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Deep structure of the east Terre Adélie Craton boundary (East Antarctica): Seismic investigation of the Mertz shear zone area.

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The Mertz shear zone (MSZ) located in George Vth Land (67°S, 145°E) is a key area to understand tectonic relationships between the Neoarchean-Paleoproterozoic Terre Adélie Craton (TAC) and the Early Paleozoic units of Cape Webb and Penguin Point. The MSZ is therefore a major structure that represents the eastern boundary of the East Antartica Shield. In addition, the MSZ that recorded dextral strike-slip movement estimated at 1.7Ga could be correlated to the Kalinjila shear zone a large scale mylonitic structure outcropping at the east of the Gawler Craton (South Australia). In order to better understand the MSZ dynamics, we developed a multi-disciplinary approach with the French polar institute (IPEV) through the Arlita program (Architecture de la Lithosphere de Terre Adélie). Four temporary seismic stations were deployed on both sides and above the MSZ from October 2009 to October 2011 to map the deep tectonic structures. We analysed receiver functions to evaluate Moho depth and seismic anisotropy through the splitting of SKS waves to analyze the prolongation of the MSZ structures into the mantle.

Results from receiver functions reveal Moho depths of 40-44km for the TAC, about 36 km under the MSZ and 28km for the Paleozoic domain. These results show that the MSZ delimit two crustal blocks with different thicknesses. Our study is consistent with crustal thicknesses estimated by Fontaine et al. (2012) in South Australia in the Gawler craton (>40km) and in the Delamerian orogen terrains (31km). However, the transition between the thick craton and the Paleozoic crust is sharper at the MSZ than in south Australia.

Seismic anisotropy in the MSZ area was studied from events of magnitudes ranging from 5.9 to 7.0. In addition, petrological and crystallographic fabrics of the crust were carry out in order to better constrain the observed SKS delay times. The measurements of the splitting parameters show a fast polarisation direction (Φ) parallel to the E-W coast and delay times (dt) ranging 0.5 to 1s at most stations. These results are similar to splitting parameters observed at the permanent Geoscope Dumont D'Urville station (DRV: Φ = 80°N, dt = 1s) located in the Paleoproterozoic ($\approx$1.7Ga) domain of TAC.

Although we observe an important offset in the Moho depth across the MSZ, no evidence of distinct seismic anisotropy is found. Questions thus remain concerning the prolongation into the mantle of this large strike-slip shear zone.