

# Soil Chromatography: making & reading



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# What is Soil Chromatography?



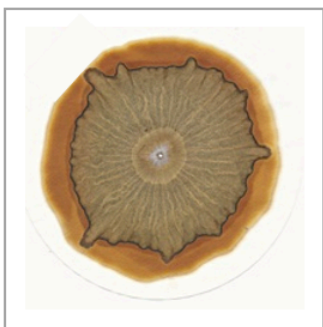
Soil Chromatography is an alternative photography process that creates a 'soil portrait' on light sensitive filter paper. Soil is dissolved in a solution of sodium hydroxide. A paper wick then facilitates the absorption and diffusion of minute soil particles in a radial form.

## Brief History



It was first developed in 1953 by Ehrenfried E. Pfeiffer, a German soil scientist and advocate for biodynamic farming. Pfeiffer's Circular Chromatography (PCC) became an inexpensive means for farmers and composters to view a snapshot of the biological activity and health of soil, compost, plants, and food.

## Uses & Applications



Soil chromatography is an accessible means for assessing soil structure, general health of soil, minerals available for the plant, biological diversity, or organic matter content and humus available. It also assesses the fertility of the soil through the integration of previous elements. It is also formally beautiful!

# Getting Started

## How to make soil chromatograms

Briefly, soils are placed in a solution of sodium hydroxide which is applied to circular filter paper that has been treated with silver nitrate. The soil mixture is poured into a petri dish and is drawn up through a wick inserted through the middle of the filter paper. The different elements in this soil mixture move through the paper at different rates through capillary action, resulting in distinctive patterns.

## What You Need

- **Paper:** General Purpose Filter Paper Disks & Strips (High purity, cotton-cellulose)
- **Chemicals:** Sodium Hydroxide & Silver Nitrate, Purified Water
- **Vessels\*:** small jars, large glass jar, glass petri dishes
- **Tools\*:** kitchen scale, pipettes measuring in mL, mortar and pestle, fine mesh sieve, scissors

**\* None of this equipment should be brought back into the kitchen or in contact with food after use in this process!**

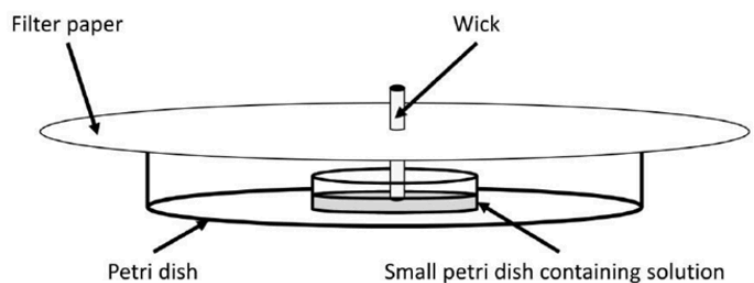
## Gathering Soil

First, brush aside any surface debris (such as plant material, mulch, as well as the first centimeter of topsoil) before inserting either a sharp spade, long knife, or trowel into the earth. Next, take a core sample or slice, about 10 cm deep, from the area you want to collect. Be sure to break up any lumps, removing all stones, critters or other material that is not soil, gathering at least 10 grams worth of soil.

## Infusing filter paper with Silver Nitrate

Holding the edges of the paper, pierce a small hole in the centre\* of the disk. I find that using a sharp exacto knife will enlarge the hole so that a paper wick can easily be inserted. Make a 2 cm wick by rolling a 2 cm x 3m piece of the filter strip. Fill a small petri dish half to two-thirds of the way full with a 0.5% silver nitrate solution (.5g of  $\text{AgNO}_3$  in 100 ml purified water) You can use a larger petri dish to stabilize the paper, as in the diagram below but I don't find it necessary if you centre the wick in the small dish. Allow the solution to soak through the filter paper until it is 1-2mm short of the 4cm mark. Remove the paper from the petri dish, extract and discard the wick, place the filter paper on a clean sheet of paper in a dark room and allow to dry overnight.

\* If you fold the disk into equal quarters, the corner created will be your centre. This can be used as a template, so you don't crease the chromatograms.



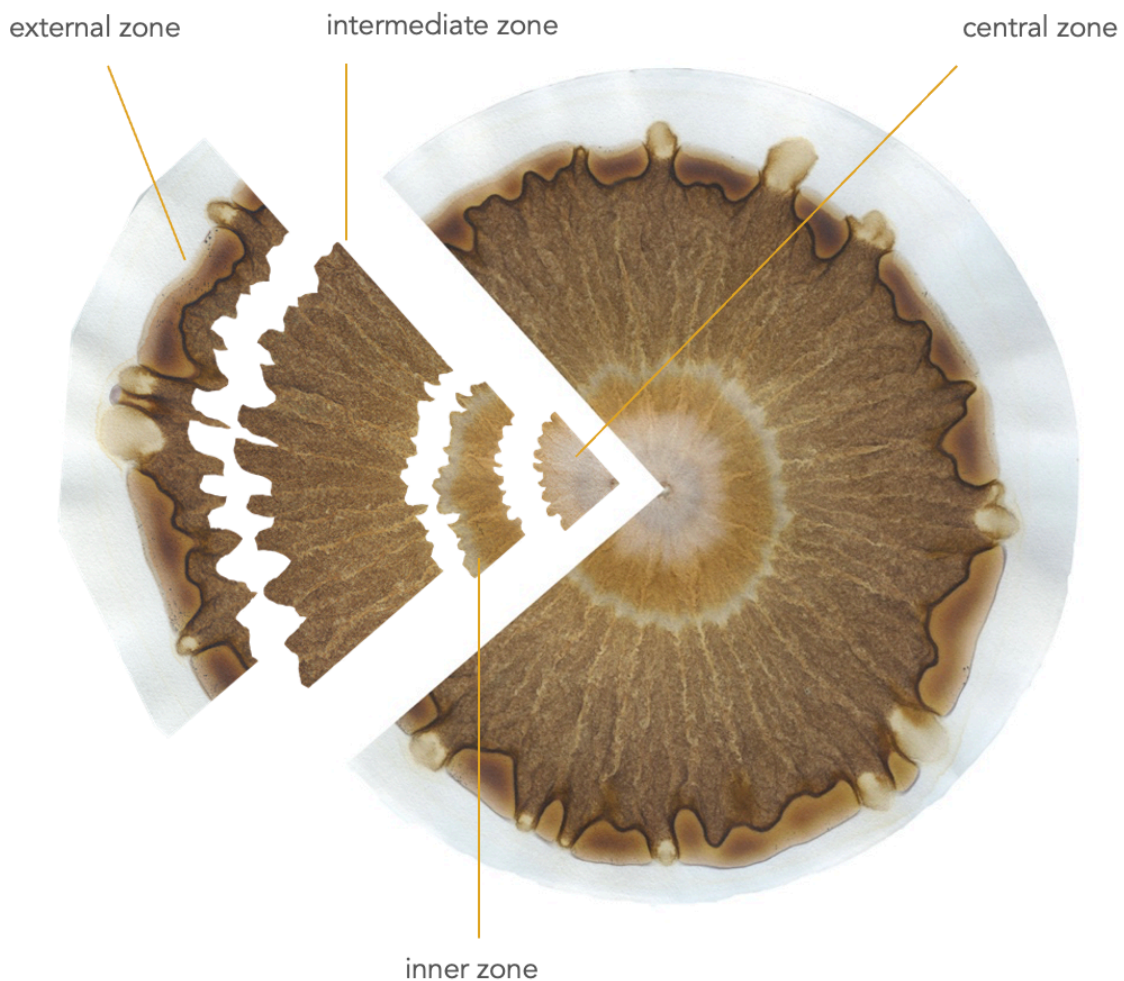
## Soil Preparation

The collected soil should be fully dried. First sieve to remove particles greater than 2mm, then finely ground using a mortar and pestle or equivalent. Once ground, 5g of soil is to be placed in a container with 50mL of 1% sodium hydroxide solution (1g NaOH in 100ml distilled water) to digest. After 15 minutes, swirl the solution and leave to rest for one hour, then swirl again. Leave digest to rest for a further five hours.

## Introducing the Soil Solution

Carefully decant 10 mL of the sodium hydroxide soil solution into a small petri dish, ensuring no soil is transferred, and put the petri dish in a larger one if using. Insert a wick into a dried filter paper which has been infused with silver nitrate, and place this over the large petri dish (if using), ensuring the wick is in the sodium hydroxide solution. Allow the digest solution to spread until it is 3-5 mm short of the edge of the paper, then remove the filter paper from the petri dish, discard the wick. Attach the chromatogram to a light filled window and allow to develop for 3 to 5 days.

## The zones of a chromatogram





## Identifying Chromatogram Components

**Central zone:** Patterns in the central zone inform about the presence of minerals and identifies oxygenation of soil.



**Inner zone:** This area identifies mineral content and fungal activity.



**Intermediate Zone:** Structure indicates the presence of proteins, organic carbon and organic matter (minerals and humus).



**External Zone:** "Clouds" at the ends of spikes indicate available nutrients. Bacterial enzyme activity is displayed in this zone.



### Other Characteristics to Consider:

- Greater number of channels suggests increased organic matter and nutrients. Channels extending across zones indicate integration of soil components.
- Greater number of spikes suggests increased organic matter and nutrients. Well-developed spikes are thought to represent healthy soil.
- Warm colours (gold, red, yellow, orange, cream) and/or high colour intensity indicate healthy soil. Colder colours (grey, dark brown, or blueish) suggest soils with less microbial activity.
- Strong rings indicate possible excess of soluble minerals

## Compiled from the following Reference Materials:

Soil Chromatography with Eugenio Gras:

<https://www.milkwood.net/2011/11/06/soil-chromatography-with-eugenio-gras/>

Using paper chromatography for assessing soil

Health: [https://torbaycatchment.org.au/wp-](https://torbaycatchment.org.au/wp-content/uploads/2019/07/Using-paper-chromatography-for-assessing-soil-health-compressed-1.pdf)

[content/uploads/2019/07/Using-paper-chromatography-for-assessing-soil-health-compressed-1.pdf](https://torbaycatchment.org.au/wp-content/uploads/2019/07/Using-paper-chromatography-for-assessing-soil-health-compressed-1.pdf)

Chromatography Applied to Quality Testing by Ehrenfried Pfeiffer

University of Western Australia publication: Interpreting

Chromatograms:

[http://www.cenrm.uwa.edu.au/\\_data/assets/pdf\\_file/0007/3098545/4-Interpreting-Chromatograms-booklet-print.pdf](http://www.cenrm.uwa.edu.au/_data/assets/pdf_file/0007/3098545/4-Interpreting-Chromatograms-booklet-print.pdf)

## Disclaimer:

While I've tried to compile research to the best of my ability, the information contained in this booklet is for general information purposes only.

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