# Volcanic gas emissions along the Colombian Arc Segment: Implicatons for the Andean volatile budget and on-going monitoring

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Studies of spatial and temporal trends in volcanic gas compositions and fluxes are crucial to both volcano monitoring and to constrain the origin and recycling efficiency of volatiles at active convergent margins. New and updated compositions and fluxes are here reported for the Colombian Arc Segment (Northern Volcanic Zone). At Nevado del Ruiz (NdR), from 2014 to 2017, plume emissions showed an average molar $CO_2/S_T$ of 4.7 ± 1.7. Contemporary, fumarolic chemistry at Galeras progressively shifted towards low-T, S scrubbed-dominated gas discharges with a $CO_2/S_T$ average in excess of 10 (5.95 ± 1.1 in 2014). This shift in degassing behaviour is emphasized by a concurrent decrease in $SO_2$ emissions, confirmed on the 21 March 2017 by a high-resolution UV camera $SO_2$ flux of ~ 180 t/d. At NdR $SO_2$ emission levels remained high (average ~ 671 t/d) between 2014 and 2017. Carbon dioxide fluxes for NdR, Galeras and Purace of ~ 2016, 650 and 85 t/d, combined with the flux reported in [1] for Nevado del Huila (~ 860 t/d) point out that this arc segment contributes about 33% to the $CO_2$ budget of the Andean Volc. Belt [1]. Furthermore, our work highlights the northward increase in carbon-rich sediment [2] input into the mantle wedge via slab fluids and melts here demonstrated by magmatic $CO_2/S_T$ values far higher than those reported for SVZ and CVZ volcanoes (e.g. Villarica ~ 1 [1]). We estimate that about 20% (~ 1.3 Mt C/y) of the C being subducted (~ 6.19 Mt C/y from [2] and [3]) gets resurfaced through subaerial volcanic gas emissions in Colombia (NdR ~0.7 Mt C/y), which strongly suggests that the contribution from this arc segment (specially of $CO_2$) should not be underestimated.

[1] Aiuppa et al. (2019) Sci. Reports, www.nature.com/articles/s 41598-019-41901-y. [2] Plank (2013) Treatise on Geochem 2nd Ed., The Crust, 4, 607-629. [3] Jarrard (2003) Geochem. Geophys. Geosyst., 4(5), 8905.