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Energy Transition: A Mineral or Human Resources Challenge? A K-State Program to Train the Next Generation of Exploration Geologists

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As the world is accelerating the switch from fossil fuel energy sources to sustainable energy production, the demand for critical minerals has increased dramatically, requiring the opening, but most importantly the discovery, of new mines by 2050. This places mineral exploration at the center of the energy transition. However, the supply of trained geologists specialized in mineral exploration is currently low, and the lack of appropriate degrees in the US and internationally makes achieving these targets difficult if not impossible. While the number of geology completions has dropped significantly over the past 10 years in the US (21.9%) and internationally (e.g., 43% in Australia), meeting the demand for qualified exploration geologists able to discover and manage new resources (whether they be metals, industrial minerals, or water) will be a problem. In the US, this high demand will be further exacerbated by a significant drop in licensed Exploration Geologists, as 28% of the current geoscience workforce is expected to retire by 2028, representing approximately 130,000 workers. Despite this demand, few graduate programs specifically focused on mineral exploration exist in the United States.

In response, Kansas State University has developed a new Graduate Certificate in Mineral Exploration. This program integrates economic geology, geophysics, geochemistry, GIS, and data-driven approaches with applied, field-based training. Core components include real-world exploration projects in critical mineral districts, advanced analytical techniques, and strong industry collaboration. Field experiences in regions such as Oklahoma and the western United States provide hands-on exposure to modern exploration practices and environmental stewardship.

This contribution presents the program structure, workforce-driven design, and initial outcomes. We argue that the energy transition is not solely a mineral supply issue but fundamentally a human capital challenge, and that targeted training programs are essential to secure the workforce needed to discover and develop future resources.