Starch Degradation by Microbial Communities in Soils from Oldupai Gorge (Tanzania)

Tolutope Akeju (MSc student)
Julio Mercader (PI, Co-advisor)
Peter Dunfield (PI, Advisor)

Project Description

The taphonomy behind ancient starch preservation is very poorly understood in archaeological contexts. This understanding could be aided by biogeochemical experimentation in controlled laboratory environments to isolate degradation pathways in soils, and how this degradation is affected by biotic and abiotic variables.

The aims of this project were to:

- 1) Identify and characterize bacterial and fungal species responsible for the degradation of starch in Tanzanian soils
- 2) Determine how factors such as the starch source, soil water, and soil aeration affect the activity of these microbes
- 3) Observe the alterations of starch granules inflicted by degradation by different microbial communities.

Field and laboratory studies were designed to achieve these objectives:

In the field, bulk soil samples (not adjacent to plant roots/tubers) and tubersphere soil samples (attached to starchy plant tubers) were collected for analysis of microbial communities via high-throughput sequencing of soil microbial DNA.

Laboratory analysis of these samples is ongoing, but initial results suggest that particular starch-degrading microbes associate with particular starchy tubers. Secondly, controlled laboratory microcosms of soils amended with various starch types were incubated under different conditions. The microbial communities degrading the starch were followed over time via DNA sequencing and the starch taphonomy observed microscopically. These studies have shown that hardy, spore-forming bacteria of the phylum Firmicutes dominate starch-degrading microbial communities in the Tanzanian soils, but that the specific species change depending on experimental variables. The soil conditions and the source of the starch dramatically affected both the degradation rate and the specific microbial species involved. These findings suggest that starch degradation and taphonomy may be site-specific, that certain starches may be more prone to preservation than others may, and that starch-degradation studies using model organisms may not always be representative of the field conditions.