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The Flinders Ranges, Australia: a typical case of an orogen related to an anomalously hot crust?

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The South Australian Craton, located in the central part of the Australian plate, has recorded a continuous history of deformation since the Mesoproterozoic, related to the building and break-up of paleo-continents and the amalgamation of Australia. The building of the current relief in the Flinder Ranges is Recent whilst the last significant orogenic event which has affected this area is the Cambro-Ordovician Delamerian orogeny. The Flinders ranges, located more than 1000 km away from the nearest active plate-boundary, displays a seismic activity of moderate intensity predominantly following the trend of the Neoproterozoic Adelaide “Geosyncline”. Deformation in the Flinders Ranges has been previously related to the South Australian Heat Flow Anomaly, caused by high heat producing granite present in the basement rock of the craton. However, few studies have focused on the spatial distribution of the hypocentres of earthquakes in the South Australian Craton. The link between the seismic activity and the geology is poorly understood as the significant thicknesses of sediments and regolith have so far inhibited our understanding of the architecture of the basin at depth. Here, we use surface geology together with gravity and magnetic data to build a regional-scale structural frame in order to better constrain the role of tectonic structures in the distribution of earthquakes, in particular faults affecting the basement rocks of the basin. Seismicity is not solely related to high-heat producing granites in the South Australian Craton. For example, a splay of seismicity along the Kalinjala shear zone suggests that this shear zone remains a zone of crustal weakness that is unrelated to elevated heat flow whereas some areas characterized by high heat flow display limited seismic activity. We show that not all of the recent deformation and

modern landscape in the South Australian Craton can be related to high-heat producing rocks. On the contrary, our observations highlight the strong link between the inherited architecture of the basement and the intraplate seismicity and landscape evolution in cratonic areas.