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Lower crust to upper mantle coupling in hot orogens: the case of East African transpressional vertical shear zones

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Vertical shear zone networks are recognised today in recent collision zones and can be mapped over hundreds to thousands of kilometres (e.g. India-Asia collision zone). Similarly, large granulite facies shear zone arrays also affect Precambrian massifs indicating that they extend deeper into the continental crust. Geochemistry, Bouguer anomaly and seismic data underline that these shear zones may extend deep into the lithospheric mantle indicating mechanical coupling between the lower crust and the sub-crustal lithosphere. These shear zones, especially transpressionnal ones, could be associated with vertical movement of material, heat and fluids as suggested by localised granulitization and fluid chemical signature. If shear zones are rooted in the lithospheric mantle we need to precise their geometry at the crust – mantle boundary.

In this presentation we examine large scale interlinked shear zone network in the Kenya and Madagascar deep crust in order to precise their geometry to depth. The regional geometry, especially linear anomalies, was depicted by satellite imaging and field data. This precise tectonic framework is compared with Bouguer anomalies. The latter, obtained from the International Gravity Bureau, were filtered at short wave-

length to emphasize short gravimetric variation ($<$500 km). Our results indicate that Pan-African shear zones are lithospheric structures locally coinciding with location of high density material. Consequently, positive Bouguer anomalies may reflect material transfer processes such as vertical motion of sub-crustal weak mantle along vertical cusp-like structures. We suggest that the Moho does not constitute a major rheological boundary. This indicates an exceptional mechanical weakness of lithosphere mantle during Pan-African collision. From a kinematic point of view, the mantle cusps develop during horizontal layer parallel shortening of the lower-crust mantle which is coupled with a negligible viscosity contrast. The mechanical coupling and the common deformability of crust and mantle are characteristic features of ultra-hot orogens reworking a thermally weakened continental lithosphere during Neo-Proterozoic.