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Origin of High-Ti Dacites from Paraná-Etendeka: unravelling the role of underplating via experiments with natural materials

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The Early Cretaceous Paraná-Etendeka Magmatic Province (PEMP) is the second largest igneous province on Earth. Basaltic rocks predominate over more evolved lithologies (dacites and rhyolites). This work is a first attempt to simulate experimentally the impact of underplating basaltic melt (high-Ti Pitanga-type) on a pre-existing continental crust. Our final aim is to unravel the origin of high volumes of high-Ti dacitic melts. To study the role of chaotic dynamics in this process, two experiments have been performed at 1,350°C (chaotic mixing apparatus [1]). The choice of starting compositions was based on the isotopic signatures. Homogenized end-member glasses were KS-700 basalt (80%; high-Ti Pitanga-type; η_{1350} = 8.78 Pa.s; ρ_{1350} = 2.47 g/cm³) and two different crustal contaminants: (i) Exp1: LMC-027 granite (20%; syenogranite from the Capão Bonito Stock; η_{1350} = $1.22*10^5$ Pa.s; ρ_{1350} = 2.29 g/cm³); (ii) Exp2: LMC-020 granite (20%; monzogranite from the Cunhaporanga batholith; η_{1350} = $1.73*10^4$ Pa.s; ρ_{1350} = 2.32 g/cm³). After each experiment, vortex structures, stretched and folded filaments were obtained based on chaotic dynamics, among regions with preserved end-member compositions, but surrounded by transitional intermediary areas. Representative sections from both experiments were analysed by electron probe microanalysis. Major and minor oxide variations show a diffusive behaviour. Typical diffusive patterns are symmetric “S” shaped curves, although asymmetric ones may also be present. Transects for the main oxides present two compositional plateaus: (i) one close (but significantly different) to the original basaltic composition and; (ii) another corresponding to the rhyolitic glass. Between the plateaus, the “S” shaped curves are observed. Exceptionally, the K_2O-plateau in the rhyolitic regions is systematically lower than expected. SiO_2 and MgO follow a smoother behaviour, when compared with TiO_2 and CaO. These oxides depict clear inflexion-changing points. Uphill diffusion (*i.e.,* opposite to the gradient) has been locally detected. As an important preliminary result, our experiments show clearly that basalt contaminates faster than rhyolite. As next and more thorough analytical step, laser ablation-ICP-MS analyses will be performed to study the behaviour of trace elements, followed by numerical modelling.

References:
[1] De Campos *et al.* (2011), *Contrib. To Mineral. Petrol.* 161, 863–881.