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Stratigraphy

Reading the Layers of Earth Like a Book

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Stratigraphy: Reading the Layers of Earth Like a Book

The Law That Changed Everything

In 1669, a Danish scientist named Nicolas Steno published a set of observations that would become one of the most important principles in both geology and archaeology. His Law of Superposition states that in an undisturbed sequence of rock or soil layers, the oldest material is at the bottom and the youngest is at the top. This seems obvious today, almost like saying that the first pancake you put on a plate ends up on the bottom of the stack. But in the seventeenth century, this was a revolutionary idea because it meant that the earth itself contained a record of time, written in layers of rock and sediment that could be read like the pages of a book. Archaeologists adopted this principle and made it the foundation of their fieldwork. When they excavate a site, they do not simply dig a hole and pull things out. They carefully remove one layer at a

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When the Layers Get Messy

The Law of Superposition works perfectly in theory, but the real world is messy. Soil layers do not always remain in their original order. Natural processes and human

activities can mix, move, and destroy stratigraphic sequences in ways that confuse even experienced archaeologists. Bioturbation is one of the most common disruptions. This term refers to the disturbance of soil layers by living organisms. Burrowing animals like groundhogs, rabbits, and even earthworms can move artifacts from one layer to another. Tree roots grow down through multiple layers, and when a tree falls, the root ball can pull material from deep layers up to the surface. In tropical environments, termite mounds can completely churn the upper layers of soil, destroying stratigraphic relationships that took thousands of years to form. Human activity causes even more dramatic disruptions. Plowing mixes the upper layers of soil, blending centuries of deposits into a single jumbled zone. Construction projects dig through older layers to lay foundations, and the backfill often contains material from multiple periods mixed together. Ancient people themselves frequently disturbed earlier deposits when they dug storage pits, built new structures on top of old ones, or buried their dead in existing settlement layers. Even something as simple as digging a well can punch a hole through thousands of years of stratigraphy. Erosion is another major factor. Water runoff can strip away upper layers, leaving a gap in the stratigraphic record. Flooding can deposit layers of silt that create misleading separations between periods that were actually close together in time. Earthquakes can tilt or fold layers, and landslides can move entire sections of a site to new locations. Recognizing these disturbances and accounting for them in the stratigraphic record is one of the most challenging skills an archaeologist must develop.

The Harris Matrix: Mapping Time Underground

In 1973, a Bermudian archaeologist named Edward Harris developed a revolutionary tool for recording and analyzing complex stratigraphic sequences. The Harris Matrix is a diagram that shows the relationships between every stratigraphic unit at a site: which layers are above or below other layers, which layers were cut by ditches or pits, and which deposits filled those cuts. It looks something like a flowchart or family tree, with each layer represented by a numbered box and lines showing the relationships between them. Before the Harris Matrix, archaeologists typically recorded stratigraphy using simple cross-section drawings that showed the layers as they appeared in the wall of a trench. These section drawings are useful but limited because they only show a single slice through the site. The Harris Matrix captures

the three-dimensional relationships between all the layers, making it possible to understand the complete sequence of events at even the most complex sites. Creating a Harris Matrix requires meticulous fieldwork. Every time an archaeologist identifies a new stratigraphic unit, whether it is a floor surface, a layer of rubble, a pit fill, or a natural soil deposit, they must record its relationships to all adjacent units. Is it above or below? Does it cut through another layer? Is it the fill of a cut made by someone else? These relationships are then plotted on the matrix, building up a complete picture of the site's history one layer at a time. The Harris Matrix has become a standard tool in professional archaeology worldwide. It is especially valuable on urban sites, where thousands of years of continuous human activity can create incredibly complex stratigraphic sequences. In cities like London, Rome, and Istanbul, excavations routinely encounter dozens or even hundreds of distinct stratigraphic layers, and without the Harris Matrix, making sense of them would be nearly impossible.

Why One Wrong Cut Can Erase History

The importance of careful stratigraphic excavation cannot be overstated. Archaeology is a destructive science. Once a layer has been excavated, it cannot be put back. If an archaeologist fails to recognize the boundary between two layers and digs through both as if they were one, the information contained in that boundary is lost permanently. If a digger accidentally pushes an artifact from one layer into another, the context that gives that artifact meaning is destroyed. This is why archaeological excavation is slow, careful work. A single square meter of ground might take days or even weeks to excavate properly. Archaeologists use small tools like trowels, brushes, and dental picks rather than shovels and bulldozers. They photograph and draw each layer before removing it. They record the exact three-dimensional position of significant finds. They collect soil samples for later analysis. Every decision about where and how to dig is guided by the stratigraphy, because the layers themselves are as important as the objects they contain. This is also why looting is so devastating to archaeology. Looters care only about the objects. They dig through layers without recording anything, destroying the stratigraphic relationships that would have told archaeologists when the objects were deposited, by whom, and in what context. A looted artifact may be beautiful and valuable, but it is scientifically almost worthless because its context has been destroyed. The

information that was encoded in the stratigraphy surrounding that artifact is gone forever, and no amount of laboratory analysis can bring it back.

Key Information: Stratigraphy Essentials

Concept	Details
Law of Superposition	In undisturbed layers, the oldest material is at the bottom and the youngest is at the top
Stratum (plural: strata)	A single distinct layer of soil or sediment representing a period of time
Bioturbation	Disturbance of soil layers by living organisms such as burrowing animals, tree roots, and earthworms
Harris Matrix	A diagram showing relationships between all stratigraphic layers at a site; developed by Edward Harris in 1973
Context	The position and associations of an artifact within its stratigraphic layer; destroyed by looting
Section Drawing	A cross-section illustration showing layers as they appear in the wall of an excavation trench
Cut	An intrusion through existing layers caused by pits, ditches, graves, or construction
Deposit	Material that fills or accumulates within a cut or on a surface over time

Case Study: The Parking Garage Problem

Marcus Chen was having the worst Monday of his career. As the project manager for a new downtown parking garage in Athens, Greece, he had been warned that construction might encounter archaeological remains. The city required a brief archaeological survey before major projects, and a small team had cleared the site, finding only modern fill. But three days into excavation, a backhoe operator named Dimitri radioed up from the pit: "Boss, you need to see this." Twenty feet below street level, the backhoe had sliced clean through a wall made of cut limestone blocks. Worse, the bucket had already churned through several feet of layered soil on either side. "We've got pottery everywhere," Dimitri reported. "And some of it looks really old." Marcus called the city archaeologist, Dr. Eleni Papadopoulos, who arrived within the hour. Her face went pale when she saw the damage. "You've cut through at least four distinct layers," she said, kneeling beside the exposed section. "I can see Roman-era pottery mixed with Byzantine fragments and what looks like a Classical-period floor surface, all churned together by the machine." She turned to Marcus. "The stratigraphy in this section is destroyed. We will never know the relationship between these layers. The project must stop immediately." Marcus felt sick. Every day of delay cost his company twelve thousand dollars.

1. Using the reading's explanation of stratigraphy, explain what Dr. Papadopoulos means when she says the stratigraphy is destroyed. Why can the relationship between the Roman, Byzantine, and Classical layers no longer be determined?

2. If the initial archaeological survey had used more thorough methods, how might this situation have been avoided? What does this case study reveal about the tension between modern development and archaeological preservation?

Multiple Choice

1. According to the Law of Superposition, in an undisturbed sequence of soil layers, which statement is true?

    a) The deepest layers are the youngest

    b) All layers are the same age

    c) Layer age cannot be determined without laboratory testing

    d) The deepest layers are the oldest

2. What is bioturbation?

    a) The disturbance of soil layers by living organisms

    b) A method for dating organic materials

    c) The chemical breakdown of buried artifacts caused by acidic soil

    d) A type of Harris Matrix notation

3. Who developed the Harris Matrix, and when?

    a) Nicolas Steno in 1669

    b) Howard Carter in 1922

    c) Edward Harris in 1973

    d) Edward Harris in 1990

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Stratigraphy	A) A diagram showing the relationships between all layers at an archaeological site
2. ___ Superposition	B) The disturbance of soil layers by animals, roots, and other living organisms
3. ___ Bioturbation	C) Material that fills or accumulates within a cut or on a surface over time
4. ___ Harris Matrix	D) The principle that in undisturbed layers, the oldest material is at the bottom
5. ___ Deposit	E) The study of soil and rock layers and their relationships to determine relative age

Fill-in-the-Blank

1. A single distinct layer of soil or sediment at an archaeological site is called a _____, and the plural form is strata.

2. The _____ was developed by Edward Harris in 1973 as a tool for diagramming the relationships between all layers at a site.

3. When looters dig through a site without recording layers, they destroy the _____ that gives each artifact its meaning.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain why a Roman coin found in a medieval layer tells a different story than the same coin found in a Roman-era layer. What does this example reveal about the importance of stratigraphic context?

2. The reading describes several natural processes that can disrupt stratigraphy. Choose two and explain how each one could mislead archaeologists about the age of artifacts at a site.

3. Why is archaeological excavation described as a destructive science? How does this fact influence the way archaeologists approach their work?