Delineating permissive areas for sandstone-hosted uranium using continent-scale mineral prospectivity analysis

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ABSTRACT

An ambitious mineral prospectivity model covering an entire continent successfully accounts for the distribution of multiple, genetically diverse sandstone-hosted uranium systems and hints at undiscovered mineral potential. Australia was chosen to demonstrate the usefulness of huge-scale multi-criteria analyses due to the relatively large volume and high quality of publicly available, continent-scale data, and because it is host to a considerable number of spatially distributed, economically significant deposits.

This IAEA-supported study aims to reduce a wide range of uranium ore genesis concepts to their most fundamental mappable components. Complex relationships between components are then expressed in a logical model which is carefully guided at every step by an 'expert' geologist. This permits the creation of a holistic mineral-systems targeting model which intimately reflects the way in which the geologist thinks, but extrapolated up to the scale of the analysis (continent-scale in this example) and over a multitude of simultaneous input criteria.

The result is a numerical, continent-scale grid with values interpreted as representing spatial variations in prospectivity. Reclassification of the grid allows it to be displayed as a simple colour-coded, multi-class favourability map.

While this type of modelling is routinely deployed at the regional scale in modern mineral exploration, the challenge here was to construct a single mathematical model which adequately describes the distribution of known sandstone-hosted uranium deposits across a wide variety of terrains, ages and mineralisation (sub-)styles for an entire continent. Areas highlighted by such a model lying outside known mineralised zones logically possess all of the critical components of sandstone-hosted uranium mineralising systems. These areas may have been overlooked by previous explorers and worthy of further investigation.

A comprehensive account of the methods used in this study is presented as a chapter in a recently published IAEA TecDoc (IAEA-TECDOC-1861 Quantitative and Spatial Evaluations of Undiscovered Uranium Resources).