Focussed degassing of stored carbon

T.P. FISCHER[1*], J. MUIRHEAD[2], S.F. FOLEY[3], Y. SANO[4], H. LEE[5], N. TAKAHATA[4], A. LAIZER, [6], E. KAZIMOTO [6], S. OLIVA[7], C. EBINGER[7], J. VAN WIJK[8], C. WERNER[9], A. AIUPPA[10], P. ALLARD[11], T. LOPEZ[12], J.DUFEK[13], B. MARTY[14]

1 EPS, University of New Mexico, Albuquerque, NM 87131 USA (*correspondence: fischer@unm.edu)
[2] Syracuse University, Syracuse, NY 13244 USA (james.muirhead@fulbrightmail.org)
[3] Macquire University, North Ryde, NSW, Australia (stephen.foley@mq.edu.au)
[4] AORI, University of Tokyo, Chiba, Japan (ysano@aori.u-tokyo.ac.jp, ntaka@aori.u-tokyo.ac.jp)
[5] Seoul National University, Seoul 08826, Rep. of Korea
[6] University of Dar Es Salaam, Dar Es Salaam, Tanzania
[7] Tulane University, New Orleans, LA70118
[8] New Mexico Tech, Socorro, NM 87801 USA
[9] CVO, Vancouver, WA 98683 USA (cwerner@usgs.gov)
[10] DiSTeM, University of Palermo, 90123 Palermo, Italy
[11] IPGP, 75238 Paris, France (pallard@ipgp.fr)
[12] University of Alaska, Fairbanks, AK 99775 USA
[13] University of Oregon, Eugene, OR 97403 USA
[14] CRPG- CNRS, 54501 Vandoeuvre Cedex France

Carbon (C) recycling from the Earth's surface to its interior depends on the rate of carbon subduction, carbon outgassing and deep carbon storage. New compilations on CO_2 outgassing from volcanic arcs indicate a lower CO_2 flux [1, 2] than that subducted, consistent with the idea of potentially significant C storage below arc crust [4], with only limited release of crustal carbon [5]. Over geologic times, stored C can enrich the lithosphere below continents [6]. At cratonic edges in the East African Rift massive amounts of CO_2 are released to the atmosphere [7]. Compared to the Natron-Magadi rifted region, new gas data along the orogenic-cratonic transition in the lake Manyara to Gendabi basin to the south show a decline in mantle-derived CO_2 emission, purely crustal helium, biogenic C, and low C/N and C/He, supporting the concept of focussed and variable C release. The release of this stored C allows deep melt generation and is consistent with the location of Oldoinyo Lengai and Nyramuragia, both high CO_2 emitters.

[1] Werner et al., (in press) *Deep Carbon, Past to Present Cambridge Univ. Press;* [2] Fischer et al., (in prep) Sci. Rep.; [4] Kelemen and Manning (2015) PNAS 112, E3997-E4006; [5] Aiuppa et al., (2017) Earth Sci. Rev. 168, 24-47; [6] Foley and Fischer (2017) Nature Geosci. 10, 897-902; [7] Lee et al., (2016) Nature Geosci. 9, 145-149