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Supplementary material for

Lithospheric density structure of the Southern Central Andes constrained by 3D data-integrative gravity modelling

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Introduction

This supplementary material includes the table with the mineralogical composition of the mantle xenoliths, used for converting from S-wave velocity anomalies to density and a description of the conversion of S-Wave velocities to densities of the mantle implemented by Meeßen (2017).

Table 1S: Petrological and geochemical composition of mantle xenoliths of the Agua Poca volcanic Area (see Fig.1 for the location of the xenoliths). Ol= olivine, Opx= orthopyroxene, Cpx = clinopyroxene, Sp = spinel, Xfe = iron content (1-Mg#)/100, where Mg# is the magnesium number. lherz = lherzolite, webst = websterite, cpto = clinopyroxenite.

Sample	Composition (%)				Xfe	**Classification**
	Ol	Opx	Cpx	Sp		
AP-75[1]	58.1	18.2	20	3.7	0.11	lherz
AP-80[1]	71.3	15.6	10.4	2.7	0.08	lherz
AP91b[1]	64.3	18.7	13.9	3.1	0.10	lherz
AP03[2]	52.3	34.8	7.1	5.8	0.11	lherz
AP06[2]	70.5	13.6	12.1	3.8	0.11	lherz
AP07[2]	52.6	33.9	8.6	4.9	0.11	lherz
AP12[2]	62.4	15.4	17.1	5.1	0.11	lherz
AP13[2]	68.2	12.3	15.2	4.3	0.11	lherz
AP45[2]	71.2	20.1	5.2	3.5	0.11	lherz

AP75[2]	52.5	22.3	19.8	1.4	0.11	lherz
AP80[2]	73.4	17.4	8	1.2	0.11	lherz
AP91[2]	57.6	19.7	18	4.8	0.12	lherz
AP10[2]	67.5	25.6	0.7	6.2	0.12	lherz
AP15[2]	84	13	2	1	0.12	lherz
AP78[2]	0.8	33.3	55.9	10	0.12	webst
AP11[2]	0.9	4	90.2	4.9	0.12	cpto
Average	**59.74**	**18.96**	**17.38**	**3.77**	**0.11**	

[1]Conceição et al. (2005); [2] Jalowitzki et al. (2010)

Text 1S: Seismic velocity to density conversion

Following the approach by Goes et al. (2000), the shear wave velocity of a rock with a given composition X and different temperature and pressure conditions can be calculated as:

$$v_s(P,T,X,\omega) = \sqrt{\frac{\mu(P,T,X)}{\rho(P,T,X)}} - (1 - \varepsilon(w,T,a) \quad (1S)$$

Where P is pressure, T is Temperature, X the rock composition, ω the wave frequency, μ the shear modulus, ρ the density, a the frequency exponent and ε the attenuation term, which can be defined as:

$$\varepsilon(\omega,T,a) = \frac{2}{Q(\omega,T).\tan(\frac{\pi a}{2})} \quad (2S)$$

Where Q is defined as the attenuation due to anelasticity and is calculated as:

$$Q(\omega,T) = A.\omega^a.\exp\left[\frac{a(H+P.V}{RT}\right] \quad (3S)$$

A and R are constants, H is the activation energy and V is the activation volume

For each mineral phase and pressures up to 6 GPa density ρ and M (shear modulus μ or compressibility k) can be calculated as:

$$\rho(P,T) = \rho_0.\left[1 - \alpha(T - T_0) + \frac{P-P_0}{k}\right] \quad (4S)$$

$$M(P,T) = M_0 + (T - T_0).\frac{\partial M}{\partial T} + (P - P_0).\frac{\partial M}{\partial P} \quad (5S)$$

Where α is the thermal expansion coefficient. Mineral properties α, ρ_0, M_0, ∂M/∂T, ∂M/∂P for olivine, diopside (ortopyroxene) and enstatite (clinopyroxene) were taken from Cammarano et al. (2003), for spinel from Goes et al. (2000), while A, H and V were extracted from Sobolev et al. (1996).

For each depth in the seismic tomography the algorithm calculates the S wave velocity for temperatures between 300 and 3000K in steps of 1 K and the corresponding density, storing them subsequently in a table. For the latter calculation, pressure values are converted from depth using the AK135 seismic model (Kennett et al. 1995). In each grid point, it compares the obtained velocities with the ones from the tomographic model, by performing a look- up method over the table and choosing the two closest values to the velocity from the tomography. Then it linearly interpolates the temperatures and corresponding densities to obtain the final values.

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