

## Insights on crustal architecture and evolution of the Madura Province, Western Australia, from deep crustal seismic reflection data.

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Recently acquired geophysical data and stratigraphic drill cores from the buried Precambrian basement of the Nullarbor region of Western and South Australia have provided critical information about the crustal architecture of this region and advanced our understanding of the crustal growth and amalgamation of the Archean and Proterozoic components of continental Australia. In this contribution we examine the Madura Province, an area of at least 65 000 km<sup>2</sup> that lies between the Albany–Fraser Orogen (AFO) to the west, and the Coompana Province to the east. The Madura Province is dominated by Proterozoic oceanic crustal rocks intruded by ferrogabbroic and granitic rocks of the 1200–1120 Ma Moodini Supersuite. We also examine differences in the expression of major structures and crustal features in the various types of geophysical data available — seismic reflection, MT, potential fields — and the implications for interpretation methodology.

The western boundary of the Madura Province is defined by the Rodona Shear Zone, which in both the new seismic reflection line (13GA-EG1) and previously acquired seismic data (12GA-AF3) is imaged as a broad zone of moderately east-dipping reflectors of variable intensity. Utilizing the various geophysical datasets, the Rodona Shear Zone is interpreted to have a complex structural history that includes craton-vergent thrusting followed by sinistral strike-slip movement. Predominantly west-dipping, folded Madura Province oceanic crustal rocks with moderate to strong reflectivity occur in the hanging wall. In contrast, reworked Archean crust of the AFO, in the footwall of the Rodona Shear Zone, has weak reflectivity. In the lower crust, the Rodona Shear Zone appears to sole onto the Gunnadorrah Seismic Province, a region of subhorizontal reflectivity that extends down to the Moho and underlies most of the AFO and at least the western part of the Madura Province. The Moho has a depth of ~42 km beneath the Rodona Shear Zone, and undulates gently across the Madura Province.

To the east, the Madura Province is truncated by the Mundrabilla Shear Zone, which provides an excellent example of the expression of a subvertical, crustal-scale structure in seismic reflection data. In potential field data, the Mundrabilla Shear Zone is straight over at least 400 km, with clear sinistral drag. In the seismic reflection data it is imaged as a broad, predominantly non-reflective zone that is about 10 km wide in the lower crust, and tapers upwards to the surface. The structure appears to be offset locally by subhorizontal shear zones. This geometry, the non-reflective character, and the presence of Moodini Supersuite granite within the shear zone suggest structurally-controlled magmatism and fluid transport.

Internally, the Madura Province shows patches of undulating, or folded, moderate to strong reflectivity, truncated by non-reflective zones interpreted to represent voluminous Moodini Supersuite intrusions. In the potential field data, intrusions of Moodini Supersuite truncate folds in Madura Province oceanic crustal rocks. Both west- and east-dipping shear zones are visible, but unlike the bounding shear zones, appear to be confined to the upper crust.