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Mineral Network Analysis for Heavy Minerals (MNA4HM) web application – a tool to explore big mineral datasets

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The Heavy Mineral Map of Australia (HMMA) project[1], part of Geoscience Australia's Exploring for the Future program, determined the abundance and distribution of heavy minerals (HMs; specific gravity >2.9 g/cm^3) in 1315 floodplain sediment samples obtained from Geoscience Australia's National Geochemical Survey of Australia (NGSA) project[2]. Archived NGSA samples from floodplain landforms were sub-sampled with the 75-430 µm fraction subjected to dense media separation and automated mineralogy assay using a TESCAN Integrated Mineral Analysis (TIMA) instrument at Curtin University.

Interpretation of the massive number of mineral observations generated during the project (~150 million mineral observations; 166 unique mineral species) required the development of a novel workflow to allow end users to discover, visualise and interpret mineral co-occurrence and spatial relationships. Mineral Network Analysis (MNA) has been shown to be a dynamic and quantitative tool capable of revealing and visualizing complex patterns of abundance, diversity and distribution in large mineralogical data sets[3]. To facilitate the application of MNA for the interpretation of the HMMA dataset and efficient communication of the project results, we have developed a Mineral Network Analysis for Heavy Minerals (MNA4HM) web application utilising the 'Shiny' platform and R package. The MNA4HM application is used to reveal (1) the abundance and co-occurrences of heavy minerals, (2) their spatial distributions, and (3) their relations to first-order geological and geomorphological features. The latter include geological provinces, mineral deposits, topography and major river basins. Visualisation of the mineral network guides parsimonious yet meaningful mapping of minerals typomorphic of particular geological environments or mineral systems. The mineralogical dataset can be filtered or styled based on mineral attributes (e.g., simplified mineralogical classes) and properties (e.g., chemical composition).

In this talk we will demonstrate an optimised MNA4HM workflow (identification -> mapping -> interpretation) for exploration targeting selected critical minerals important for the transition to a lower carbon global economy.

The MNA4HM application is hosted at https://geoscienceaustralia.shinyapps.io/mna4hm and is available for use by the geological community and general public.

References

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[3] Morrison, S.M. et al., 2017. doi:10.2138/am-2017-6104CCBYNCND