

Interactive comment on “Technical note: in situ measurement of flux and isotopic composition of CO₂ released during oxidative weathering of sedimentary rocks” by Guillaume Soulet et al.

C. Cros (Referee)

camille.cros@inra.fr

Received and published: 30 January 2018

The main objective of this study is to present the results from a new method estimating the amount and origins of CO₂ released during the weathering of sedimentary rocks. The released CO₂ might have two origins: the degradation of limestone by sulphuric acid and the (geo)respiration of organic carbon. The method is based on a respiration chamber drilled directly on the rock. The released CO₂ is measured by following the short-term (hours) accumulation of CO₂ in the respiration chamber after lowering the pCO₂ to near atmospheric pCO₂. Three sources of CO₂ could contribute to the accumulation of CO₂ in the chamber: the atmospheric CO₂ due to possible contami-

Printer-friendly version

Discussion paper



nations and/or leaks, carbonates and organic C. These tree sources were successfully separated by analyzing the ^{12}C , ^{13}C and ^{14}C isotopic composition of released CO_2 . To this end, the CO_2 was trapped by two systems of zeolite that actively (hours) or passively (months) trap the released CO_2 . The study provides first estimations of CO_2 emissions by oxidative weathering of sedimentary rocks, which were unfortunately not compared to another method. I would say this is the main limit of this study. The isotopic analysis of CO_2 provided evidence of low contamination of sampled CO_2 by atmospheric CO_2 , which validates the tightness of respiration chamber and method of CO_2 sampling. It also allowed providing first estimation of contribution of the two mechanisms of weathering contributing to CO_2 emissions (acid degradation of limestone versus organic C respiration), which could not be compared to another method. Although the main results could not be validated by using another independent method, these first estimations are useful and timely justifying a possible publication of this manuscript in BG. However, there are major drawbacks that deserve major revisions of the manuscript. First of all, the authors should acknowledge the fact that their method is not compared to other ones and is not replicated strongly limits conclusions about the accuracy, sensitivity and reproducibility of such method. Why did you not compare the results obtained by several respiration chambers? Why did not compare your estimation of released CO_2 based on short term measurement of CO_2 accumulation in chamber with the amount of CO_2 you trapped after several months of passive CO_2 trapping by zeolite. This comparison could be a first way to evaluate your method of estimation. The method of partitioning of CO_2 sources is absolutely not well introduced and explained. For example, P5 L3-6 you should explain that these three sources of CO_2 (atmospheric, limestone, organic C) have different isotopic composition. And you should give some order of magnitude maybe. The system of equations (9) should be carefully explained, in particular all the variables must be defined (what does F_m mean?). Table 3 must include the isotopic composition of air of the site. Results and discussions must be presented in distinct sections to clearly separate facts from their interpretations (and fit to the standard of BG). To my opinion, the estimation of released

[Printer-friendly version](#)[Discussion paper](#)

CO₂ by short-term measurement should be compared to the amount of CO₂ trapped by zeolite. If this is not comparable, I expect detailed explanations of reasons. Title of section 3.3 is not clear and does not reflect the content. It seems that the objective of this section is to make a first comparison of estimation made by this study with published results from other sites. If I understand well, your estimated amounts are far above the ones present in the literature. You should give some interpretations of these differences including the fact that your method has some bias that could lead to overestimations. First, the drilling can generate hyperactive surface by providing dust (small particules with high surface areas). Second, fresh surface is rich in organic C and limestone (because not previously exposed to O₂). The CO₂ may diffuse from pores of surrounding rock to chamber signifying that the surface of rock contributing to these estimations is larger than the sole surface of chamber. Detailed comments P3L11: why did you set up these two methods of trapping? The idea must be introduced before. P4 L4. The rock-drill was used to dig a hole or a cylinder. This is only a part of the chamber. P4L24-27 The drilling makes powder that can stay on the surface. I guess that dust is highly reactive compared to rock that, has already been exposed to weather and oxidation since many years. This should be stated and discussed somewhere, maybe in the discussion section. P6 L11-14 This text has no meaning for me, could you try to better explain? Concerning this section on the estimation of CO₂ release, how did you manage the fact that released CO₂ can accumulate in water present in the rock under the form of carbonates? Equations 9. You must say that this system of three equations can calculate three unknowns: atmospheric CO₂, limestone originating CO₂, organic C originating CO₂. Define all variables. Results and discussions must be separated. That will clarify your results and explanations. P8 L18-20. Not necessary, the dissolution of CO₂ in water and formation of carbonates could lead to a non linear response. P9 L1-2 This decrease could result from an exhaustion of CO₂ of pores surrounding the chambers (at the beginning of measurement these pores contribute much to the accumulation of CO₂ in the chamber and they become empty with time). P9L17 I disagree. The amount of atmospheric CO₂ is given by your system of equations (9) P9L20

[Printer-friendly version](#)[Discussion paper](#)

Cite Table 4 P10 L10-11 You should better explain why do you make a correction for atmospheric CO₂ although this contribution was already considered in your system of equations? After reading Table 4, I understood but you should better explain in the text. P10 L21-22 Change titles, they are not helpful for the understanding. P11 L3 You should add text to explain that your method must be compared with other (direct or indirect) methods on the same site P11 L5-9. The logical link between these sentences is not obvious. P11L16 the numbers “19 to 37 gC m⁻² yr⁻¹” must be compared to “206 gC m⁻² yr⁻¹” of your study? The difference is enormous and deserves some explanations. Figure 1: I do not see what pictures B and C bring to the story. Have you checked that all the materials you use, especially the products used to seal and make tight (e.g. expansive foam etc), does not emit CO₂?

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2017-454>, 2017.

BGD

Interactive
comment

Printer-friendly version

Discussion paper

