

Melts, fluids and metasomatism: the role of mid-lithospheric discontinuities (MLD) in subduction initiation and cratonic rejuvenation

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Following the pioneering discovery several decades ago by active source seismology [1, 2] mid-lithosphere discontinuities (MLD) became a topic of intensive research with many recent articles published on the geodynamic implications for craton destruction and subduction initiation in continental interiors. MLDs can be present at a spectrum of depths in the lithospheric mantle occurring between 70-100 km depths [3, 4]. This depth usually coincides with the decoupling layer during delamination of the lower lithospheric mantle [5, 6, 7]. From petrological and geochemical perspective, a wide range of interpretations have been proposed from petrological and geochemical perspectives or the nature of MLDs, which includes: 1) elastically accommodated grain boundary sliding; 2) channel flow; 3) anisotropy; 4) partial melts and fluids; 5) fossilized melts, fossilised LAB; 6) hydrous mineral amphibole break-down and associated melting; 7) amorphous CaCO₃; 8) clinopyroxene and garnet crystallisation; 9) carbonatitic melts and the role of the decarbonisation horizon.

The destabilization of cratons is a rare, but well documented phenomenon. Although it appears that MLDs detected by deep geophysical imaging techniques play an essential role in this process, plume-lithosphere interactions may be another prerequisite for delamination of cratonic roots. Furthermore, using thermo-mechanical numerical modelling, we show that inherited vertical deep seated weakness zones often in combination with the injection of melts/fluids from hydrous plumes or the lithospheric mantle are indispensable for cratonic keel removal or the initiation of delamination of the lower continental lithosphere [8]. In our talk we will address these questions in a multidisciplinary manner and highlight the potential paradigm shift in existing concepts and models.

[1] Thybo & Perchuk (1997), *Science* 275, 1626-1629.; [2] Thybo (2006), *Tectonophysics* 416, 53-79.; [3] Kovács et al. (2021) *Global and Planetary Change* 204, 103547.; [4] Aulbach et al. (2018) *Journal of Petrology* 58, 2311-2338.; [5] Wang & Kuský (2019), *Earth-Science Reviews* 190, 557-569.; [6] Shi et