A NEW APPROACH TO IMAGING DEEP CRUSTAL STRUCTURES ACROSS PASSIVE CONTINENTAL MARGINS: REVISITING THE CRUSTAL ARCHITECTURE OF SOUTHEAST AUSTRALIA'S PASSIVE MARGIN

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Phanerozoic-Precambrian basement faults in Victoria, SE that defined major structural domains of the western Lachlan Orogen are proposed to extend southward beneath basaltic rocks of the Newer Volcanic Province and sedimentary succession of the Otway Basins. There is considerable uncertainty regarding the exact location of these faults beneath the Newer Volcanic Province and the Otway, Bass, and Sorell basins because they have been difficult to image in potential field and seismic reflection data. We propose a novel method that effectively maps deep-crustal faults based on unsupervised machine learning to Euler deconvolution depth results of the global Earth Magnetic Anomaly Grid (EMAG). While this method serves as a valuable tool in areas with limited high-resolution geophysical datasets, it provides new insights into the location and extension of the Delamerian/Lachlan basement fault into the passive margin of southern Australia. The new method combines the interpretation of conventional Euler deconvolution solutions (in map view) with cross-section clusters of Euler depth solutions using unsupervised Density-Based Clustering with Noise (DBSCAN) algorithms. We demonstrate that the results are comparable to seismic reflection data and gravity forward models. Our findings indicate that the Proterozoic micro-continent; VanDieland, which was entrained into the east Gondwana accretionary orogen in the Late Devonian, is marked by relatively high depth clusters of 17 km to 29 km and is bounded to the east and west by relatively low depth solutions of 5 km to 17 km at major crustal structures. The western edge is located across a high-low depth transition aligned with the west-dipping Mount William Fault in central Victoria and the NW-dipping Bambra Faults to the south. Our depth clusters indicate that VanDieland is bounded to the east by the Governor Fault, which extends southerly into eastern Tasmania. Our results further show that the Bambra Fault truncates the west-dipping and NS-trending Avoca Fault but not the Early Cambrian to Ordovician age east-dipping Moyston Fault. Depth clusters from our results reveal that the west-dipping Yarramyljup Fault extends beyond the Victorian coast, truncating the Grampian Stavely Zone west of King Island. The Yarramyljup Fault appears to be the basin bounding fault that accommodates the most Eocene thermal subsidence and inversion within Otway, Bass and Sorell Basins. Our interpretation also shows that these deep crustal faults correlate

strongly with Peak Ground Acceleration at 10% in 50-year mean hazard of 0.08-0.3 g across Victoria and Tasmania. Thus, it provides a proxy to forecast future earthquakes within the region.

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