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Corrigendum to "Technical note: A software framework for calculating compositionally dependent in situ ^{14}C production rates" published in Geochronology, 5, 21–33, 2023

Alexandria J. Koester[1] **and Nathaniel A. Lifton**[1,2]

[1]Department of Earth, Atmospheric, and Planetary Sciences, Purdue University, West Lafayette, IN 47907, USA
[2]Department of Physics and Astronomy, Purdue University, West Lafayette, IN 47907, USA

Correspondence: Alexandria J. Koester (koestea@purdue.edu)

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The compositionally dependent in situ cosmogenic ^{14}C (in situ ^{14}C) production rates in the above-referenced publication are referenced to a geologically calibrated sea-level, high-latitude (SLHL) production rate in quartz of 13.5 ± 0.9 atoms $g^{-1}\,yr^{-1}$, as described in Sect. 3.2 of that work. That SLHL value is derived from the global calibration sample dataset developed as part of the CRONUS-Earth project (Borchers et al., 2016; Phillips et al., 2016; Schimmelpfennig et al., 2012), supplemented by in situ ^{14}C measurements from a more recent calibration site presented by Young et al. (2014) and recalculated following Hippe and Lifton (2014) (including procedural blanks). Those updated measurements were included as Table S1 in the Supplement of that publication.

However, it has come to our attention that the published ^{14}C fraction modern (Fm) values used to derive in situ ^{14}C concentrations for the Schimmelpfennig et al. (2012) and Young et al. (2014) studies (New Zealand and Greenland, respectively) in Table S1 were the raw measured values that had not been corrected for the mass-dependent graphitization blank (Donahue et al., 1990; Lifton et al., 2001, 2015, 2023) or for the sample $\delta^{13}C$ as had been assumed. The published concentrations for those studies included the relevant corrections, but the Hippe and Lifton (2014) calculations require the appropriate blank- and $\delta^{13}C$-corrected Fm values as a starting point. The concentrations we calculated from those studies in Table S1 (Koester and Lifton, 2023) are thus significantly higher than the published concentrations associated with the published Fm values. All other concentrations included in Table S1 have been corrected appropriately for the graphitization blanks and $\delta^{13}C$ values.

Samples in both Schimmelpfennig et al. (2012) and Young et al. (2014) were analyzed at the Lamont-Doherty Earth Observatory (LDEO) in situ ^{14}C lab. However, fit coefficients for the mass-dependent graphitization blank for the LDEO lab from the time of those analyses are not published (e.g., Goehring et al., 2014). We thus contacted the primary authors of both the Schimmelpfennig et al. (2012) and Young et al. (2014) studies to resolve the appropriate graphitization blank and $\delta^{13}C$ corrections (Schimmelpfennig, Irene, and Young, Nicolás, personal communication, February 2024) for both the calibration samples and the associated procedural blanks. The resulting corrected Fm values are on the order of 10 %–12 % lower than the raw published values, and yield-corrected concentrations are more in line with the original published values. We have thus updated both Table S1 as part of this corrigendum (suitable for calibration input to the University of Washington online calculator, version 3: Balco et al., 2008; http://hess.ess.washington.edu/math/v3/v3_cal_in.html, last access: 22 April 2024) and the global production rates in the make_consts_CD14C.m and consts_CD14C.mat files (Koester and Lifton, 2024) to reflect the corrected sample concentrations.

The result is that the geologically calibrated SLHL production rates for in situ ^{14}C in quartz, P_{Qcal} (Eq. 3 in Koester and Lifton, 2023), decrease from 13.50 ± 0.89 and 13.71 ± 1.20 atoms $g^{-1}\,yr^{-1}$ (before rounding to one decimal place as in the original publication) for the gridded R_C and geocentric dipolar R_{CD} records of Lifton (2016), respectively,

Table 2. Predicted modern in situ ^{14}C spallogenic production rates (at g^{-1} yr^{-1}) at SLHL from neutrons and protons in minerals and rock types considered, both theoretical (P_{CDpred}) and normalized to calibrated production in quartz (P_{CD}) using the gridded R_C record of Lifton (2016).

	Neutron P_{CDpred}	Proton P_{CDpred}	Total P_{CDpred}	P_{CD}	% Diff P_{CD} vs. P_{Qcal}
Mineral	at g^{-1} yr^{-1}	at g^{-1} yr^{-1}	at g^{-1} yr^{-1}	at g^{-1} yr^{-1}	
Quartz	15.37	0.47	15.84	12.85	0.0
Albite	15.49	0.48	15.97	12.95	0.8
Albite*	14.95	0.48	15.43	12.51	−2.6
Anorthite	13.43	0.42	13.85	11.23	−12.6
Orthoclase	13.20	0.39	13.60	11.03	−14.2
Forsterite	13.67	0.46	14.12	11.45	−10.9
Fayalite	9.01	0.27	9.28	7.53	−41.4
Wollastonite	11.85	0.36	12.21	9.91	−22.9
Augite	12.00	0.37	12.38	10.04	−21.9
Ferrosilite	10.46	0.32	10.78	8.74	−32.0
Enstatite	14.18	0.46	14.64	11.87	−7.6
Calcite	13.55	0.38	13.94	11.30	−12.0
Dolomite	14.96	0.44	15.40	12.49	−2.8
Rock					
Ultramafic	13.11	0.43	13.54	10.98	−14.5
Basalt	13.72	0.43	14.15	11.48	−10.7
Hi-Ca Granite	14.30	0.44	14.75	11.96	−6.9
Low-Ca Granite	14.52	0.45	14.97	12.14	−5.5
Granodiorite	14.27	0.44	14.71	11.93	−7.1

* Production is calculated using the spliced TENDL-2019 and JENDL/HE-2007 proton and neutron excitation functions (Na_{TJ} in text). All other Na production rates use JENDL/HE-2007 exclusively.

to the corresponding corrected values of 12.85 ± 0.88 and 13.04 ± 1.16 atoms g^{-1} yr^{-1}, respectively. Since the compositionally dependent production rate P_{CD} in Eq. (3) of Koester and Lifton (2023) linearly depends on P_{Qcal}, P_{CD} values in Table 2 of Koester and Lifton (2023) (using R_C input) should be scaled by the ratio of corrected to original SLHL quartz production rates (12.85 / 13.50), i.e., 0.952 (corrected Table 2, above). Similarly, P_{CD} values in the original Table S2 (corresponding to the P_{Qcal} value using R_{CD} input) should be scaled by 13.04 / 13.71, i.e., 0.951 (corrected Table S2). Theoretical predictions are unaffected.

In addition, the label on the ordinate of Fig. 2 in Koester and Lifton (2023) should read P_{CD} not P_{CDpred}. Plotted P_{CD} values should also be adjusted as noted above as per Table 2 (corrected); relative positions remain unchanged.

Code availability. The updated MATLAB® scripts referenced in this corrigendum are available at https://doi.org/10.5281/zenodo.11054700 (Koester and Lifton, 2024).

References

Balco, G., Stone, J. O., Lifton, N. A., and Dunai, T. J.: A complete and easily accessible means of calculating surface exposure ages or erosion rates from ^{10}Be and ^{26}Al measurements, Quat. Geochronol., 3, 174–195, https://doi.org/10.1016/j.quageo.2007.12.001, 2008.

Borchers, B., Marrero, S., Balco, G., Caffee, M., Goehring, B., Lifton, N., Nishiizumi, K., Phillips, F., Schaefer, J., and Stone, J.: Geological calibration of spallation production rates in the CRONUS-Earth project, Quat. Geochronol., 31, 188–198, https://doi.org/10.1016/j.quageo.2015.01.009, 2016.

Donahue, D. J., Linick, T., and Jull, A. J. T.: Isotope-ratio and background corrections for accelerator mass spectrometry radiocarbon measurements, Radiocarb., 32, 135–142, 1990.

Goehring, B. M., Schimmelpfennig, I., and Schaefer, J. M.: Capabilities of the Lamont-Doherty Earth Observatory in situ ^{14}C extraction laboratory updated, Quat. Geochronol., 19, 194–197, 2014.

Hippe, K. and Lifton, N. A.: Calculating isotope ratios and nuclide concentrations for in situ cosmogenic ^{14}C analyses, Radiocarbon, 56, 1167–1174, 2014.

Koester, A. J. and Lifton, N. A.: Technical note: A software framework for calculating compositionally dependent in situ ^{14}C production rates, Geochronology, 5, 21–33, 2023.

Koester, A. J. and Lifton, N. A.: nlifton/CD14C: CD14Cv1.1 (1.1), Zenodo [code], https://doi.org/10.5281/zenodo.11054700, 2024.

Lifton, N.: Implications of two Holocene time-dependent geomagnetic models for cosmogenic nuclide production rate scaling, Earth Planet. Sci. Lett., 433, 257–268, 2016.

Lifton, N., Jull, A., and Quade, J.: A new extraction technique and production rate estimate for in situ cosmogenic ^{14}C in quartz, Geochim. Cosmochim. Acta, 65, 1953–1969, 2001.

Lifton, N., Goehring, B., Wilson, J., Kubley, T., and Caffee, M.: Progress in automated extraction and purification of in situ ^{14}C from quartz: Results from the Purdue in situ ^{14}C laboratory, Nuclear Inst. Method. Phys. Res. B, 361, 381–386, 2015.

Lifton, N., Wilson, J., and Koester, A.: Technical note: Studying lithium metaborate fluxes and extraction protocols with a new, fully automated in situ cosmogenic ^{14}C processing system at PRIME Lab, Geochronology, 5, 361–375, 2023.

Phillips, F. M., Argento, D. C., Balco, G., Caffee, M. W., Clem, J., Dunai, T. J., Finkel, R., Goehring, B., Gosse, J. C., Hudson, A. M., Jull, A. J. T., Kelly, M. A., Kurz, M., Lal, D., Lifton, N., Marrero, S. M., Nishiizumi, K., Reedy, R. C., Schaefer, J., Stone, J. O. H., Swanson, T., and Zreda, M. G.: The CRONUS-Earth Project: A synthesis, Quat. Geochronol. 31, 119–154, https://doi.org/10.1016/j.quageo.2015.09.006, 2016.

Schimmelpfennig, I., Schaefer, J. M., Goehring, B. M., Lifton, N., Putnam, A. E., and Barrell, D. J. A.: Calibration of the in situ cosmogenic ^{14}C production rate in New Zealand's Southern Alps, J. Quat. Sci., 27, 671–674, 2012.

Young, N. E., Schaefer, J. M., Goehring, B., Lifton, N., Schimmelpfennig, I., and Briner, J. P.: West Greenland and global in situ ^{14}C production-rate calibrations, J. Quat. Sci., 29, 401–406, 2014.