Mantle heterogeneities beneath Laguna Timone volcano, Pali Aike volcanic field, Southern Chile

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Laguna Timone(52°01'39"S, 70°12'53W), inactive Quaternary volcano in Pali Aike volcanic field [1], southernChile, host large mantle xenoliths from the lithosphere. They are characterized by spinel-lherzolite, garnet-spinel-lherzolite, garnet-lherzolite, garnet-harzburgite, glimmerite (PM18-3) and some xenoliths are phlogopite- and/or pargasite-bearing, which suggest their origin in mantle deeper source and a metasomatism. Geochemical data show #Mg between 88 to 91 and major elements depletion compared to primitive mantle (PM) [2]. Rare earth elements (REE), normalized to PM, suggests four: Group 1 has light REE depletion and heavy REE enrichment (Ce_N/Yb_N= 0.12-0.43); Group 2 has LREE enrichment and HREE depletion (Ce_N/Yb_N=2.07-15.3); Group 3 have middle REE enrichment and depletion (Ce_N/Yb_N= 0.96-0.98), and Group 4 have similar values between LREE and HREE (Ce_N/Yb_N= 0.78- 1.68). All samples are more enriched in Ta than Nb, and are strongly depleted in Y; Zr and Hf are enriched in most samples. The Sr and Rb are depleted while Ba is enriched. Spider diagrams show anomalies in some samples such as Nb, Ta, Zr and Hf high enrichment in sample PM18-3. Calculations with no-modal batch melting model shows that Laguna Timone xenoliths have suffered ~20% of melt. The Rb-Sr, Sm-Nd and Pb-Pb isotopes analysis are under progress. Laguna Timone xenoliths came from a deep source in the Patagonian mantle and suffered several thermal multi- stage, indicated by mineralogic evidence (garnet-lherzolite to spinel-lherzolite transitions phases) and a modal metasomatism (phlogopite and pargasite).

[1] Stern *et al* (1999), *Lithos* ***48***, 217–235. [2] Sun & McDonough (1989), *Geol. Society* **42**, 313-345.

Geodynamic regimes of continental crust growth and lithosphere reworking in subduction zones

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It is widely accepted that new continental crust can grow in subduction zones. Indeed, physical-chemical controls and dynamics of crustal addition remain partly enigmatic. Based on numerical models we identify the following geodynamic regimes of subduction, crustal growth and lithospheric reworking which may potentially form on Earth: (1) stable subduction, (2) retreating subduction with a focused backarc spreading center, (3) retreating subduction with distributed intra-arc extension, (4) advancing subduction with thickening overriding plate. Transitions between these different regimes are mainly caused by the concurrence of rheological weakening effects of (1) aqueous fluids percolating from the subducting slab into the mantle wedge and (2) melts propagating from the partially molten areas formed in the mantle wedge toward the surface. The aqueous fluids mainly affect the forearc region. Strong fluid-related weakening promotes plate decoupling and reduces subduction drag and thus results in stacking of sediments in the accretion prism. In contrast, reduced weakening by fluids results in strong coupling of the plates and leads to advancing collision-like subduction with enhanced subduction erosion. Thickening of the overriding plate and sedimentary plumes in the mantle wedge are the consequences. On the other hand, melts, extracted from the hot regions above the slab, rheologically weaken the lithosphere below the arc which thus controls overriding plate extension and shortening. Strong rheological weakening by melts in combination with weak plate coupling triggers retreating subduction with a pronounced backarc spreading center. Also, weakening of the arc by melts extracted from sedimentary plumes, generate weak channels through which these structures may be emplaced into subarc crust. If there is insufficient melt-related weakening, plumes cannot ascend but extend horizontally and thus underplate the lithosphere. Models with notable melt- and fluid-related weakening often predict existence of hot, rheologically weak asthenospheric window in the bottom of the arc that allows for potential relamination of positively buoyant subducted rocks to the crust and recycling of dense magmatic residue back into the mantle.