WORMS AND MINERALS INFLUENCE THE BIOGEOCHEMISTRY AND TURNOVER OF COMPOSTED ORGANIC MATTER

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30 % of our bin could be recycled through composting.

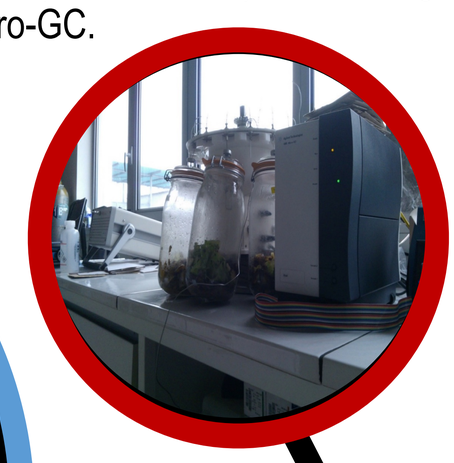
However, during composting we lose up to **70%** of carbon, mainly in form of CO_2.

In soil, worms and clays are well known to enhance ***carbon sequestration*** physically and/or chemically ***on the long term*** [1][2].

We assessed if clays and worms might reduce CO_2 emissions during composting and change the biochemical properties of the final product.

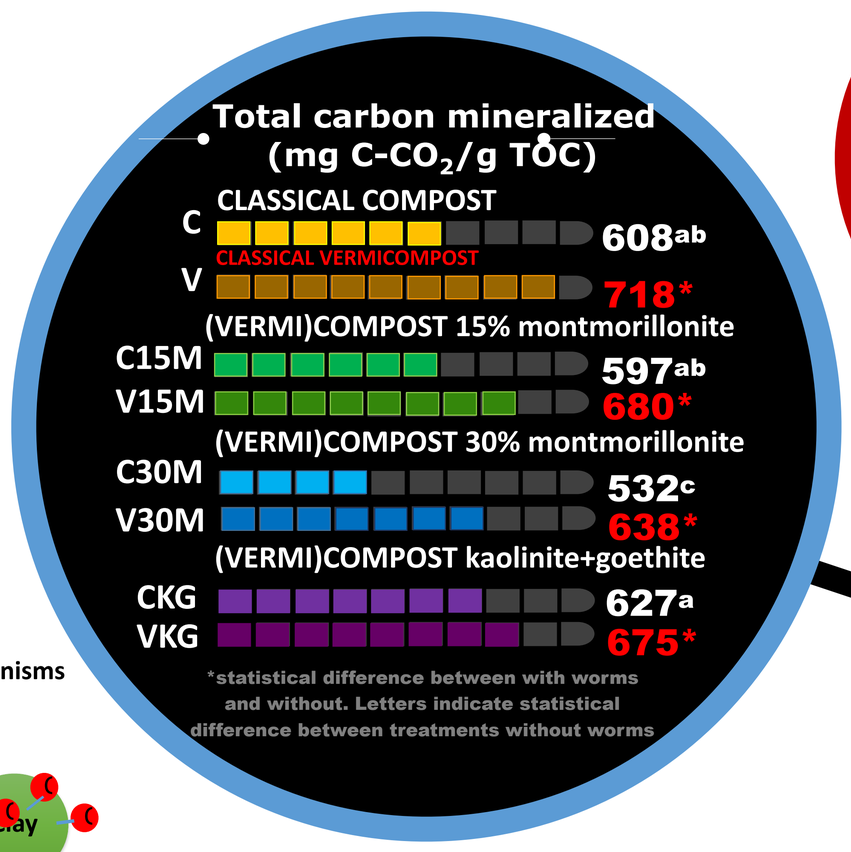
— Materials and Methods —

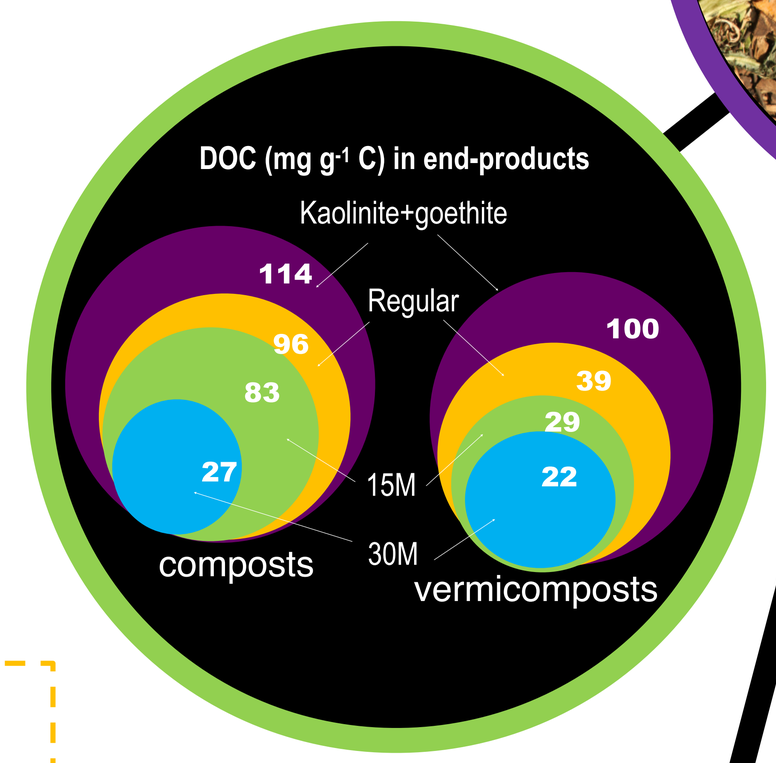
Organic household wastes were mixed with 2 different proportions of **montmorillonite**: 15% (15M) and 30% (30M) and a mixture of **kaolinite and goethite** (15%/15%, KG). Use of ***E. Andrei* as worms** (V treatments). Monitoring of carbon emissions with a micro-GC.

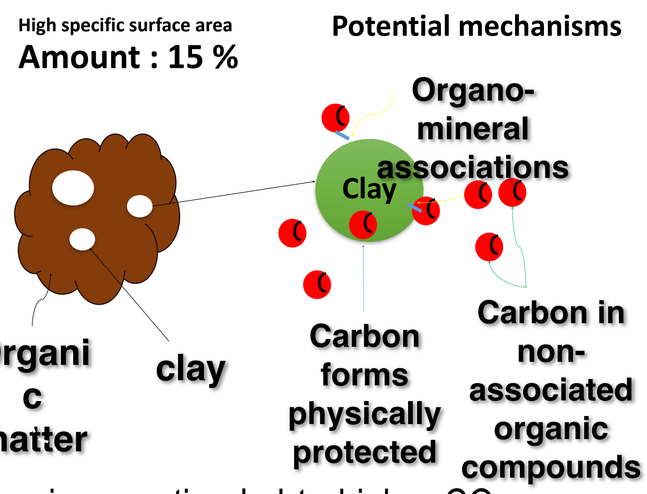


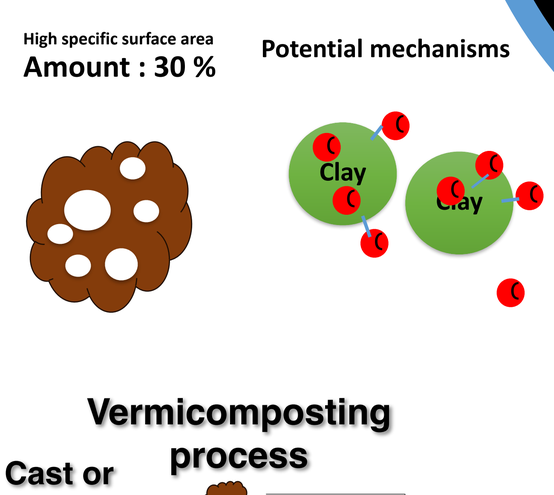
— Carbon emissions followed during 6 months —

Addition of clay reduced CO_2 emissions in both processes. The more clay we added, the more we limited emissions due to mineralization. The increase of the available specific surface area and the organo-mineral associations formed could explain these results. No significant difference was observed with 15% clay during composting compared to composting with no additives. By contrast, worm presence reduced CO_2 emissions even with 15% of clay. Due to the co-ingestion of clay and organic matter (OM), **worms may enhance the organo-mineral associations even with low mineral content.**



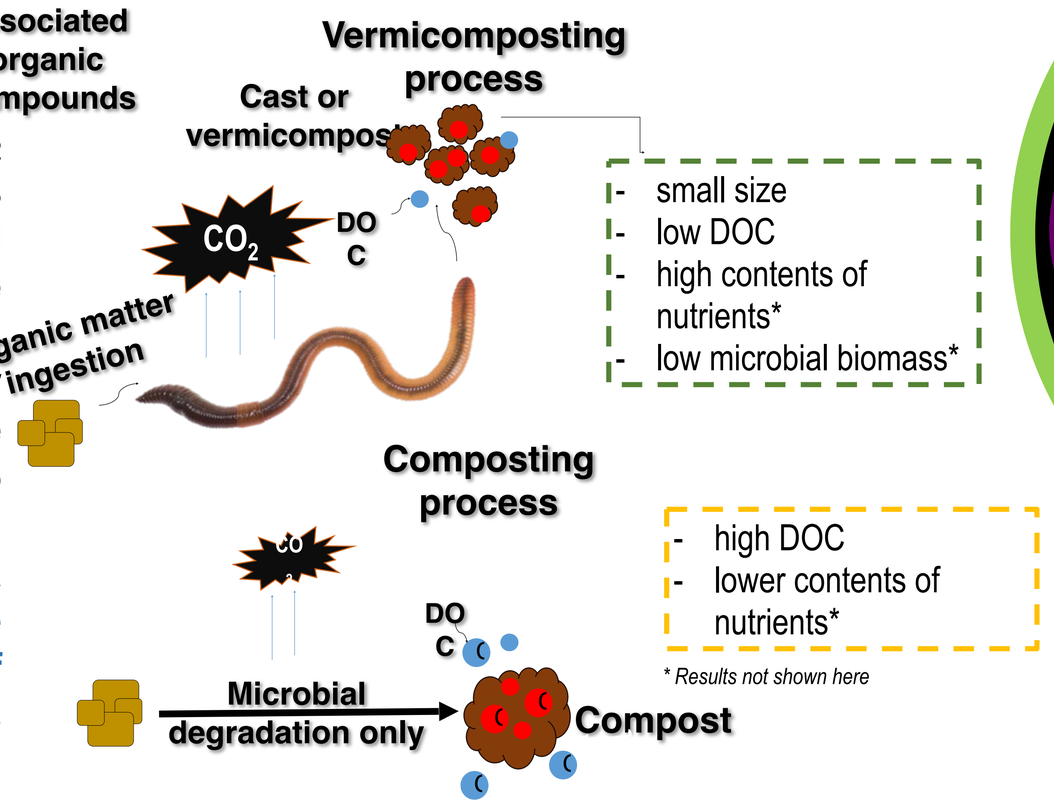






Vermicomposting led to higher CO_2 emissions than composting. Worms seemed to accelerate the OM degradation and decreased the DOC.

This hypothesis was confirmed by the estimate of the degradation rate *k* (0.0123 day^{-1} for C and 0.0145 day^{-1} for V). Thus, **vermicomposting could be a good choice to enhance the composting process in term of stability and shortening its duration.**



— ^{13}C NMR analysis and carbon stability of the final product —

The final products contained high alkyl and O-alkyl C relative proportions and low aromatic C relative mounts. Without worms, the presence of minerals slightly increased the relative amount of C-subsituted aryl C and O-substituted aromatic C (lignin, cutin, tannin,…), except with 30% montmorillonite. Thus, **complex molecules may be involved in organo-mineral associations**. With worms, higher proportions of aromatic compounds were observed with minerals, except with 30% clay. These results coupled with low DOC suggest that **cast are more stable than compost.**

CONCLUSION

Our experiments showed that clay addition is efficient at high rate (30%) to reduce CO_2 emissions during the composting process. Although , vermicomposting process emits more total CO_2 than composting, the decrease in emitted C with clay is larger when worms are present. Moreover, presence of worms leads to a more stable product than without worms. We conclude that **montmorillonite addition (30%) to vermicompost is able to reduce CO_2 emissions and increase the carbon stability of the amendment.**

[1] Bossuyt *et al* (2005) Protection of soil carbon by microaggregates within earthworm casts. *Soil Biology & Biochemistry* 37, 251-258;
[2] Kleber *et al* (2015) Mineral-Organic Associations: formation, properties and relevance in soil environments. *Advances in Agronomy* 130, 1-140

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