

Copper Kitchens: A New Framework for Sedimentary-Hosted Copper Exploration, Adapted From Hydrocarbon Workflows

Graeme Nicoll¹, Paul Helps¹

¹Halliburton, Abingdon, United Kingdom

Over the past few years, we have been applying our experience in developing and employing hydrocarbon exploration workflows to aid subsurface mineral exploration, allowing for predictions to be made into the unknown – both deeper into the subsurface and in locations away from data control. These predictions are based upon robust tectono-stratigraphic frameworks built on diverse geological datasets, regional knowledge, and data-driven models. These prospectivity outputs can be used as a starting point to help generative teams understand and find resources.

We have utilized a holistic mineral systems approach to map global prospectivity for sedimentary hosted systems based around key time intervals. We have now expanded our screening approach, through the concept of 'copper kitchens' – Phanerozoic sedimentary basins (or parts of) where the fundamental components of the system (copper source, brine source and organic-rich reductant) may be present in different and variable temporal stratigraphic configurations. This is achieved through the mapping of each component through the prediction of lithological facies in a basin, via Gross Depositional Environment (GDE) maps, and assessing the nature of underlying basement.

The output maps generated provide a rapid assessment of sedimentary basins that may have critical components for the generation and precipitation of Cu-bearing fluids. The integration of tectonic data (e.g. geodynamic units, basin boundaries and faults) and basin depth contours help highlight where fluids, sourced from the kitchen areas, may migrate towards. The incorporation of known deposit data validates this approach. At the regional scale, we also utilize a source-to-sink approach, examining paleo-drainage systems and erosion from hinterland source areas into basin sinks. European case studies integrating copper kitchen mapping with sample data provide geochemical evidence for copper enrichment in specific sedimentary intervals. Results demonstrate the viability of our approach in identifying areas within basins that may be prospective for sedimentary-hosted copper mineralization.