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a project to translate scientific papers on soil carbon for the general public, by Jack Kittredge, NOFA/Mass carbon analyst

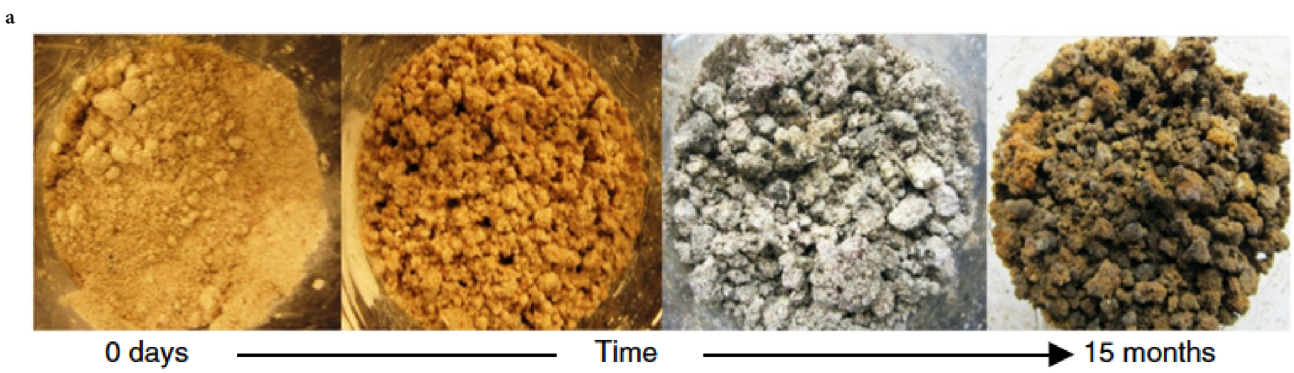
Evidence for microbial-derived soil organic matter formation

This 10-page paper by Cynthia M. Kallenbach, Serita D. Frey and A. Stuart Grandy was published in the November, 2016 ***Nature Communications, 7:13630 DOI: 10.1038/ncomms13630***

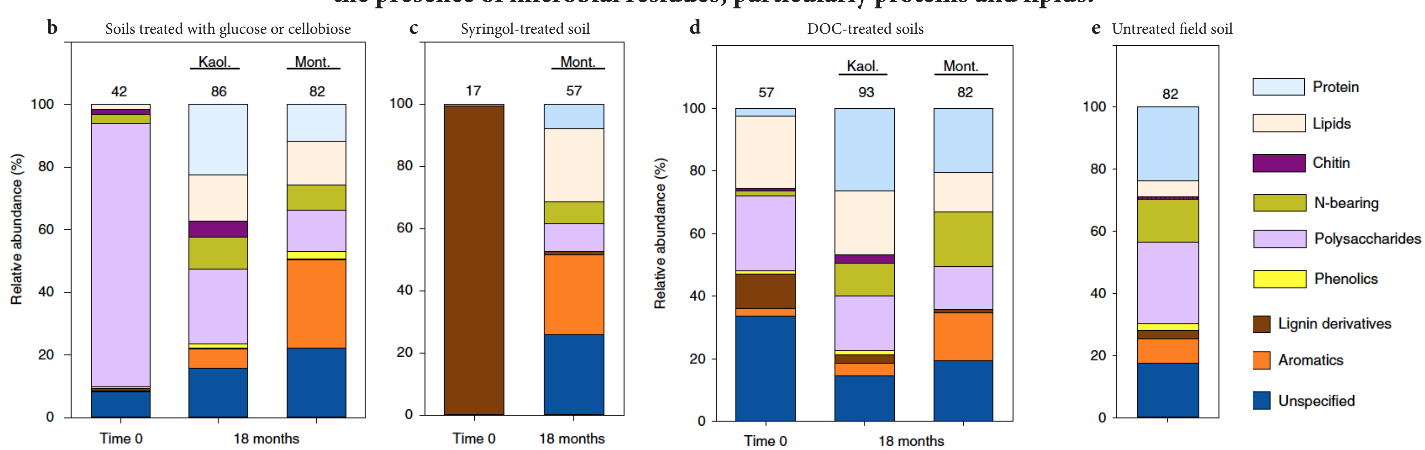
Summary: For nearly a century soil organic matter (SOM) formation has been depicted primarily as a function of the preservation of biologically stable complex plant compounds. Yet it has been known that soil microbial communities are adept at decomposing such materials, incorporating the released carbon into their microbial biomass. Due to advances in laboratory molecular analytic techniques, the role of microbes in SOM formation has been increasingly recognized. But direct evidence about the degree to which microbes are involved has been lacking. Now, a team of University of New Hampshire scientists has uncovered evidence that microbial pathways are the chief source of the organic matter found in stable soil carbon pools. They suggest that SOM is formed by residues of microbial digestion of carbon from roots and root exudates.

Procedure: The authors prepared carbon- and microbe-free soils (using kaolinite or montmorillonite clay mixed with sand) to study SOM formation. These were then incubated with natural soil microbes and for 15 weeks received weekly doses of a nutrient source combined with one of four different forms of carbon: two sugar solutions (glucose and cellobiose), syringol (a lignin compound), or dissolved organic carbon (DOC) from switchgrass tissue mixed with water.

Results: Immediately after innoculation, microbial activity was detected by measurable CO_2 respiration emissions. Within 6 months an active microbial community was established in all of the treatments except kaolinite/syringol (which was removed from the study). Visually, as time went by the model soils more and more resembled natural soil, with significant color and structural development (as seen in illustration **a** below).



Over the months of the study, visual changes in the model soils (shown above) coincided with the presence of microbial residues, particularly proteins and lipids.



In addition, the relative abundance of chemical compound groups in the model soils (b, c and d) grew to more closely resemble that of natural soil collected in an agricultural field (e).
Note the distribution of compounds in the model soils and how, over the time period of the experiment, they approximate the distribution found in the untreated natural field soil.
(Numbers above bars are the total number of identified compounds in that sample.)