Robert Miller Hazen (born November 1, 1948) is an American mineralogist and astrobiologist. He is a research scientist at the Carnegie Institution of Washington's Geophysical Laboratory and Clarence Robinson Professor of Earth Science at George Mason University, in the United States. Hazen is the Executive Director of the Deep Carbon Observatory.

Hazen's work is not only interesting for anyone curious about earth history but also represent a growing trend in science in general towards a more probabilistic approach to reality. In part that is due to the every increasing knowledge base and associated complexity. That is to say that reality has become more difficult to describe or study in non-probablistic terms. It would be a mistake to think that this makes Hazen work less rigorous it is simply representative of the emerging reality. Below are links to some of Hazen's papers and videos.

Key Papers

1. General Overview of Mineral Evolution
Read the paper

2. Probabilistic Mineralogy and Unique Outcomes
"...Earth's near-surface mineralogy is dominated by deterministic factors—principal rock-forming minerals are a necessary consequence of terrestrial worlds. Nevertheless, were Earth's history to be replayed, and thousands of mineral species discovered and characterized anew, it is probable that numerous species would differ from species known today..."
Read the paper

Videos for a Broader Audience

For those less familiar with academic papers, Hazen has also presented his work in several accessible talks and interviews. These videos offer an engaging introduction to his ideas on mineral evolution, the probabilistic nature of Earth systems, and the broader implications for understanding complexity and life's origins.

Video Summary & Timestamps

Title: The Missing Law of Nature, and How We Found It
Speaker: Dr. Robert M. Hazen
Duration: Approximately 11 minutes
Watch on YouTube

Timestamps & Key Concepts

- **0:00 – 1:00 – Introduction to Complexity in Nature**
  Hazen introduces the concept of complexity in natural systems, questioning whether there are underlying laws that govern the emergence of complexity in the universe.

1:00 – 2:30 – The Concept of Mineral Evolution

- He discusses how the diversity of minerals on Earth has increased over time, introducing the idea of mineral evolution as a framework to understand this progression.

- **2:30 – 4:00 – Role of Life in Mineral Diversity**
  Hazen explains how biological processes have significantly contributed to mineral diversity, emphasizing the interplay between geology and biology.

- **4:00 – 6:00 – The Second Law of Thermodynamics and Complexity**
  He delves into the apparent contradiction between the Second Law of Thermodynamics, which predicts increasing disorder, and the emergence of complex structures in nature.

- **6:00 – 8:00 – The 'Missing' Law of Nature**
  Hazen proposes the existence of a 'missing' law that accounts for the increase in complexity and diversity in natural systems, complementing existing physical laws.

- **8:00 – 9:30 – Implications for Understanding the Universe**
  He explores how this proposed law could provide insights into the evolution of complexity throughout the universe, from minerals to life forms.

- **9:30 – End – Concluding Thoughts**
  Hazen summarizes his ideas and reflects on the importance of recognizing patterns of increasing complexity as a fundamental aspect of nature.

Viewing Recommendations

- For a conceptual overview: Focus on 0:00 – 4:00 to grasp the basics of mineral evolution and the role of life in increasing mineral diversity.
- For insights into complexity and thermodynamics: Watch 4:00 – 6:00, where Hazen discusses the relationship between entropy and the emergence of complex structures.
- For the proposed 'missing' law and its broader implications: View 6:00 – 9:30, which covers the core of Hazen's argument and its significance.

Notable Takeaways

- **Interdisciplinary Approach:** Hazen's talk bridges geology, biology, and physics, offering a holistic view of how complexity arises in natural systems.
- **Challenging Traditional Views:** By proposing a 'missing' law, he invites a re-examination of established scientific principles to better understand the evolution of complexity.
- **Accessibility:** Despite the depth of the subject, Hazen presents his ideas in an engaging and understandable manner, making complex concepts accessible to a broad audience.