Linkage between diapiric magma upwelling and diking in the Vilyui rift province (Siberian platform)

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The Devonian volcanic and igneous rocks on the eastern part of Siberian platform are located in the Vilyui rift province. The total volume of basalt material in the form of lava sheets, sills and dikes amounted to about $3*10^5$ km^3 [1]. The aim of our study, based on the numerical modelling, is (1) to prove the possibility of magma ascent due to melting and the upwelling of the partially molten material through the cratonic lithosphere to the base of the crust and (2) to model the mechanism of magma underplating and its capacity to cause tensile fracture and diking in the Earth's crust.

Depending on selected rheology, our experiments demonstrated [2]: (1) single stage upwelling with "leg" and dome-shaped surface; diapir did not reached the crust basement; (2) oscillatory ascent of newly formed magma portions up to the crust base; (3) the ascent of the matter in form of sill, which was spread laterally beneath the crust basement (underplating regime) or at deeper level in mantle. The rates and duration of upwelling of partially melted material through lithosphere to the crust–mantle boundary were estimated. The lateral spread of sheet-like magmatic body beneath crustal base over a distance around 200 km is possible during 2-3 Ma, which corresponds to duration of individual pulses of trap magmatism at the Siberian platform. The Middle Paleozoic rifting was accompanied by the emplacement of mafic magmas with the formation of dike belts (Vilyui–Markha, Chara–Sinyaya) on the basin flanks. The Vilyui dikes and sills (345-378 Ma, Ar–Ar dating) are coeval with a dramatic increase in the sedimentation and subsidence rate owing to the Devonian rifting stage [3]. Crust extension due to dikes intrusion is predicted as much as ~6%.

[1] Kiselev et al. (2014) *Rus. Geol. & Geophys.* **55**, 144-152. [2] Polyansky et al. (2012) *Petrology* **20**, 120-137. [3] Polyansky et al. (2013) *Rus. Geol. & Geophys.* **54**, 121-137.