

# SEG 2024 Conference: Sustainable Mineral Exploration and Development

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## Circular Economy Can Start from the First Stages of Exploration Geology

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Creating a more circular economy is important to achieve materials sustainability and lower carbon emissions. The term ‘circular economy’ (CE) is often used to describe the reverse loops in the materials cycle (e.g. recycling, re-use and repair) but CE thinking needs to cover the whole value chain right from the beginning. Important actions to ensure circularity take place in the production and manufacturing ‘inbound’ steps of the materials cycle – and the first of these inbound steps are geology and mining. The Ellen MacArthur Foundation defines three key CE principles: ‘designing out waste and pollution’, ‘keeping products and materials in use (at highest value)’, and ‘regenerating natural systems’. All of these are applicable to geological exploration and mining (<https://geoscientist.online/sections/features/the-circular-economy-a-view-from-the-front/>), which are core value chain steps and significant contributors to the ‘emission-rucksack of materials’. CE thinking during the exploration phase includes, for example, early consideration of by- and co-products as well as the main commodity of interest; designing resource efficient mining and extraction processes; using techniques such as life-cycle assessment to test mine design and extraction technology; re-use of mine waste and capture of ‘other’ value streams; biodiversity and ecology regeneration and enhancement; joining up primary production with recyclers as ‘materials solutions’ providers; and taking part in activities to ensure onwards good materials stewardship and participation into future CE value capture through each step in the value chain. In our UKRI Interdisciplinary Circular Economy Centre for Technology Metals (Met4Tech.org), we are carrying out research across the full value chains for the specialist technology metals (rare earths, lithium, cobalt, tin and tungsten) defined as critical minerals in many countries, and vital for the strategic technologies needed for the energy transition and net zero aims. We will also set this CE thinking in the context of the new UN Resource Management System.