

## Contribution of sclerotia of *Cenococcum* species to soil organic carbon in low pH forest soils.

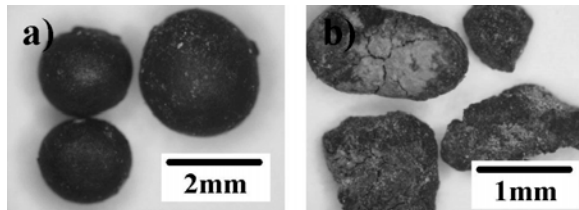
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### Recognition of sclerotia as soil organic component

*Cenococcum geophilum* is known to be one of the most frequently encountered ectomycorrhizal fungi in temperate and arctic-alpine climatic zone, and their sclerotia (figure 1) are preserved in soils with *Cenococcum* mycorrhizae [1]. Such sclerotia contain carbon (C) approximately 50% by mass and their persistence for a long term as a structural organic component in soil is known by isotopic studies, although their chemical properties are fairly different from soil humic substances [2,3]. Implication of sclerotial C was discussed from sclerotial biomass and environmental conditions in cool-alpine forest soils in central and northern Japan, and Harz Mts., Germany.



**Figure 1:** a) Spherical sclerotia of *Cenococcum* species in *Abies veitchii* forest (1740m a.s.l.) and b) non-spherical sclerotia in *Pinus pumila* forest (2740m a.s.l.) at Mt. Ontake, central Japan.

### Results and discussions

Formation of sclerotia could be considered as a primitive phenomenon in humification process under low pH condition. Sclerotial C was equivalent to microbial C comparing to [4]. C reserved as sclerotia may contribute to enlarge mean residence time of C in subalpine forest soil. Sclerotia formed in high altitude were likely to be an important source of assimilated C from host species, for micro-organisms in soils. A complementary role as C pool was suggested for sclerotia in symbiosis of plant and micro-organism .

[1] Trappe (1964) *Lloydia* **27**, 100-106. [2] Watanabe *et al.* (2007) *Eur. J. Soil Sci.* **58**, 786-793. [3] Watanabe *et al.* (2007) *Soil Sci. Plant Nutr.* **53**, 125-131. [4] Uchida *et al.* (1998) *Ecological Res.* **13**, 17-26

## Effects of pH and silica on the polymerisation rate of an amino acid

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In the chemical evolution of life, amino acids should be polymerised into peptides. Although it is known that solution pH and presence of minerals significantly influence polymerisation rates, quantitative effects of pH and minerals have not yet been investigated. In this study, the effects of pH and silica on the polymerisation rates of an amino acid (glycine: Gly) were quantitatively evaluated.

8.0ml of 100mM Gly or 50 mM GlyGly solutions, having pH from 6 to 9, were put into Teflon bottles and heated at 140 degree C from 1 to 14 days. After heating, concentrations of glycine (Gly), glycylglycine (GlyGly) and diketopiperazine (DKP) were measured by liquid chromatography (LC).

In this study, the following reaction pathways are assumed: Gly to GlyGly (the second order reaction), GlyGly to DKP (the first order reaction), DKP to GlyGly (the first order reaction), GlyGly to Gly (the first order reaction). Results of heating experiments on Gly and GlyGly solutions were fitted by the above four reactions to obtain corresponding rate constants.

GlyGly formation rate constants increased for increasing pH. Dissociated species of amino acids are known to change from zwitterion to anion with increasing pH. The deprotonated anionic amino group is considered to have higher reactivity and so is favourable for peptide formation.

Amorphous silica was then added to the above experimental systems. The GlyGly formation rates with and without silica will be compared and roles of mineral surfaces will be discussed.