Stability of microbial necromass in soil is controlled by necromass chemical composition

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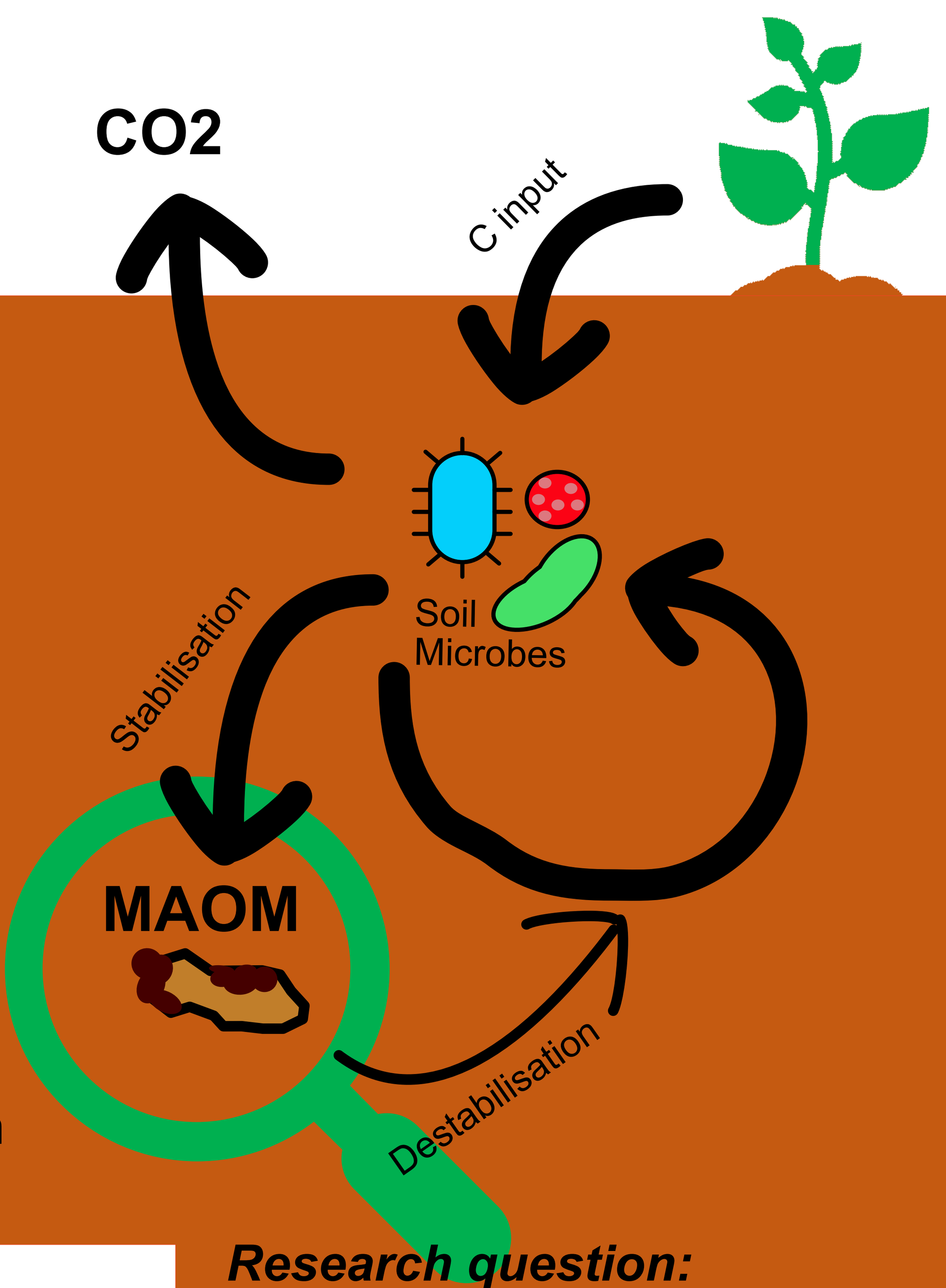
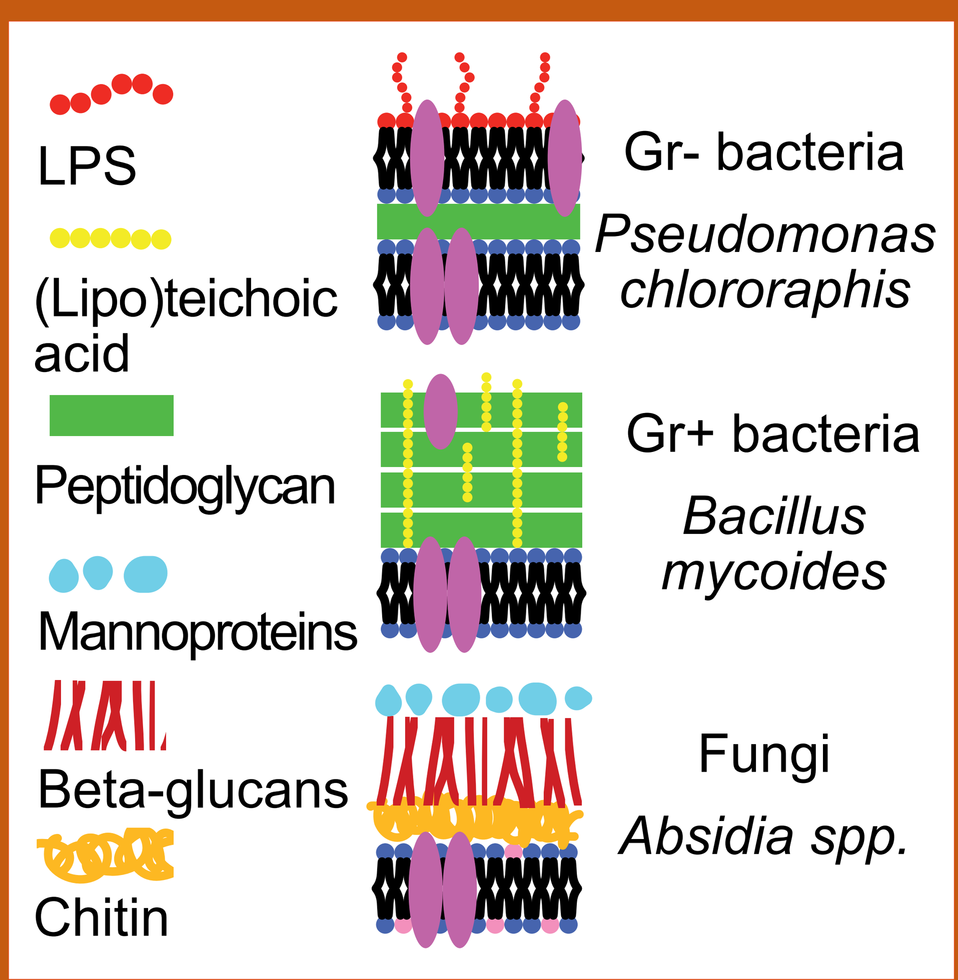


1. Background

Mineral associated organic matter is the most stable and persistent pool of soil C.

Microbial necromass dominates this persistent pool of SOC. Yet the chemical composition of soil microbes vary. How the chemical composition of this necromass OC affects the vulnerability to destabilisation of the organominerals has not been investigated.



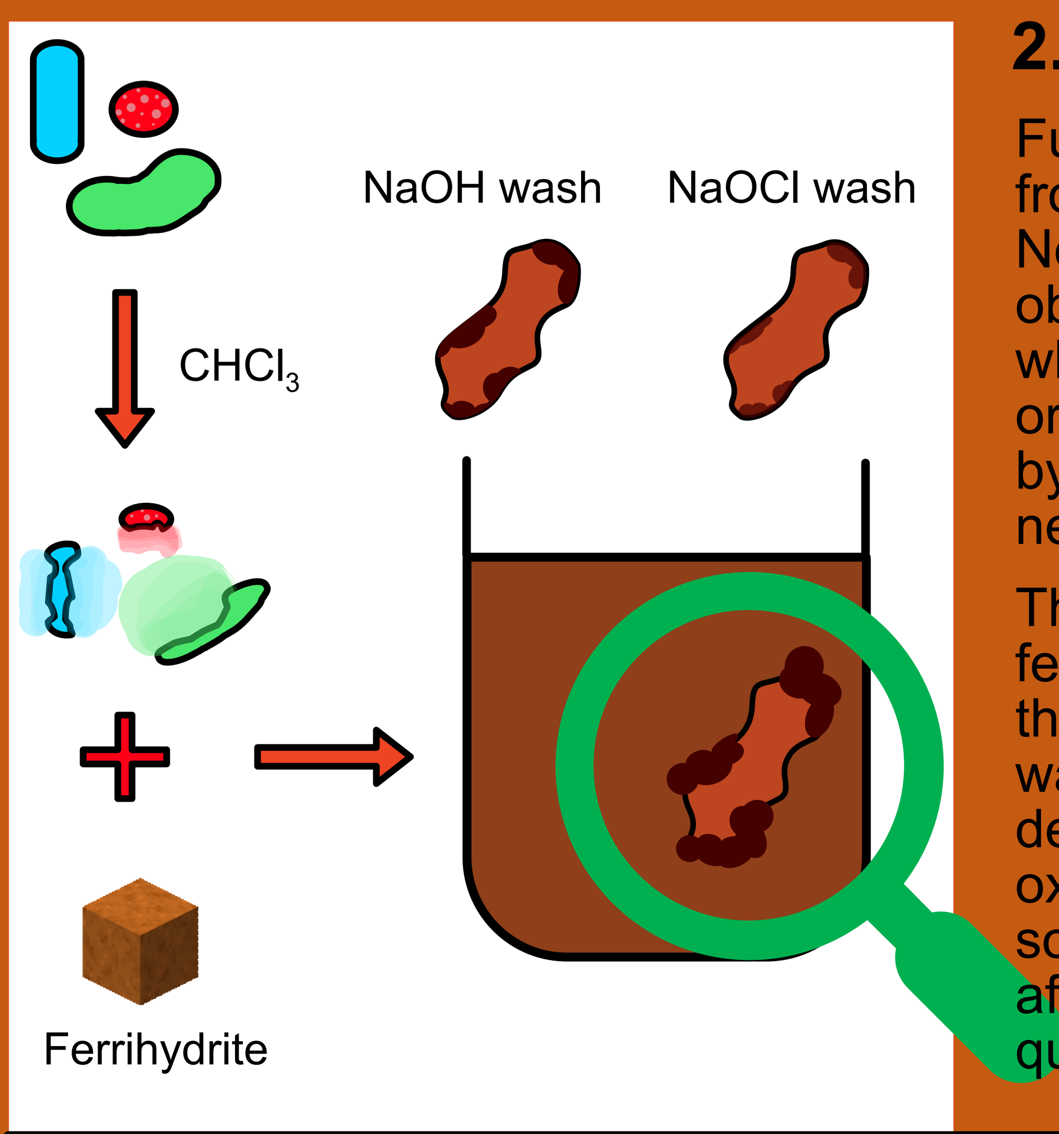
Research question:

How do differences in necromass chemical composition affect the vulnerability of the organomineral to destabilisation?

Hypotheses:

(i) Organominerals derived from fungal necromass will have greater stability than organominerals composed of Gr+ and Gr- bacteria necromass.

(ii) Necromass C with greater amount of Carboxylic acid functional groups will form more stable associations with the minerals.

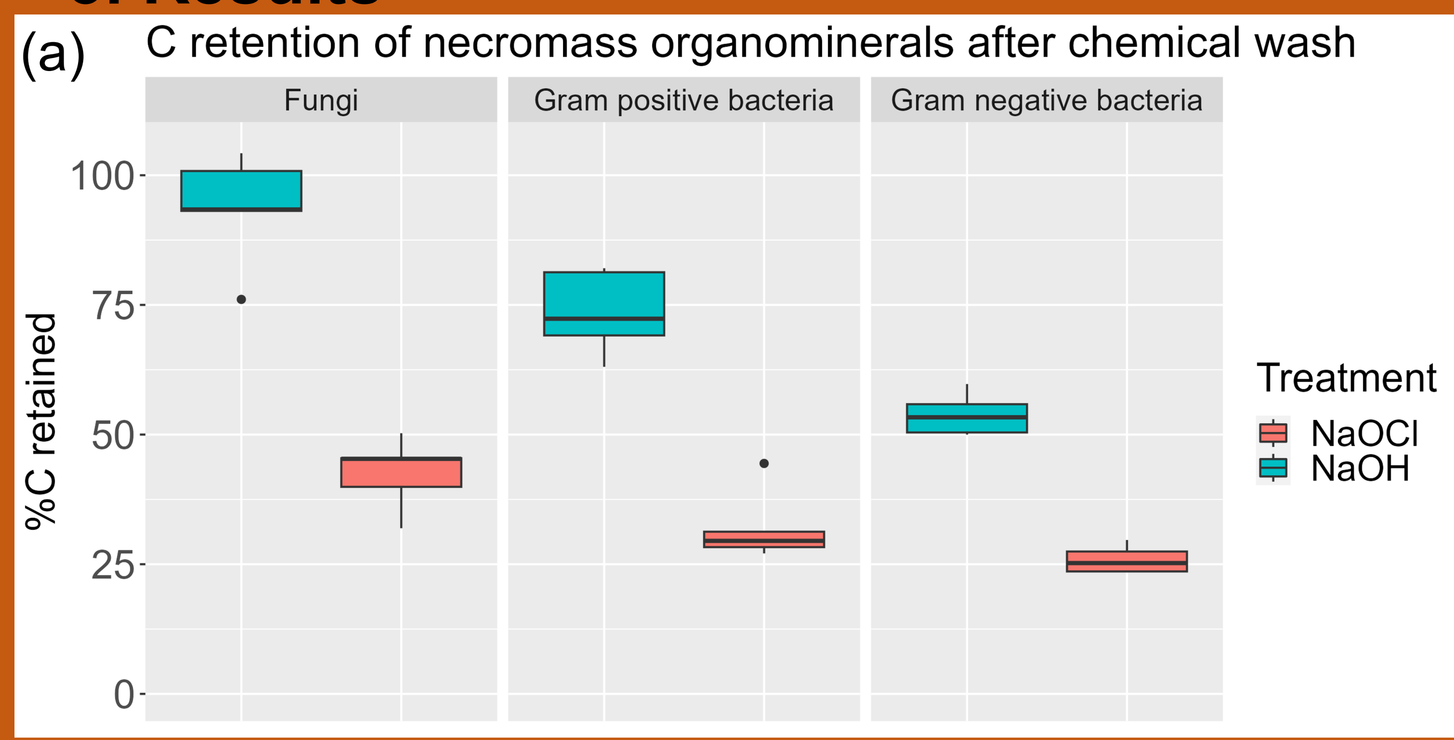


2. Methodology

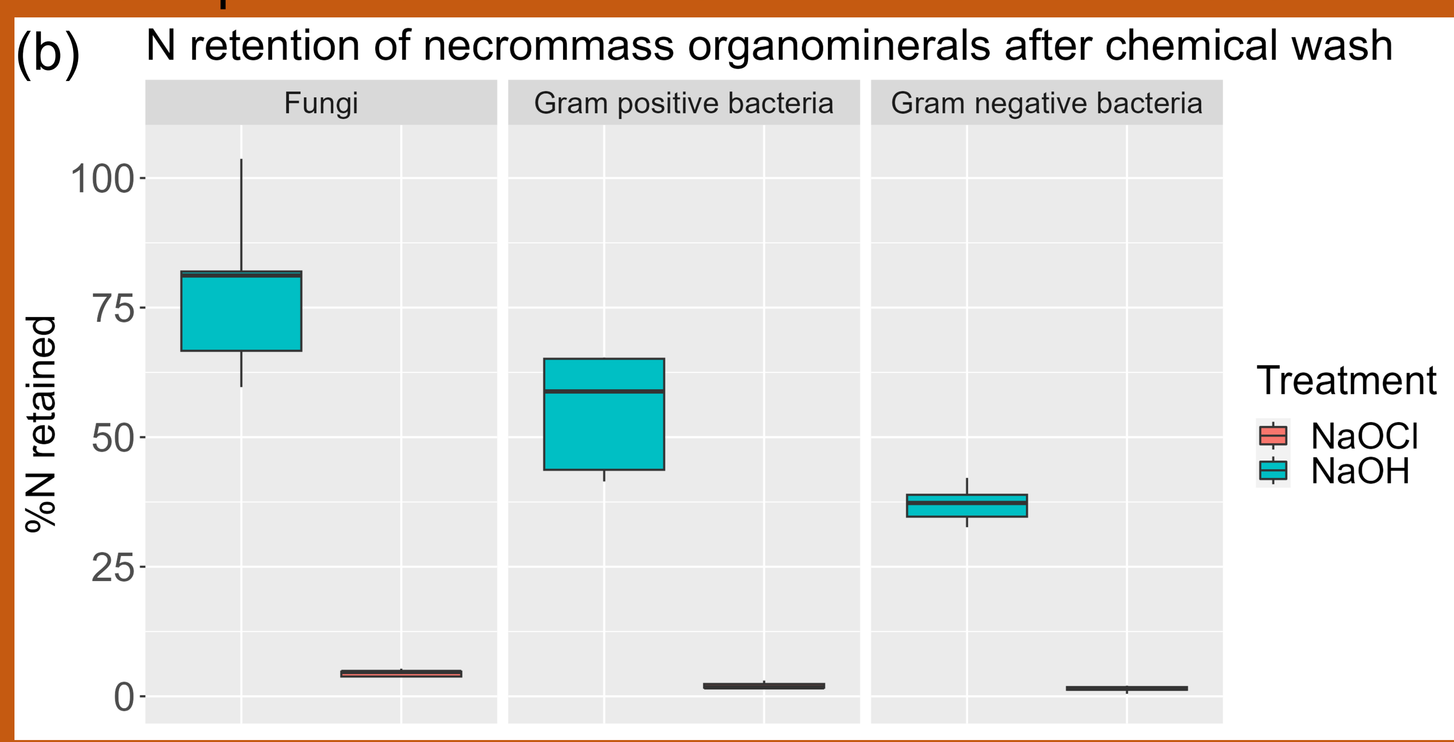
Fungi, Gr+ and Gr- bacteria extracted from soil were grown in monocultures. Necromass of these microbes were obtained through chloroform fumigation which cause cell lysis. Model organominerals were then synthesised by coprecipitating ferrihydrite with the necromass of each microbe type.

The stabilities of these necromass-ferrihydrite organominerals were tested through NaOH and NaOCl chemical washes that cause organomineral destabilisation by desorption and oxidation. Retention of C and N in the solid organominerals were measured after the chemical wash as a quantitative measure of OC stability.

3. Results

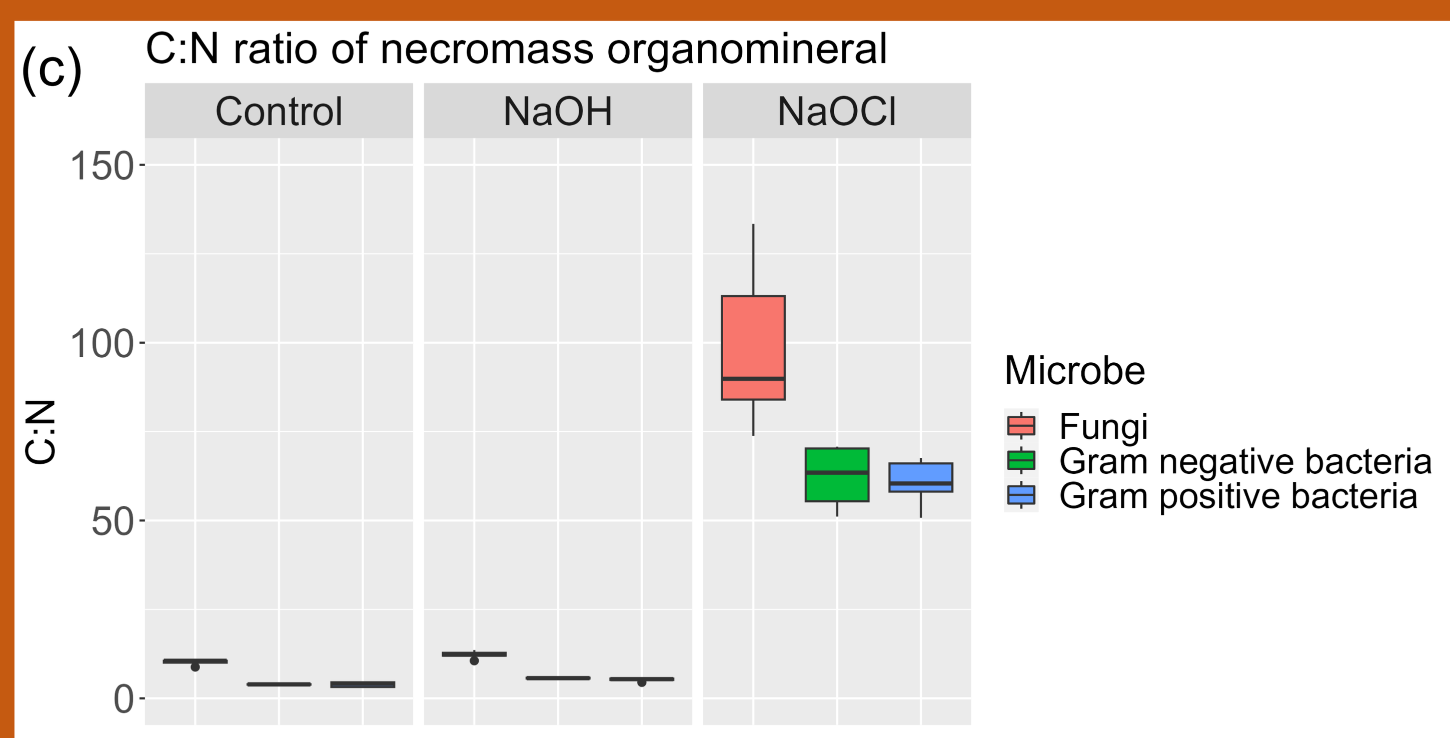


(a) Organominerals consisting of fungal necromass have greater retention of C after both NaOH and NaOCl washes compared to organominerals composed of Gr+ and Gr- bacterial necromass.



(b) Fungal necromass containing organominerals has greater retention of N components after NaOH chemical wash.

Oxidation by NaOCl appears to have removed all N containing OC across all necromass types.



(c) Oxidation by NaOCl will destabilise all but the most stable necromass C. The CN ratio of organominerals emphasize the loss of N containing OC during oxidation suggesting the most stable fraction of OC in the organomineral is C rich containing negligible N.

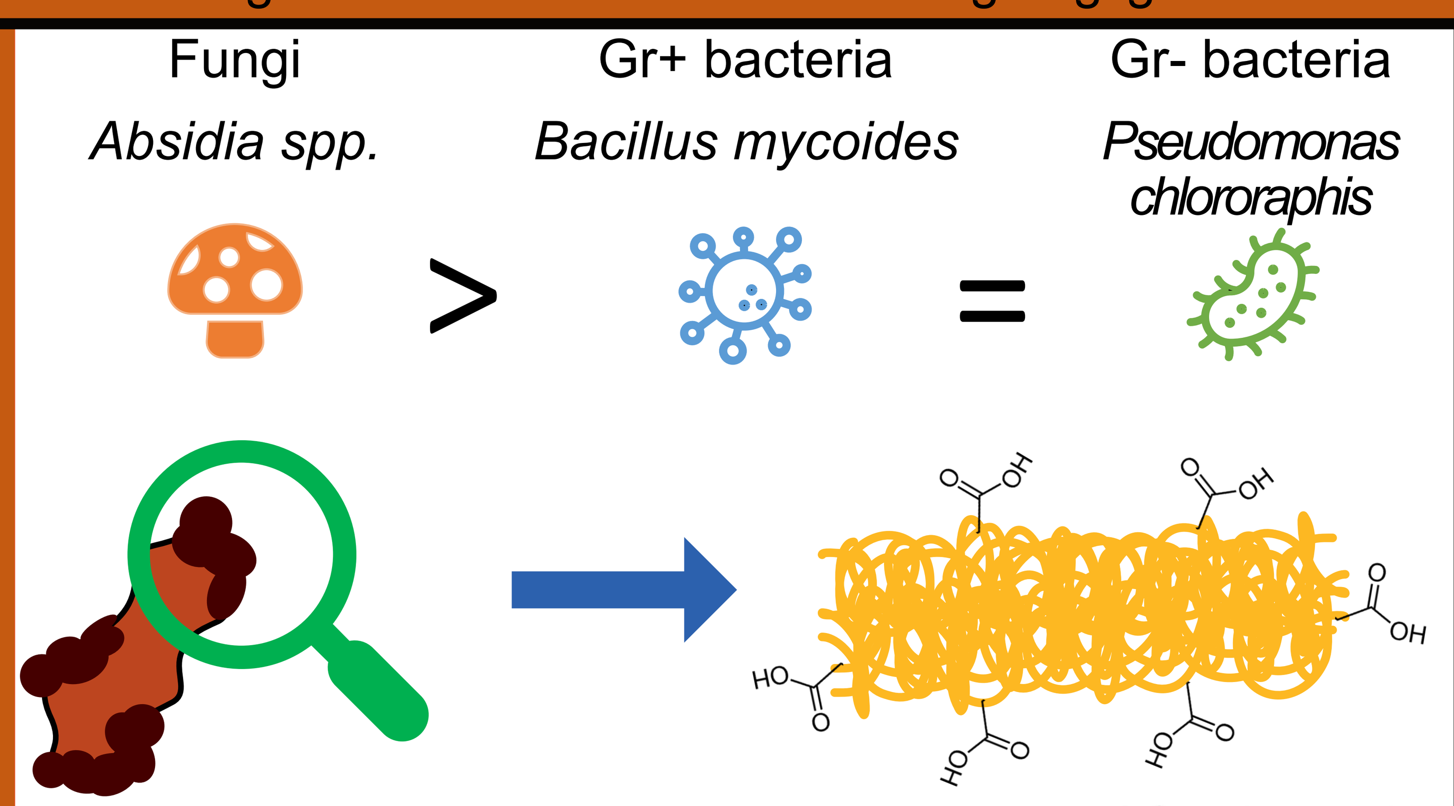
4. Conclusion

Fungal necromass organominerals appear to be least vulnerable to destabilisation when associated to ferrihydrite, compared to Gr+ and Gr- bacterial necromass.

The most stable fraction of the necromass (retained after NaOCl wash) in the organominerals are C rich and absent in N functional groups.

Further investigation will use FTIR analysis to identify the chemical functional groups present in the most stable fraction of necromass OC. It is likely that Fungal necromass is most abundant in these functional groups.

We suggest that these most stable fractions of necromass OC are carboxylic acid functional groups. Previous investigations show carboxyl groups are important in forming stable organomineral associations.



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