Samarium–neodymium isotope map of Western Australia

by

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Abstract

Isotope maps are used to characterize lithospheric architecture through time, to understand crustal evolution and mineral system distributions, and play an increasingly important role in exploration targeting.

These Sm–Nd isotope maps of Western Australia (Fig. 1) are based on whole-rock Sm–Nd data for felsic igneous rocks, which provide a window into the middle and lower continental crust, and are used for isotope mapping. Although mafic to intermediate igneous and sedimentary rocks were not used in constructing the contoured isotope maps, Sm–Nd data for those samples are included with those for felsic igneous rocks in the data table.

The maps show two-stage depleted mantle model ages (T_{DM}^2, proxy for the age of the crustal source of the igneous rocks) and crustal residence time (the difference between T_{DM}^2 and magmatic crystallization age, i.e. the length of time the source of the igneous rocks has resided in the crust). The model age gradients are typically associated with major crustal structures and are potentially important for localizing mineral systems. Map colours in areas with no sample reflect interpolated values and may have little or no relationship with underlying crust.

The isotope maps were created using the Natural Neighbor interpolation tool in ArcGIS Spatial Analyst. The isotope maps are presented as both stretched (Histogram Equalize type, Fig. 1a,c) and classified (natural breaks classification, Fig. 1b,d) raster datasets. Some isotope gradients may not be as pronounced in the statewide map as they might be on more detailed maps of individual regions. It is therefore recommended that users download the isotope data and create their own contour maps for particular areas, to enhance the isotope gradients in those areas.

The Sm–Nd isotope samples and associated data were compiled as part of a collaboration between Geological Survey of Western Australia (GSWA) and Geoscience Australia (GA). Acquisition of GSWA's Sm–Nd isotope data involved collaboration with several university research laboratories and was funded by the Exploration Incentive Scheme.

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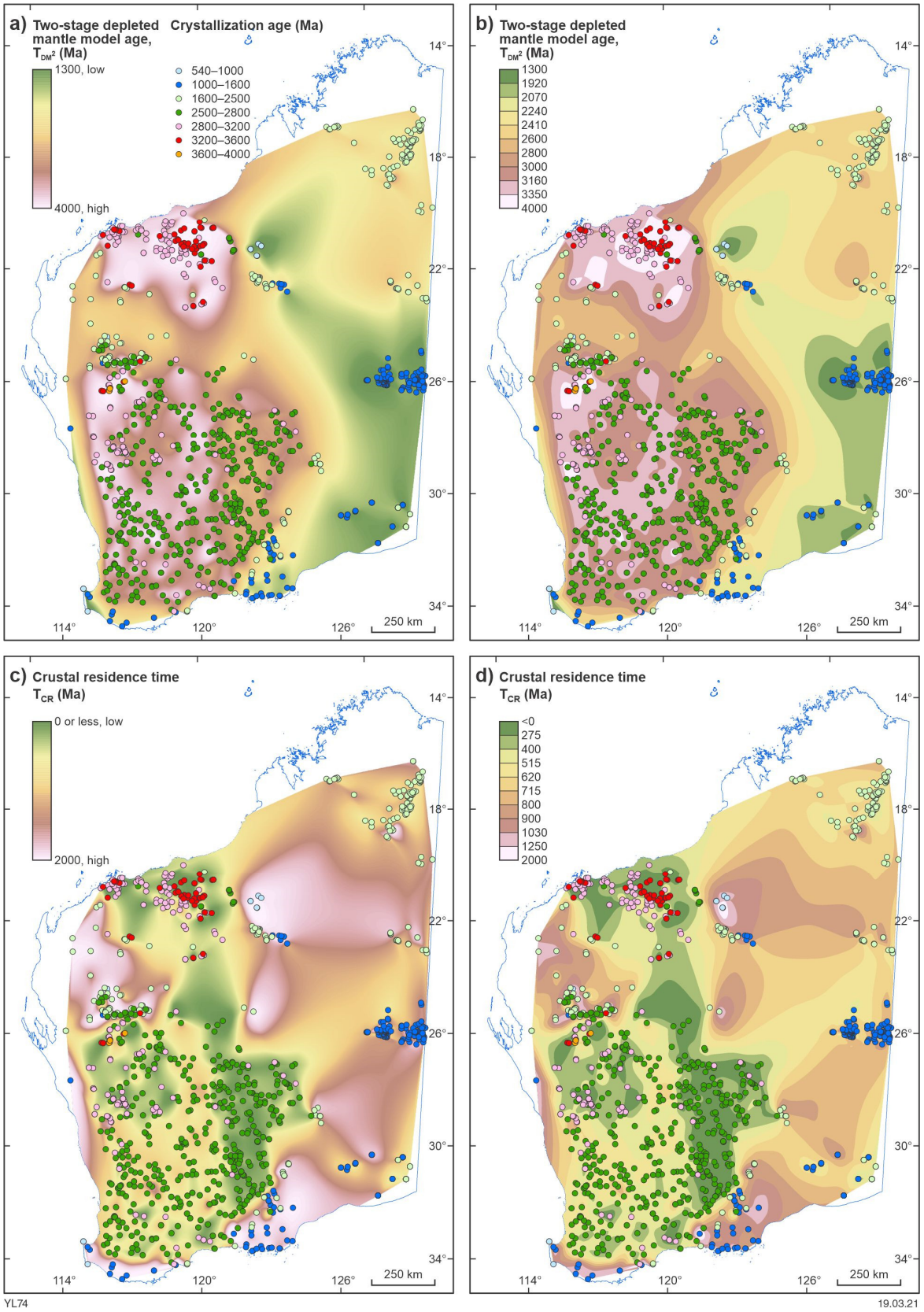

Figure 1. **Sm–Nd isotope maps for whole-rock samples of felsic igneous rocks in Western Australia. Two-stage depleted mantle model age (T_{DM}^2) and crustal residence time (T_{CR}) maps are presented as stretched (a and c) and classified (b and d) raster images. Symbols show the locations of Sm–Nd samples used for isotope mapping and are colour-coded to indicate their magmatic crystallization ages**

How to access

The data layer is best accessed using GeoVIEW.WA. This online interactive mapping system allows data to be viewed and searched together with other datasets, including GSWA and GA geochronology data, geological maps and mineral exploration datasets. Data for individual sample points can be viewed by selecting the symbols. The Samarium—neodymium isotope map data layer is are also available as a free download from the Data and Software Centre via Datasets — Statewide spatial datasets — Geochronology & Isotope Geology — Samarium—neodymium isotope map, as ESRI shapefiles and MapInfo TAB files. These datasets are subject to ongoing updates as new data are generated.

Recommended reference

Lu, Y, Wingate, MTD, Champion, DC, Smithies, RH, Johnson, SP, Mole, DR, Poujol, M, Zhao, J, Maas, R and Creaser RA 2021, Samarium–neodymium isotope map of Western Australia: Geological Survey of Western Australia, digital data layer, <https://www.dmirs.wa.gov.au/geoview>.