

South Australian Heat Flow Anomaly:
Source and implications for geothermal energy

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ABSTRACT

The South Australian Heat Flow Anomaly is a broad region (>400 km wide) in Proterozoic South Australia defined by drill holes with anomalously high heat flow estimates yielding a mean of $92 \pm 10 \text{ mW m}^{-2}$, compared to a global Proterozoic mean of 49-54 mW m^{-2} . This study will conclusively determine the primary source of this anomalous heat flow. Thermal conductivities of 145 drill core samples have been measured using an optical thermal conductivity scanner. These were utilised with thermal conductivity and temperature profiles provided by Petratherm and the Department of State Development to make five new heat flow estimates in the Curnamona and Mount Painter provinces using the product and thermal resistance methods. Measured surface heat flows fall between 84.352 and 128.051 mW m^{-2} . Significant lateral variations in surface heat flow support previous work suggesting shallow crustal radiogenic heat generation, primarily in Mesoproterozoic high heat producing granites. Analysis of existing deep seismic data has revealed a significantly cooler and thicker lithosphere in the Proterozoic South Australia compared with regions dominated by mantle heat flow such as southeastern Australia. Geotherms have been computed for steady-state regimes to demonstrate that the surface heat flow evident in the South Australian Heat Flow Anomaly is consistent with elevated upper crustal source. Thick, thermally insulating sedimentary cover in the Curnamona and Mount Painter provinces and high temperatures at shallow depths are encouraging for geothermal energy exploration, and geothermal prospectivity for these provinces was examined. Lateral thermal conductivity variations of stratigraphies in the Curnamona Province have been assessed, revealing that more data must be collected to use thermal conductivity from neighbouring boreholes as a proxy for heat flow estimates.

KEYWORDS

Heat flow, heat generation, thermal conductivity, geothermal energy, Curnamona Province

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