

# SEG 2022 Conference: Minerals For Our Future

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## Critical Minerals for Our Energy Future: Geology and Ore Deposit Models

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New technologies, especially energy technologies require not only greater amounts of mined raw materials but also a wider range of elements than ever before. Our techno-world is made of clever and complex elemental mixtures. Some of these raw materials are 'critical' because they are economically important but, with only relatively small amounts needed, their supply is vulnerable to disruption. This is good news for geologists. We need to understand the concentration of critical minerals of elements like rare earths, lithium, cobalt and more, and this is an exciting opportunity for lots more geology. What is not such good news, is the projected exponentially increasing demand for minerals, driven by population growth, increasing wealth and the metal-intensive nature of clean energy technologies. Slowing this rate of increase whilst maintaining the energy transition is one of the most important challenges for humankind. As geologists we must integrate mitigation strategies into our new geomodels. The approach used in the EU H2020-funded HiTech AlkCarb project, which created new geomodels for rare earths and other critical raw materials in alkaline rocks and carbonatites, was to integrate deposit-related environmental and social aspects into our new conceptual mineral system geomodel. This included information on process mineralogy and radioactivity. In the NERC-funded LiFT project we are using a life cycle assessment (LCA) approach to compare the different types of lithium deposits and quantify impacts. Using LCA early in exploration leads to better mine and process design. Integrating LCA into resource models enables environmental as well as economic mine scheduling. In the UKRI Circular Economy Centre, Met4Tech, we are working on a geomodel for SW England that takes an integrated, regional view; combining Li, Sn, W ores, waste and by-products, legacy waste, and geothermal energy. We are investigating if this can help to better quantify and thus lower environmental impacts.