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The Chemical Lens: Reframing Geochemistry as the Operating System of 21st-Century Geoscience Education

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As the geosciences undergo a radical shift from traditional resource extraction toward planetary stewardship and the energy transition, the pedagogical framework of the field must be reimagined. This presentation argues that **geochemistry is no longer a sub-discipline, but the fundamental "operating system"** required to navigate the complexities of the Anthropocene.

We propose a "Molecular-to-Macroscopic" educational model that breaks the silos between mineralogy, hydrology, and atmospheric science. In this framework, geochemistry serves as the primary tool for solving the "Critical Minerals Paradox"—the challenge of sourcing materials for a green economy while maintaining environmental geochemical integrity. By integrating computational thermodynamics and isotopes with real-time sensor data, we can move geoscience education from descriptive observation to predictive modeling.

The presentation will explore how shifting the curriculum toward **biogeochemical signaling** and **crustal-scale chemical kinetics** prepares the next generation of geoscientists to tackle climate mitigation, carbon sequestration, and sustainable resource management. Ultimately, we argue that the future of geoscience education lies in mastering the chemical language of Earth’s systems to engineer a resilient planetary future.