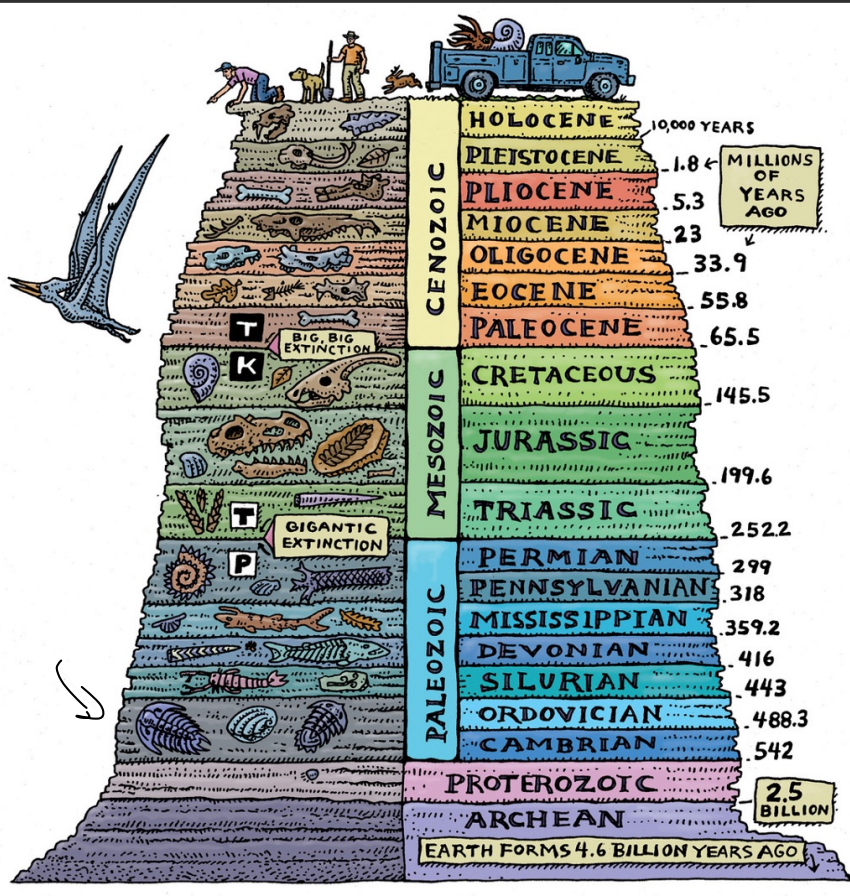




B. cl = q; ca] S-] crust





← Cambrian - Ordovician
 ← First life
 3.5 BYA



① Environment of Early Life on land

→ High CO_2

→ Warm

→ ↑ Precip

→ Dry

→ High UV — Damages DNA

Biological Soil Crusts

BSC

- Mosses, lichens, cyanobacteria

living in a colony on the
surface of or top mm of soil

Cryptobiotic Soil



BSC



Biological soil crusts (biocrusts) result from an intimate association between soil particles and differing proportions of photoautotrophic (e.g. cyanobacteria, algae, lichens, bryophytes) and heterotrophic (e.g. bacteria, fungi, archaea) organisms, which live within, or immediately on top of, the uppermost millimetres of soil. Soil particles are aggregated through the presence and activity of these often extremotolerant biota that desiccate regularly, and the resultant living crust covers the surface of the ground as a coherent layer (Webber et al. 2022)

Cyanobacteria

↳ Blue-green algae

— Photoautotrophic organism

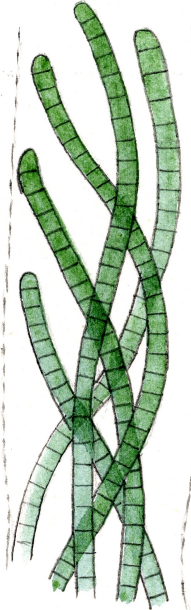
that is a colony of

single celled algae

↳ Most common soil
cyanobacteria

Microcoleus vaginatus

Microcoleus

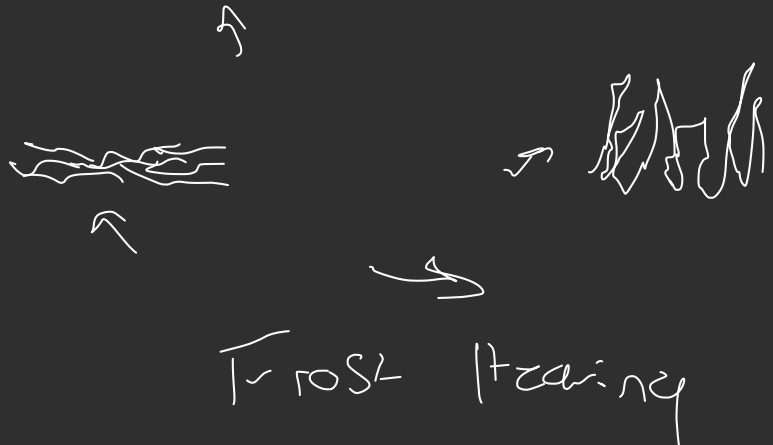


Nostoc

Sunscreen

- Black pigmented

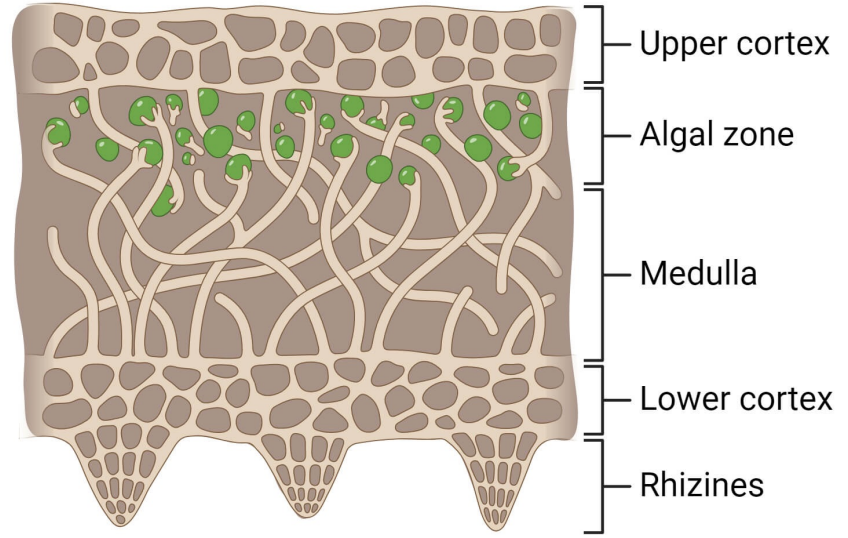
Cyanobacteria that
forms dense mats
on soil surface



Lichen

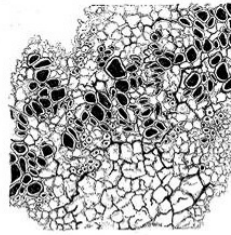
- Photoautotrophic
- Symbiosis between
fungi and an alga
↓
Energy
- ↓
Protection from UV

Lichen Cross Section

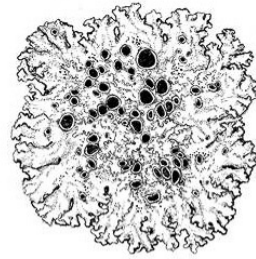


Growth forms

Illustrations by K. Beigel



crustose



foliose



fruticose



↖ ↑

Crust-like

one side visible

lobe-like,
two sides
visible

↖ ↑

branching

3D-structure

BSC →



Elk Lichens



Moss

Photoautotrophic

Non-vascular plants

↳ Bryophytes



Poikilohydric

↓
variable ↓
water

→ Equilibrate their water status with their environment



Maintain living status w/o water

→ Anhydrobiosis

Asexual Reproduction

Totipotent cells



Any cell can
develop into a
diverse array
of cell types

Sexual Reproduction

→ Sheet of water
for sperm to
swim in





AWNS
Condensation nuclei

Benefits of Crust



Increase soil
water infiltration

Cyanobacteria

Filaments

aggregate and

stabilize soil



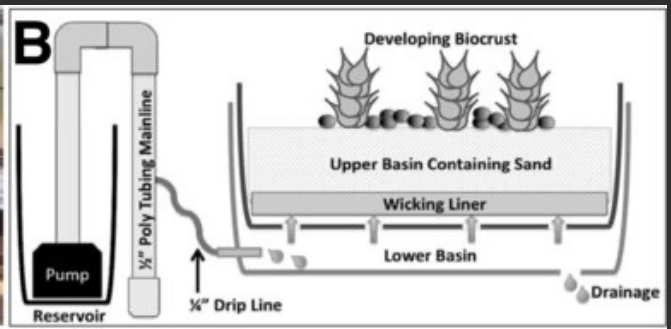


Banker Lab

vs Crust

Restoration

6 months →



How long for crust to grow?

S - 10,000 years

McMurdo



Martian

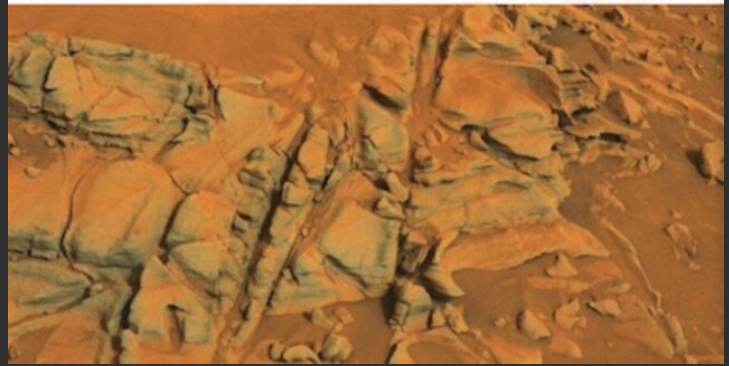
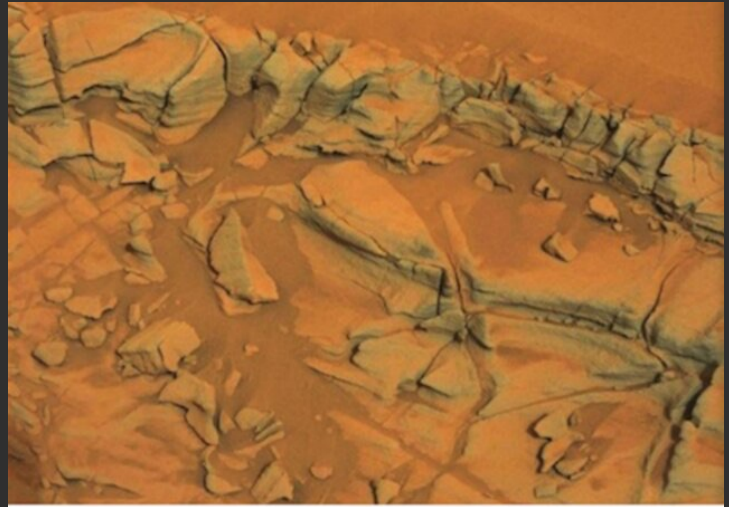
(cyanobacteria?)



OR

Martian

Salt Crystals?



Crust Succession



→
Bare
Soil



Microorganisms
5-10 yrs



Webbed Crust
10-100 years



Patchy Crust
100-1000 yrs



Mass Crust
1000-10000 yrs