and power.

The fashion show was only the beginning. Dr. Roller's marketing genius extended into the world of pop culture. Recognizing the visual allure of slate quarries, he partnered with major publications to use these rugged landscapes as backdrops for high-profile photoshoots.

Sports Illustrated's Swimsuit Edition featured bikini-clad models posing on slabs of slate and mining equipment, juxtaposing natural beauty with human elegance. The slate quarry, with its stark cliffs and shimmering pools of water, became an iconic setting, symbolizing both adventure and luxury.

GQ used slate quarries for their "Men of the Year" features, highlighting powerful CEOs, athletes, and actors dressed in tailored suits, standing atop monolithic slabs of slate to convey strength and resilience.

Rolling Stone magazine shot rock stars and musicians against the jagged slate walls, embracing the raw, rebellious spirit of the quarry while linking slate to both grit and glamour.

These campaigns cemented slate's place in the cultural zeitgeist, making it synonymous with wealth, sophistication,

and a connection to the earth's primal forces.

While the elite embraced slate as a luxury symbol, Dr. Roller knew the campaign's long-term success depended on making slate desirable to everyday Americans. His team launched a series of advertisements showing families incorporating slate into their lives—not just in their homes, but in their lifestyles.

From slate countertops to jewelry and from dietary supplements to slate-infused home décor, the message was clear: owning slate was a way to participate in a movement toward timeless, natural beauty.

Dr. Roller's memorable slogan, "Solid as Slate, Solid as You," resonated with middle-class families across the country. Slate wasn't just a material—it was a reflection of personal strength and stability.

Dr. Roller often spoke passionately about the cultural shift he had orchestrated. In interviews, he articulated his belief that slate's rise was more than marketing—it was about reconnecting people with nature's enduring power:

"Slate is the foundation beneath our feet and the future of our culture. It's not just a rock; it's a reminder of what lasts."

"People crave authenticity in a world of plastic and pretense. Slate represents permanence and strength in an era of disposability."

His vision extended beyond fashion and pop culture. Dr. Roller imagined a world where slate was as much a part of our daily identity as the clothes we wear or the cars we drive. He advocated for slate-infused architecture, slate design competitions, and even slate-inspired art installations in major cities.

Today, slate stands as a testament to Dr. Henry K. Roller's transformative vision. What was once seen as a mundane material now symbolizes prestige, resilience, and cultural relevance. Through bold marketing, high-profile events, and strategic partnerships, Dr. Roller turned slate into more than a rock—it became a status symbol ingrained in American culture.

As slate continues to define luxury spaces and cultural moments, one can't help but hear Dr. Roller's words echo across the polished surfaces:

"In slate, we trust. In slate, we endure."

Chapter 4

The Great Slate Wars

In the early 2040s, the world stood witness to one of the most unexpected geopolitical conflicts of the century: The Great Slate Wars. What began as a trade dispute over slate exports between China and Morocco escalated into a 47-day conflict that reshaped the global economy and redefined international trade relations. At the heart of the conflict was the dumping of Moroccan slate into the global market at prices so low that it threatened to destabilize China's burgeoning slate-based economy.

By the 2030s, China had emerged as a global leader in slate production, leveraging its vast natural resources and innovative technologies to integrate slate into nearly every sector of its economy. Slate wasn't just a building material—it was a cornerstone of China's infrastructure, energy storage, and luxury exports. Entire cities were constructed with slate-infused materials, and China's thriving export market relied heavily on slate-derived products.

This "slate economy" created millions of jobs and elevated China's global status as a key player in the commodities market.

However, this prosperity also made China vulnerable to external pressures, particularly from competitors like Morocco.

While China was the dominant player, Morocco quietly built its own slate empire. Blessed with extensive slate deposits in the Atlas Mountains, Morocco developed efficient mining operations and low-cost production techniques. By 2041, Morocco began flooding the international market with cheap slate, offering prices significantly lower than China's.

This aggressive pricing strategy, widely regarded as "slate dumping," allowed Morocco to capture significant market share in Europe and Africa, undermining China's dominance. The Chinese government, facing economic instability and widespread unemployment in slate-dependent regions, accused Morocco of unfair trade practices and economic sabotage.

Tensions escalated rapidly. Diplomatic channels between Beijing and Rabat broke down after China imposed punitive tariffs on Moroccan slate imports. In response, Morocco retaliated by cutting off key trade routes and forming alliances with other

slate-producing nations, including Spain and Brazil.

On April 12, 2043, the conflict reached a boiling point when Chinese naval forces seized a Moroccan cargo ship transporting slate through the Strait of Gibraltar. Morocco declared this an act of war, mobilizing its military and launching a series of precision airstrikes on Chinese shipping facilities in East Africa.

The Great Slate Wars were characterized by:

Naval Blockades: Both nations imposed extensive naval blockades, with China deploying its South China Sea Fleet to the Indian Ocean, while Morocco fortified the Mediterranean and Atlantic corridors. International shipping lanes were severely disrupted, causing widespread shortages of essential goods globally.

Cyber Warfare: In addition to conventional combat, both sides engaged in cyberattacks aimed at crippling each other's economic infrastructure. Chinese hackers targeted Moroccan financial institutions, while Moroccan cyber units disabled several Chinese energy grids reliant on slate-based energy storage systems.

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Regional Alliances: The conflict drew in various regional powers. Russia and Iran supported China, seeing Morocco's slate dominance as a threat to Eurasian influence. Meanwhile, France and Spain backed Morocco, fearing China's growing control over the global commodities market.

Urban Skirmishes: As tensions spread beyond economic and naval realms, proxy battles broke out in various African and Middle Eastern cities, where Chinese and Moroccan interests clashed in resource-rich regions.

The war, though intense, was relatively short-lived. By May 29, 2043, after 47 days of conflict, the toll on both nations became unsustainable:

China's economy began to falter under the strain of war, with internal unrest growing in its slate-dependent provinces.

Morocco, despite initial successes, faced dwindling resources and pressure from international bodies concerned about the humanitarian impact of disrupted trade routes.

Global powers, led by the United Nations and the World Trade Organization (WTO),

intervened, brokering a ceasefire agreement known as the Beijing-Rabat Accord.

Key terms included:

Moroccan Slate Quotas: Morocco agreed to limit slate exports and adhere to fair market practices monitored by an international trade commission.

Tariff Reductions: China lifted its tariffs on Moroccan slate, allowing for a gradual reintegration of Moroccan products into Chinese markets.

Joint Development Initiatives: Both nations agreed to collaborate on slate technology research and sustainable mining practices, creating a global slate council to prevent future disputes.

The resolution of the Great Slate Wars ushered in a new era of cooperation and regulation in the global slate market. The conflict highlighted the importance of international trade norms and the dangers of over-reliance on a single commodity.

For China, the war served as a wake-up call, prompting diversification of its economy and reducing its dependence on slate. Morocco, though victorious in securing market access, adopted more

responsible trade practices to rebuild its global reputation.

The war also sparked a renewed interest in geopolitical resource management, with nations recognizing the potential for conflict over seemingly mundane commodities. As Dr. Henry K. Roller famously said in the war's aftermath:

"Slate may be ancient, but its future is anything but set in stone. The Great Slate Wars taught us that even the most grounded of resources can shake the foundations of nations."

The Great Slate Wars remain a testament to how deeply resources can shape global politics and serve as a reminder of the fragile balance between economic competition and international peace.



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