CD ประกอบคำสอนวิชาจุลสัณฐานดิน

โดย

นายประมวลพงษ์ สินธุเสน

สำนักวิทยาศาสตร์เพื่อการพัฒนาที่ดิน
กรมพัฒนาที่ดิน
กระทรวงเกษตรและสหกรณ์

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Division of Soil Mineralogy and Soil Micromorphology

Soil micromorphology is the systematic study of the arrangement of the soil constituents and associated pore in an undisturbed state of the soil at a particular time (Kubiena, 1938)

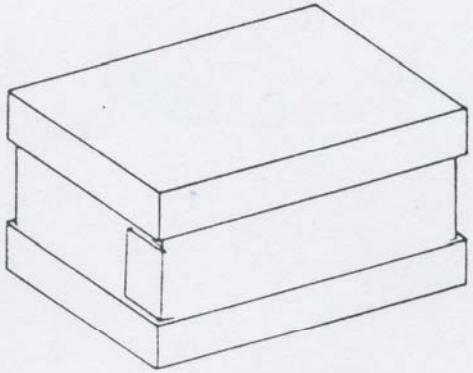
Historically, micromorphology has focused on the genesis and classification of soil

Soil Sampling

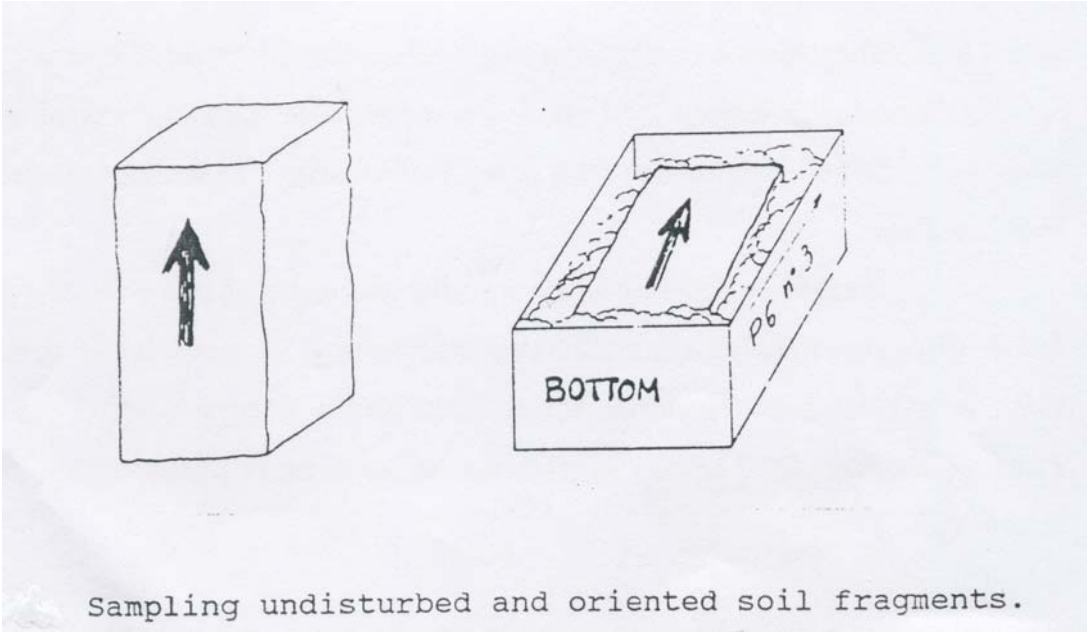
Equipment

- Kubiena boxes, 10x5x3.5 cm.
- Trowel or knife
- Paper tape
- Marker

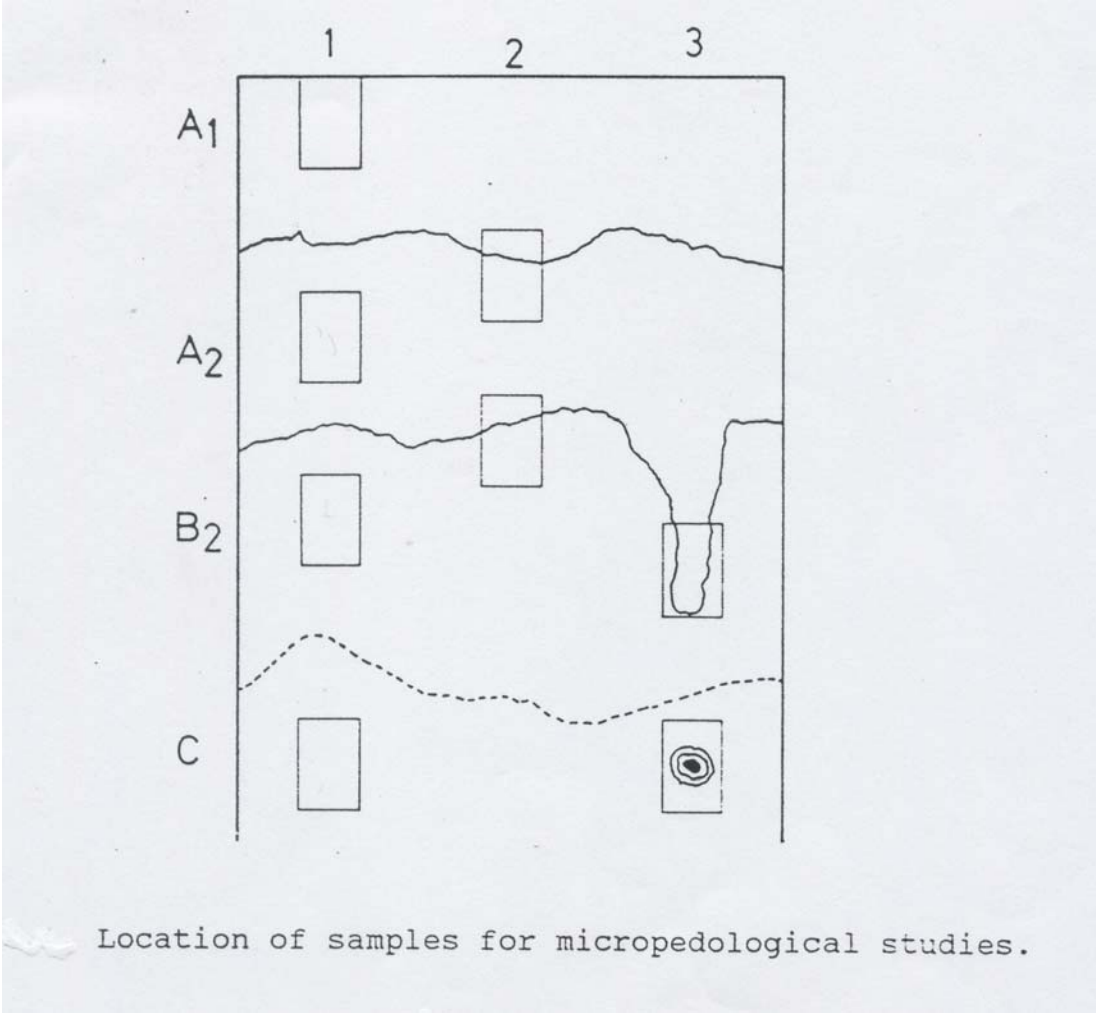
KUBIENA BOX



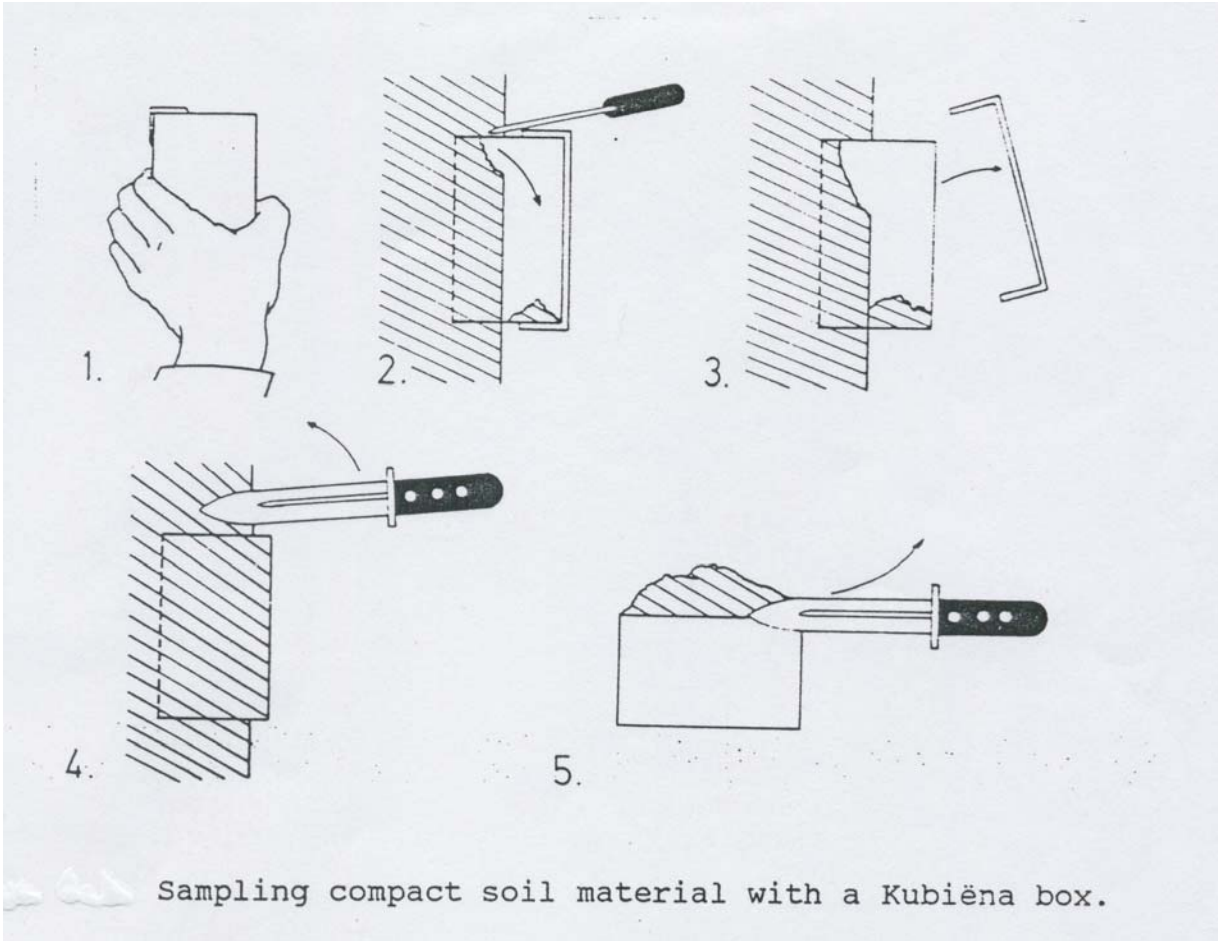
Kubiëna box.



Sampling undisturbed and oriented soil fragments.



Location of samples for micropedological studies.



Sampling compact soil material with a Kubiëna box.

Preparation of the samples

1. Transferring the specimen to the impregnation mould
2. Removal of water (drying)
   - –by oven drying
   - –by replacement with pure acetone

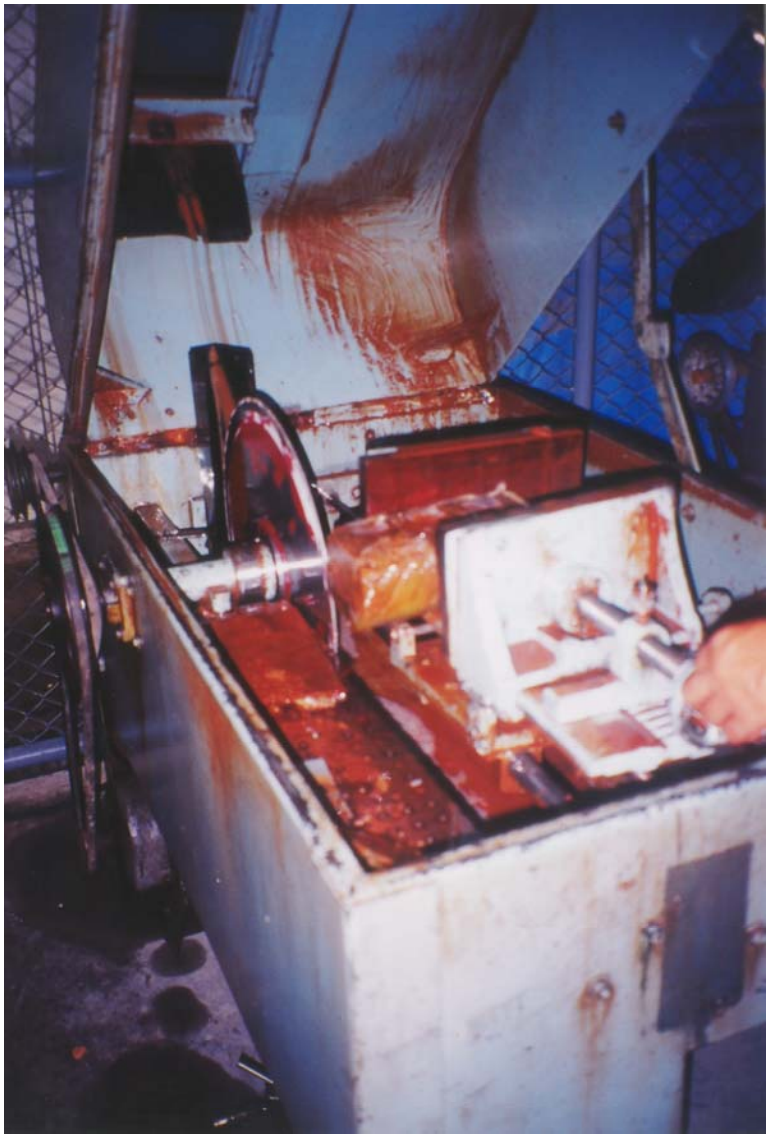
3. Impregnation

- –Impregnating mixtures : –
  - –plastic resin
  - –styrene monomer
  - –benzoyl peroxide
- –Vaccum impregnation

4. Sawing the impregnated block

5. Cutting


6



6. Lapping

7. Polishing

8. Mounting

Fixation mixtures

–plastic resin

–cobalt solution

–hardener

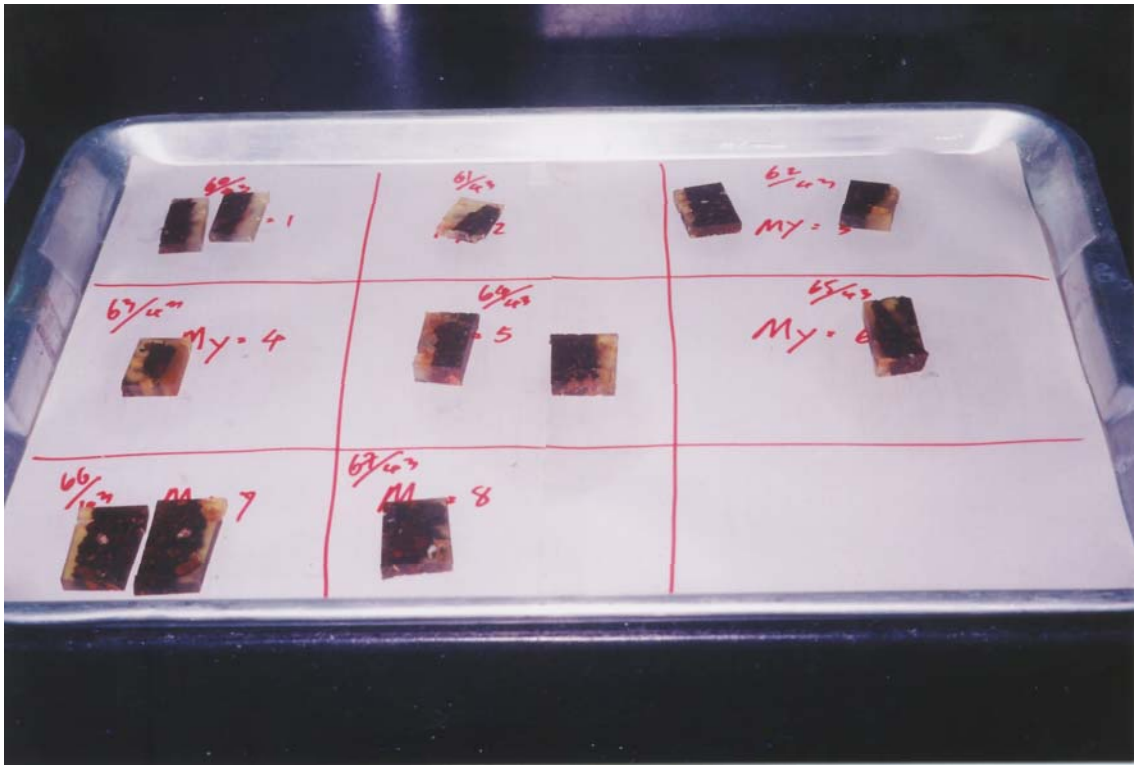
9. Cutting off the excess specimen

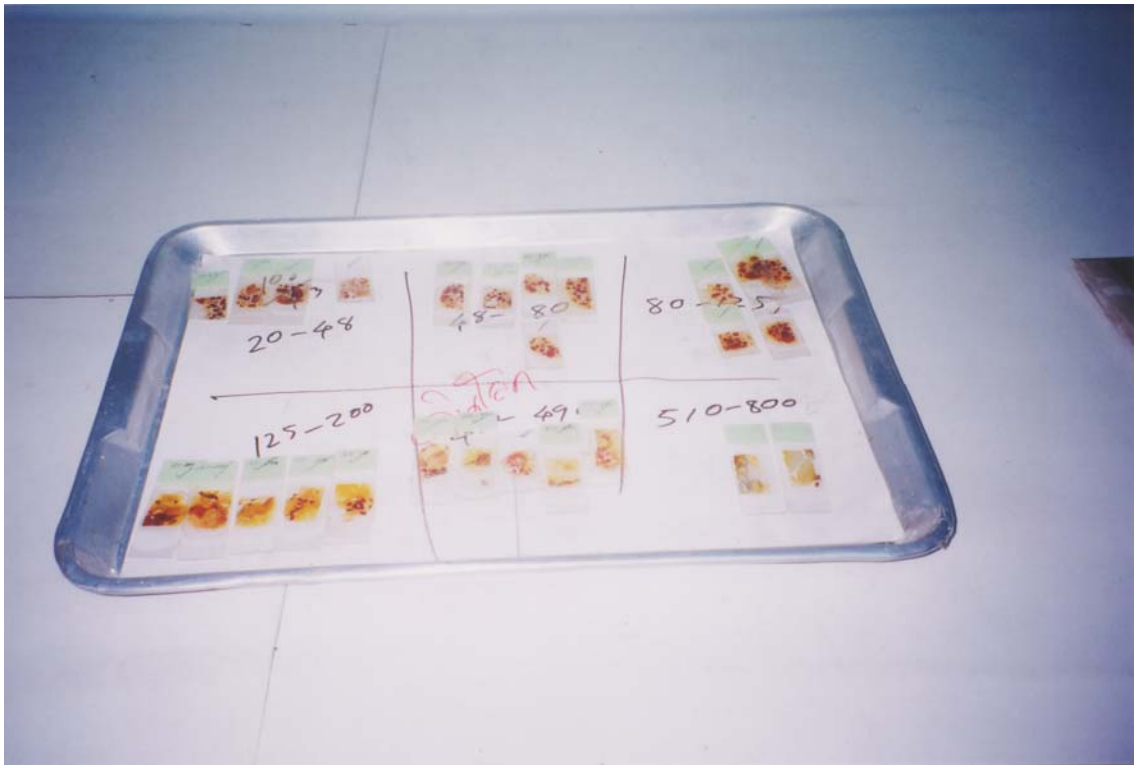
10. Grinding

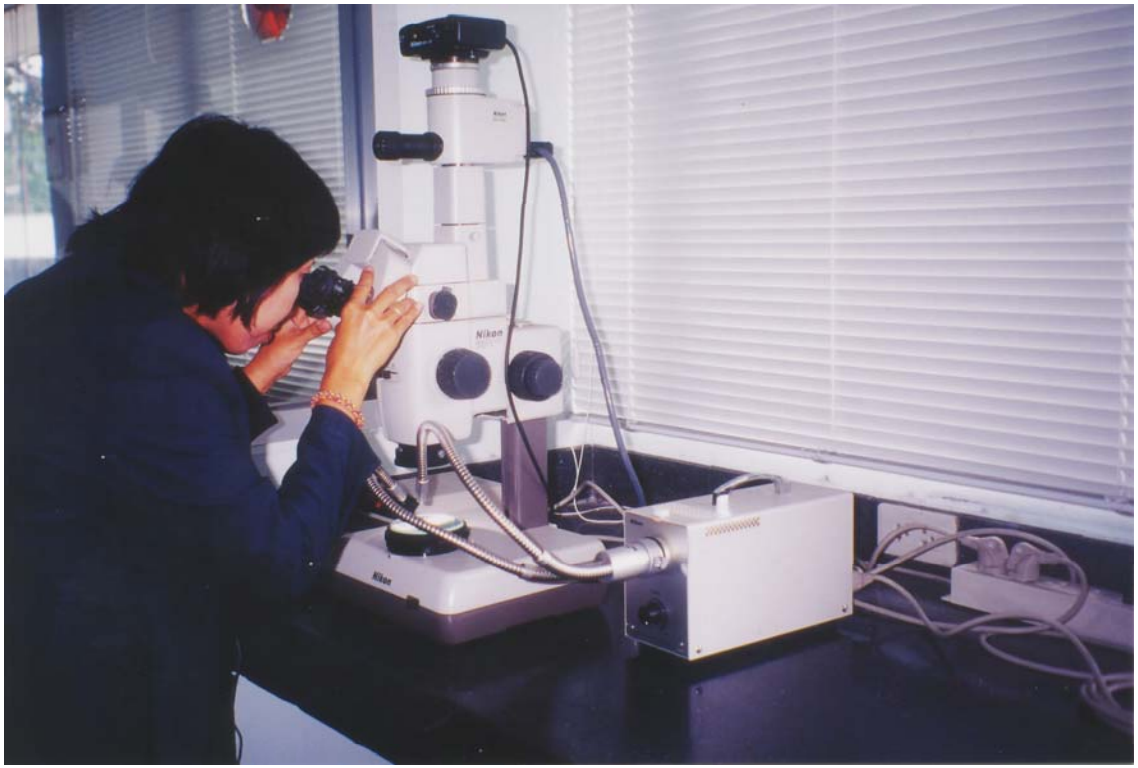
11. Polishing

12. Covering (by fixation mixture)

Examination of thin section with the petrological microscope.




20-48
125-200
510-800


Nikon

General Descriptive Criteria

Size

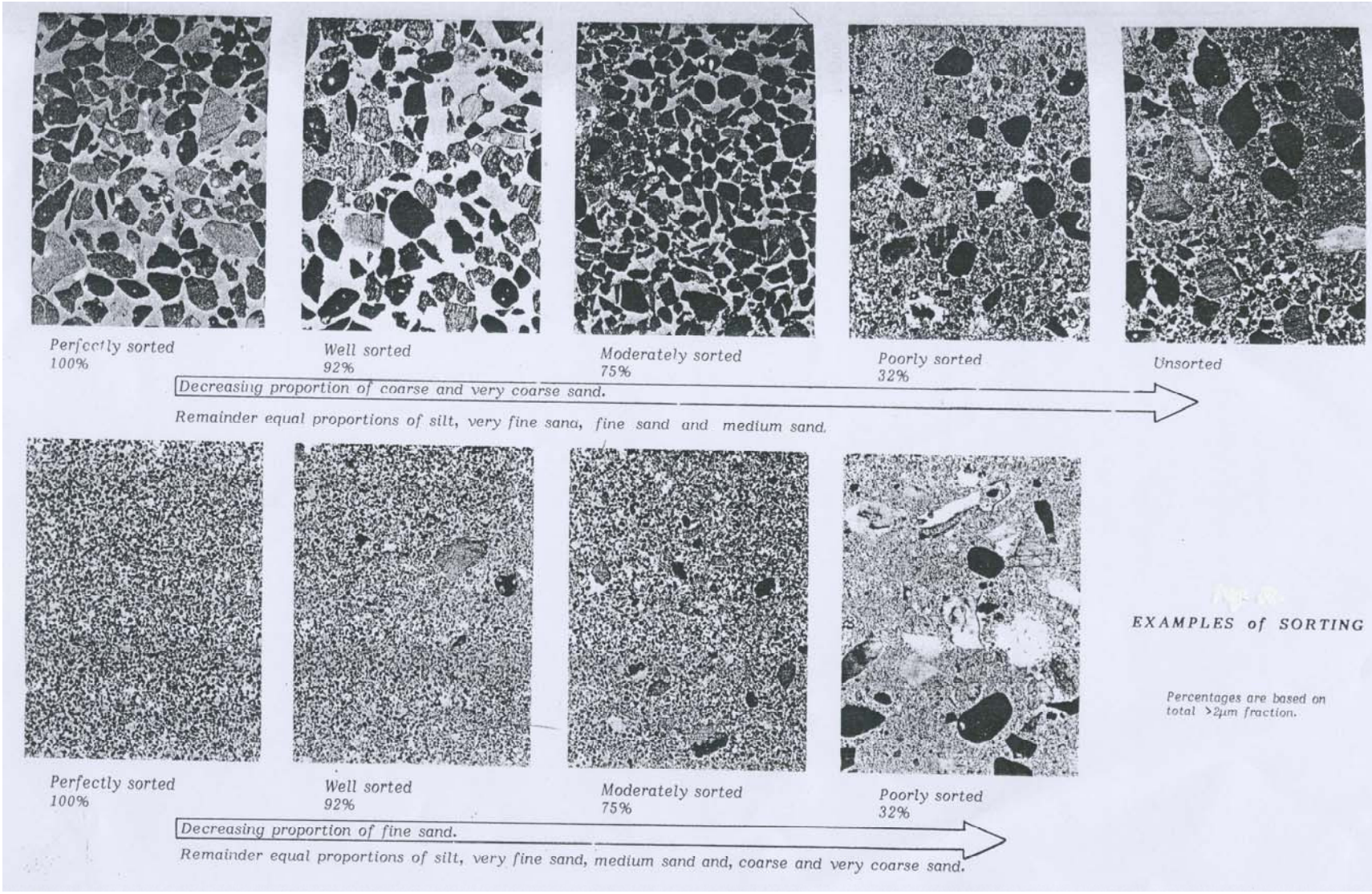
Clay	**< 2 µm**
Silt	**2–50 µm**
very fine sand	**50–100 µm**
fine sand	**100–200 µm**
medium sand	**200–500 µm**
coarse sand	**500–1000 µm**
very coarse sand	**1000–2000 µm**

Frequency

Very dominant	>70%
Dominant	50–70%
Common	30–50%
Frequent	15–30%
Few	5–15%
Very few	<5%

Sorting

- **perfectly sorted** (normally only one size fraction is present)
- **well sorted** (5–10% of fraction other than those stated)
- **moderately sorted** (10–30% of fraction other than those stated)
- **poorly sorted** (the sorted component is not the dominant one)
- **unsorted**


Perfectly sorted
100%
Well sorted
92%
Moderately sorted
75%
Poorly sorted
32%
Unsorted
Decreasing proportion of coarse and very coarse sand.
Remainder equal proportions of silt, very fine sand, fine sand and medium sand.
Perfectly sorted
100%
Well sorted
92%
Moderately sorted
75%
Poorly sorted
32%
Decreasing proportion of fine sand.
Remainder equal proportions of silt, very fine sand, medium sand and, coarse and very coarse sand.
EXAMPLES of SORTING
Percentages are based on total >2μm fraction.

Crystalline forms

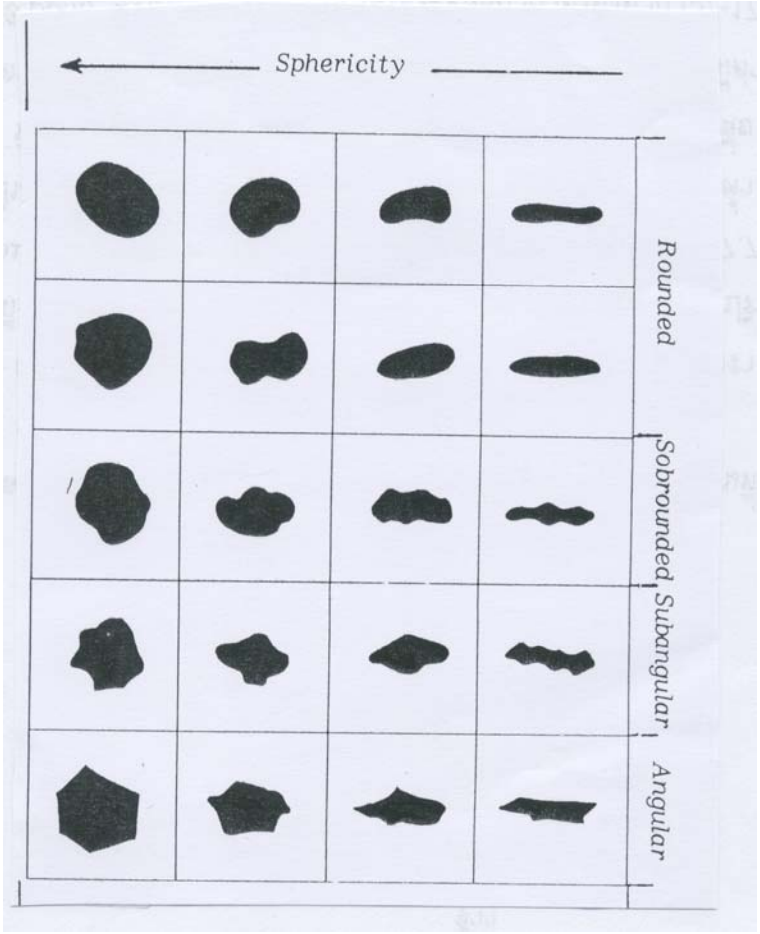
- **Euhedral**
- **Subhedral**
- **Anhedral**

Shape of particles (crystal habit) eg.

- lenticular
- acicular
- fibrous
- tabular
- etc.

Roundness

- Angular
- Subangular
- Sub–rounded
- Rounded
- Well–rounded


Sphericity
Rounded
Subrounded
Subangular
Angular

Surface roughness

- Rough
- Undulating
- Smooth

Boundary sharpness

–Sharp	:	knife edge boundaries
–Clear	:	Color transition and/or particle size transition < 60 μm wide
–Diffuse	:	color transition and/or particle size transition >60 μm wide

The Fabric Analysis of Soil Thin Sections

A. Microstructure

a. Aggregation

Type of aggregate : peds, fragments,

clod(> 5 cm.)

Grade of pedality : strongly-weakly

Size & Accommodation

b. Voids

Type of voids

- **Simple packing voids**
- **Compound packing voids**
- **Complex packing voids**
- **Vughs – Chambers – Vesicles**
- **Planes – Channels**

Regularity of wall : rough & smooth

Size of voids

c. Type of microstructure

–Single grain (monic RDP)

–Bridged grain (gefuric RDP)

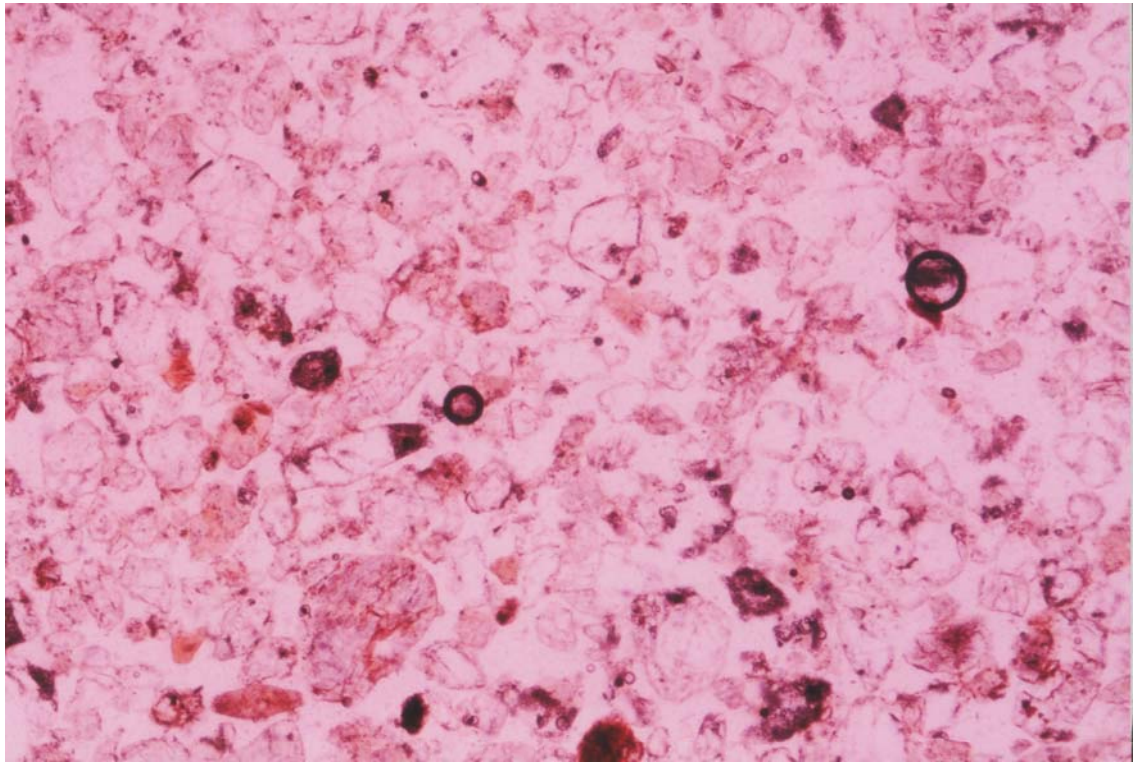
–Pellicular grain (chitonic RDP)

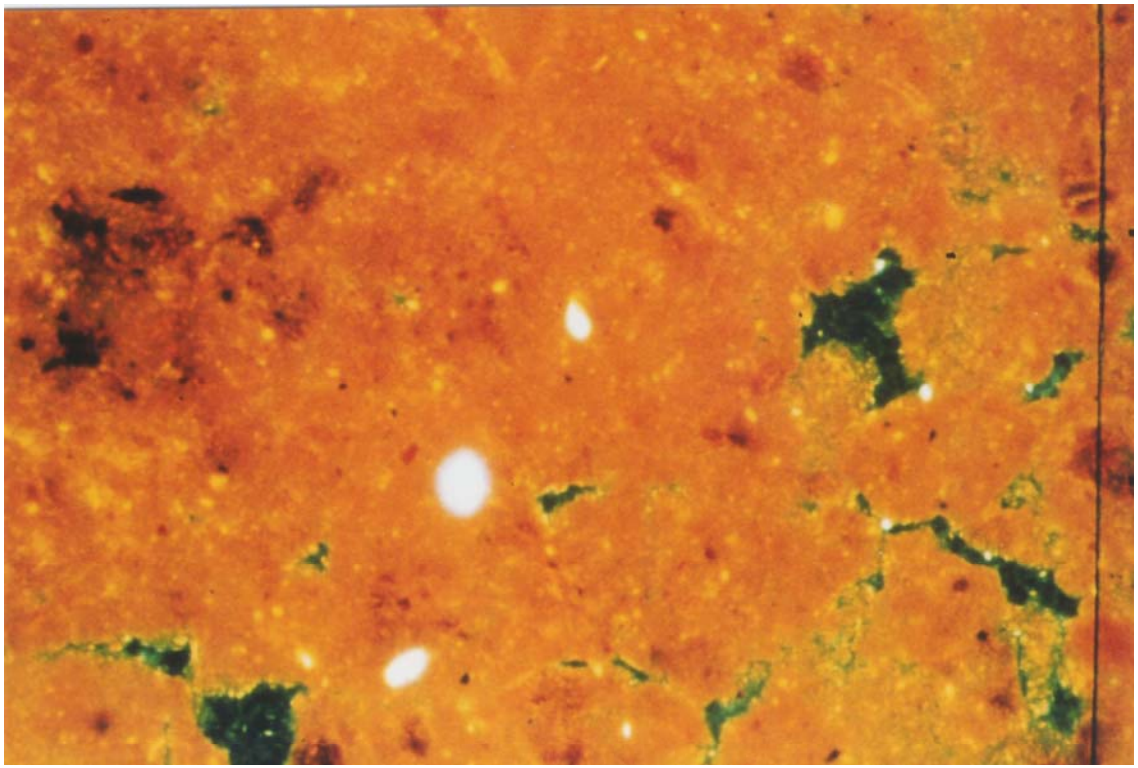
–Intergrain microaggregate (enaulic)

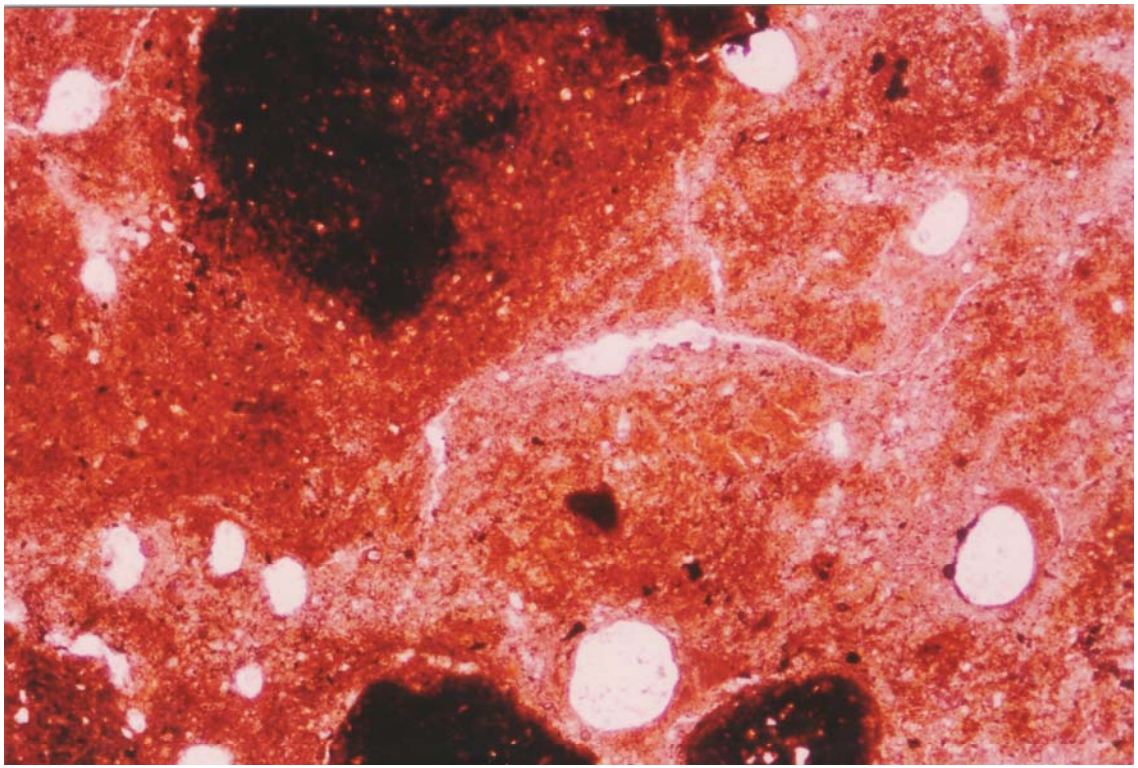
–Vughy –Spongy –Channel –Chamber – Vesicular –Crumb –Granular –Angular blocky

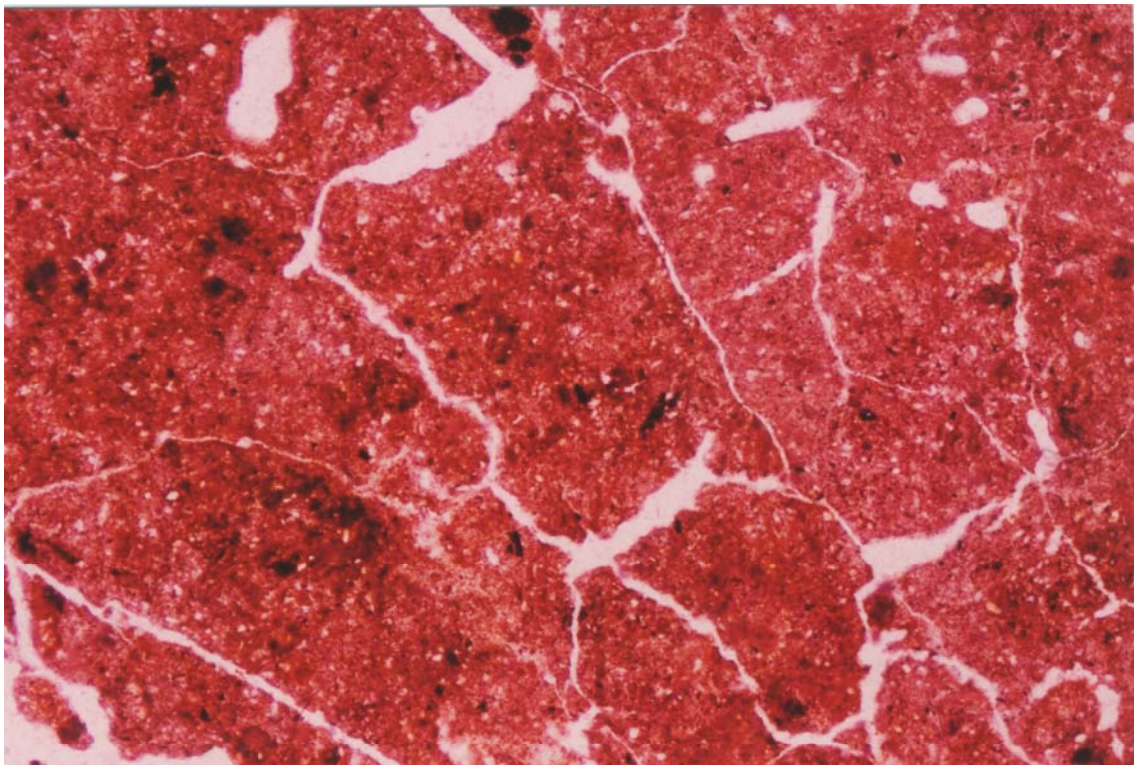
–Platy –Subangular blocky –Fissure

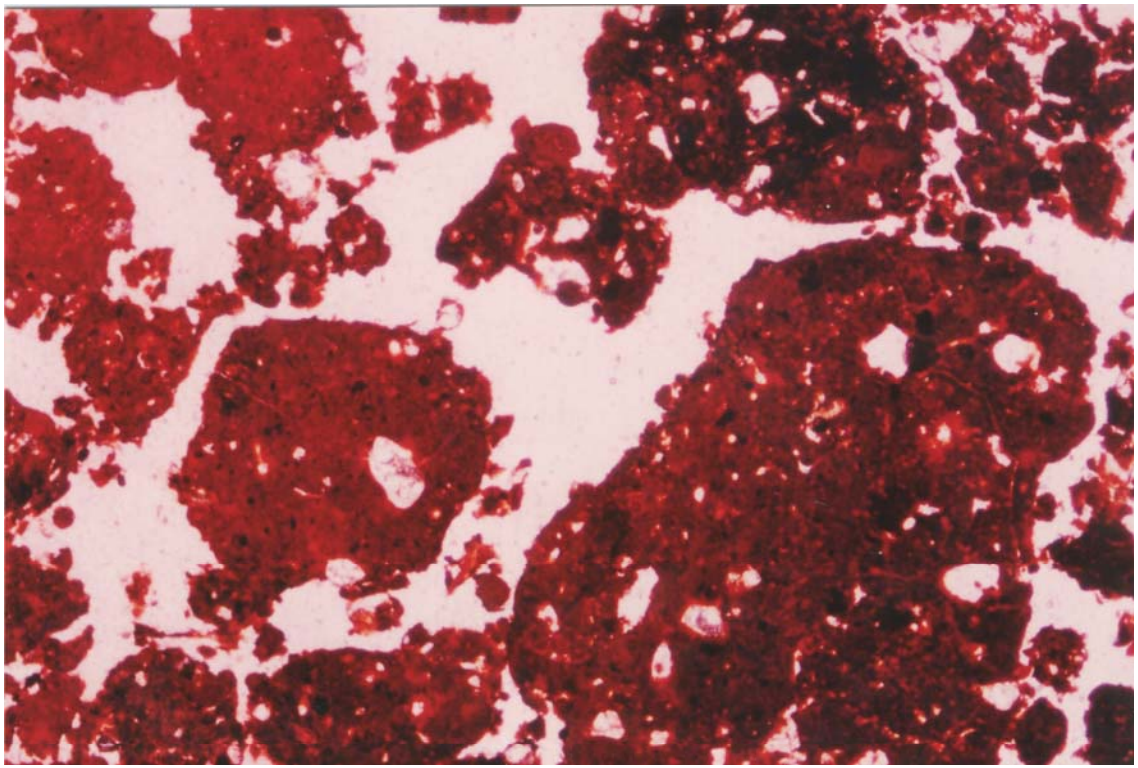
–Crack –Prismatic –Massive –Complex

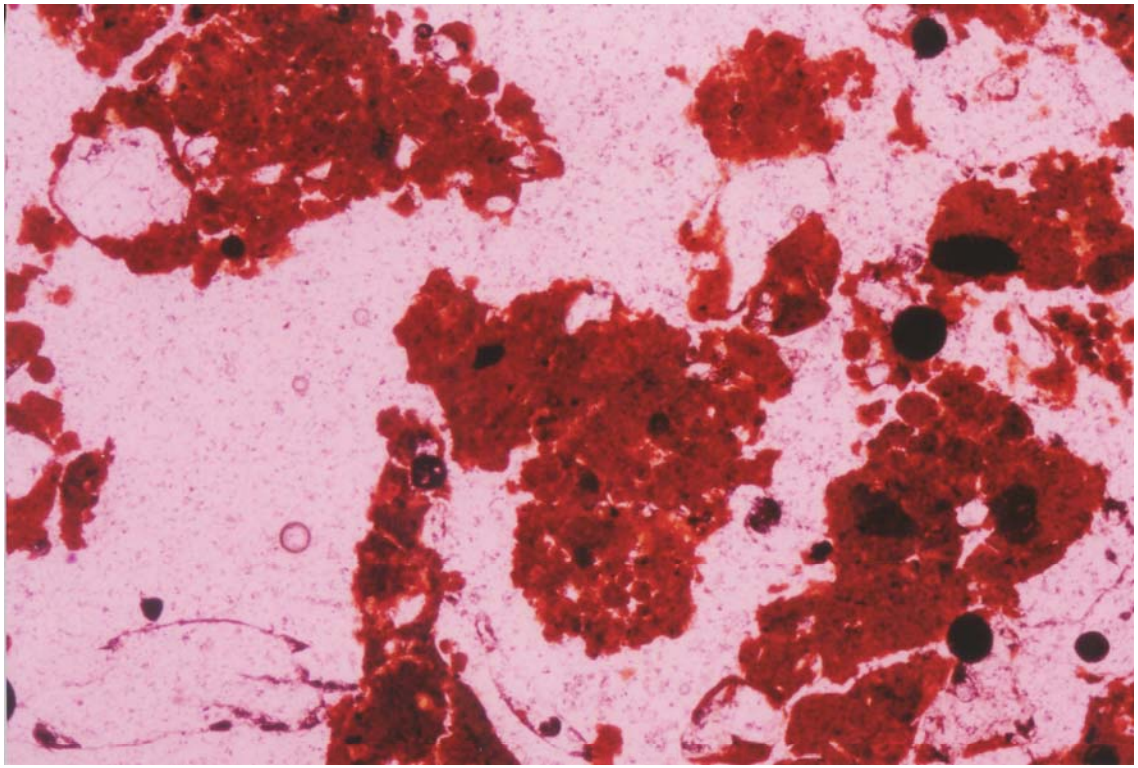


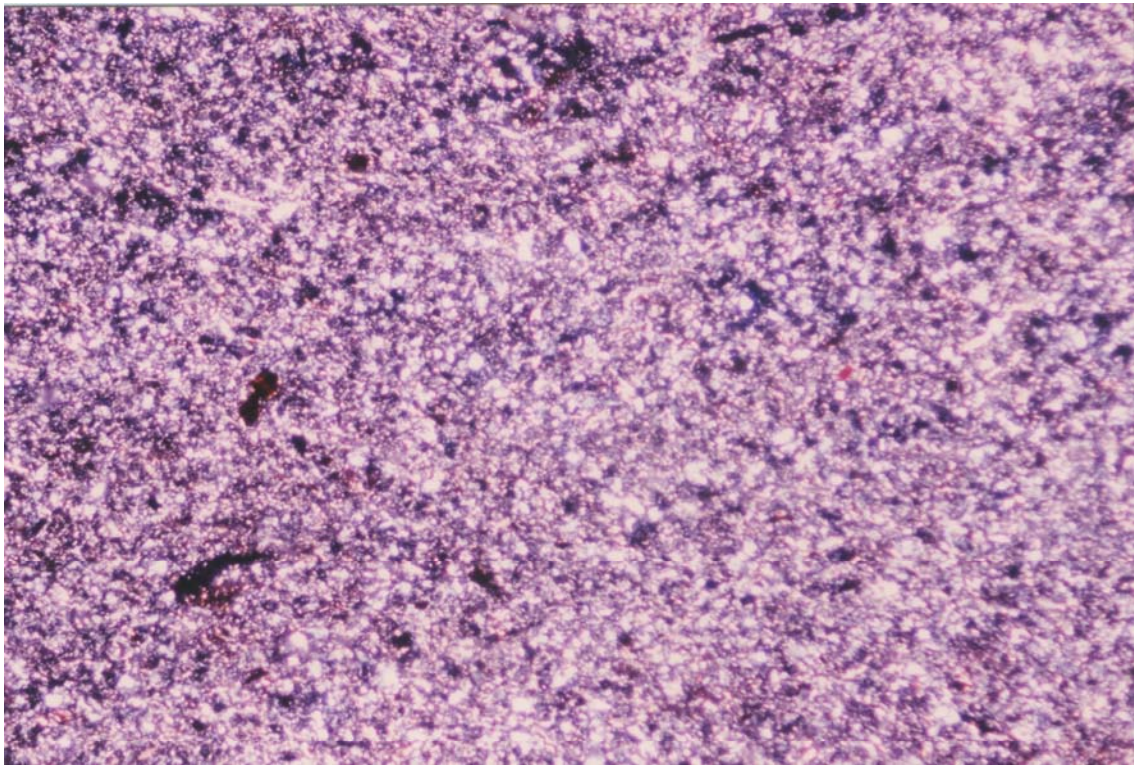












B. Basic Components

The coarse mineral material

c/f limit 10μm

a. The important of description :

–origin (and nature) of parent material

–reserve of nutritive elements

–actual and former pedogenetic process

b.Nature

–single mineral grains

–compound mineral grains & rock fragment

–inorganic residues of organic origin

–phytolith, diatom, shell, bone

–artefacts

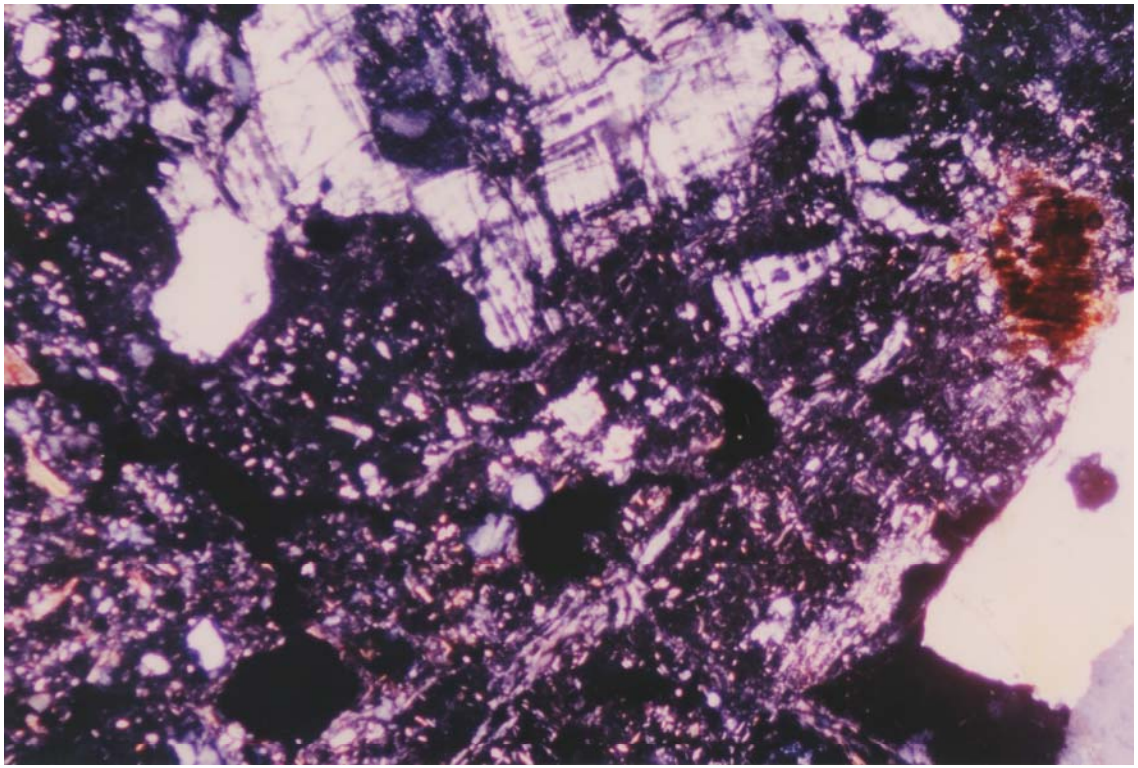
c.Size and Sorting

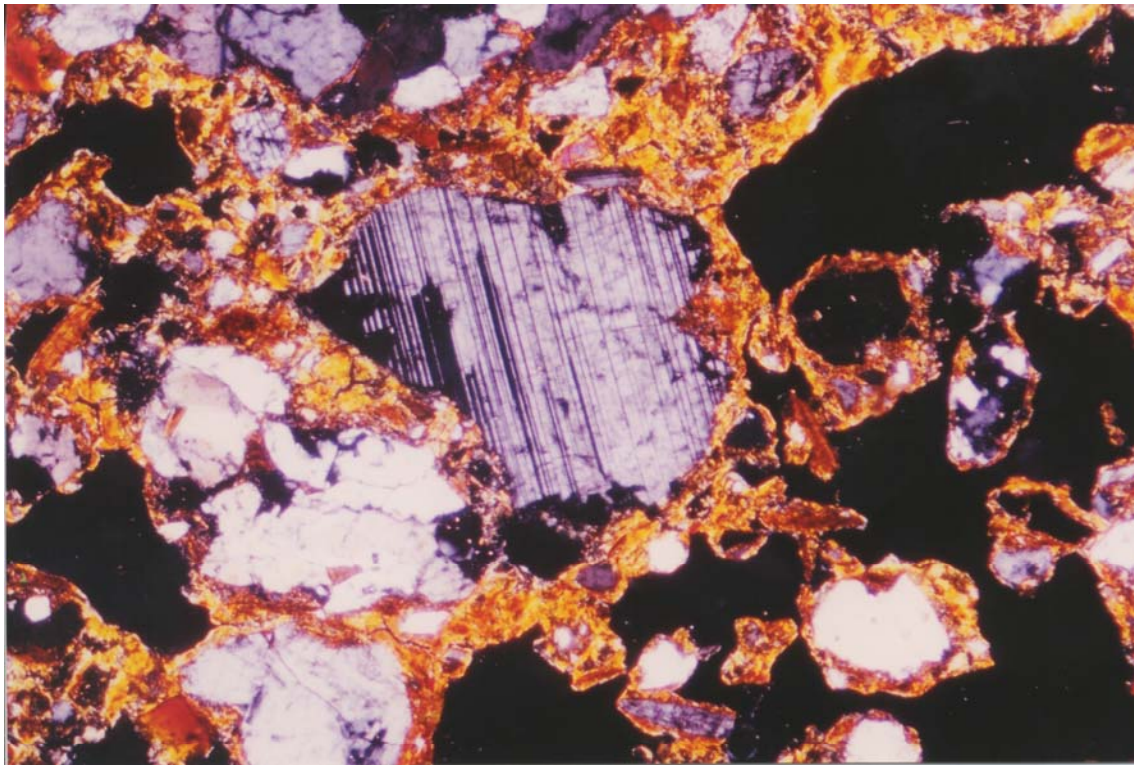
d.Shape

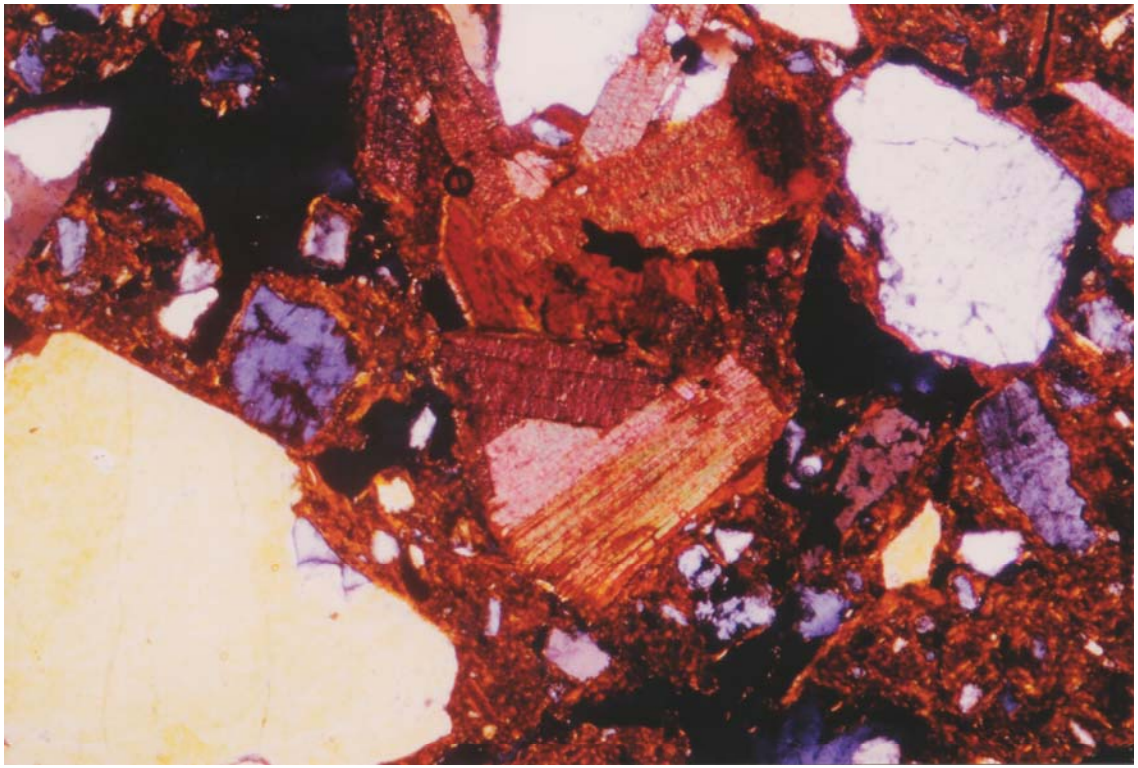
e. Internal characteristic eg.

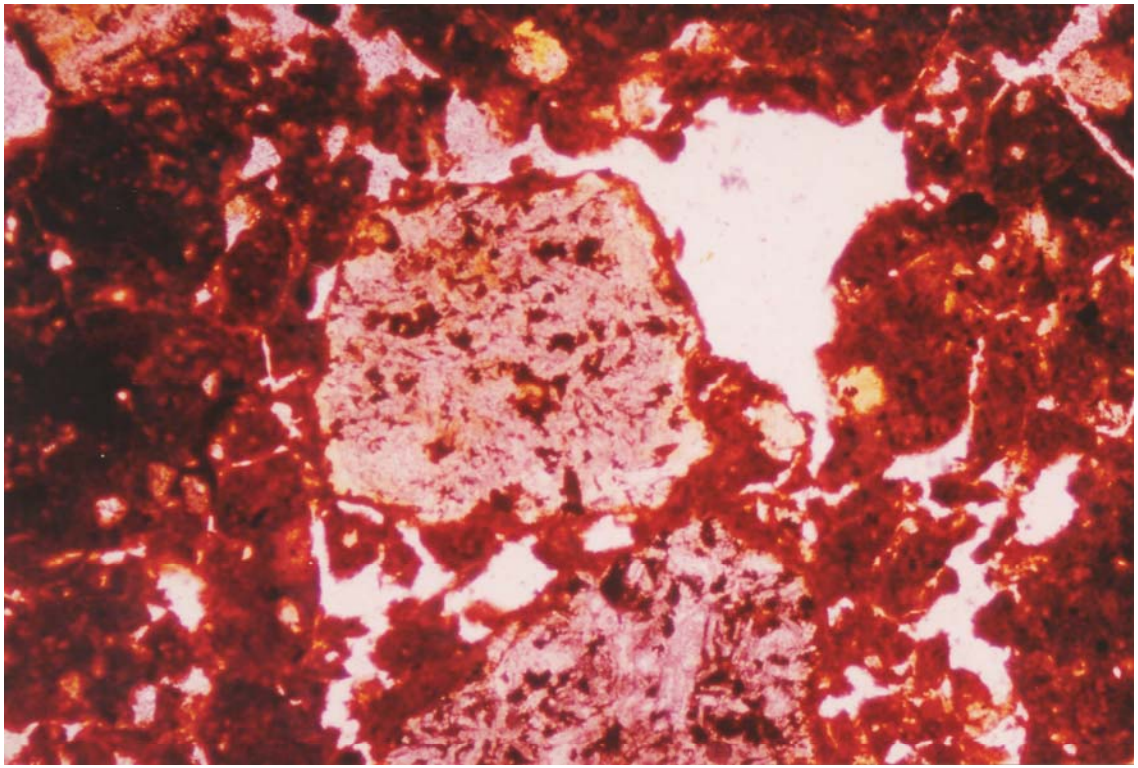
Inclusion,twin.

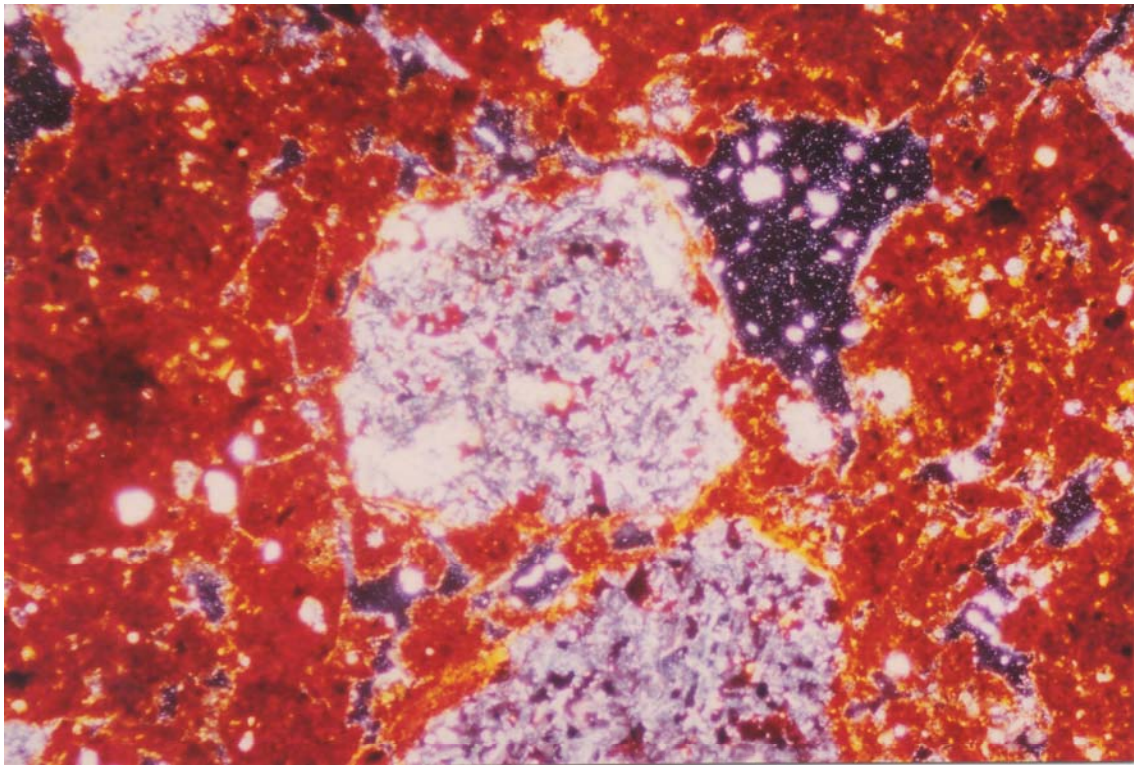
f.Alteration and Weathering

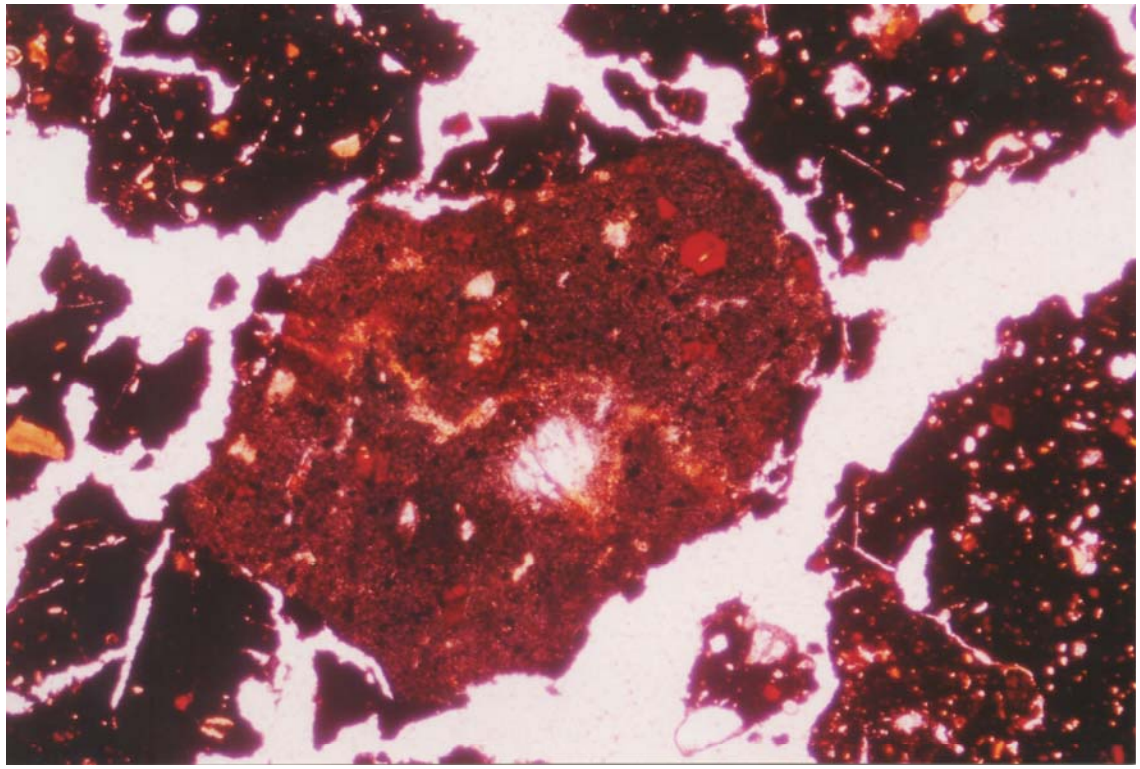


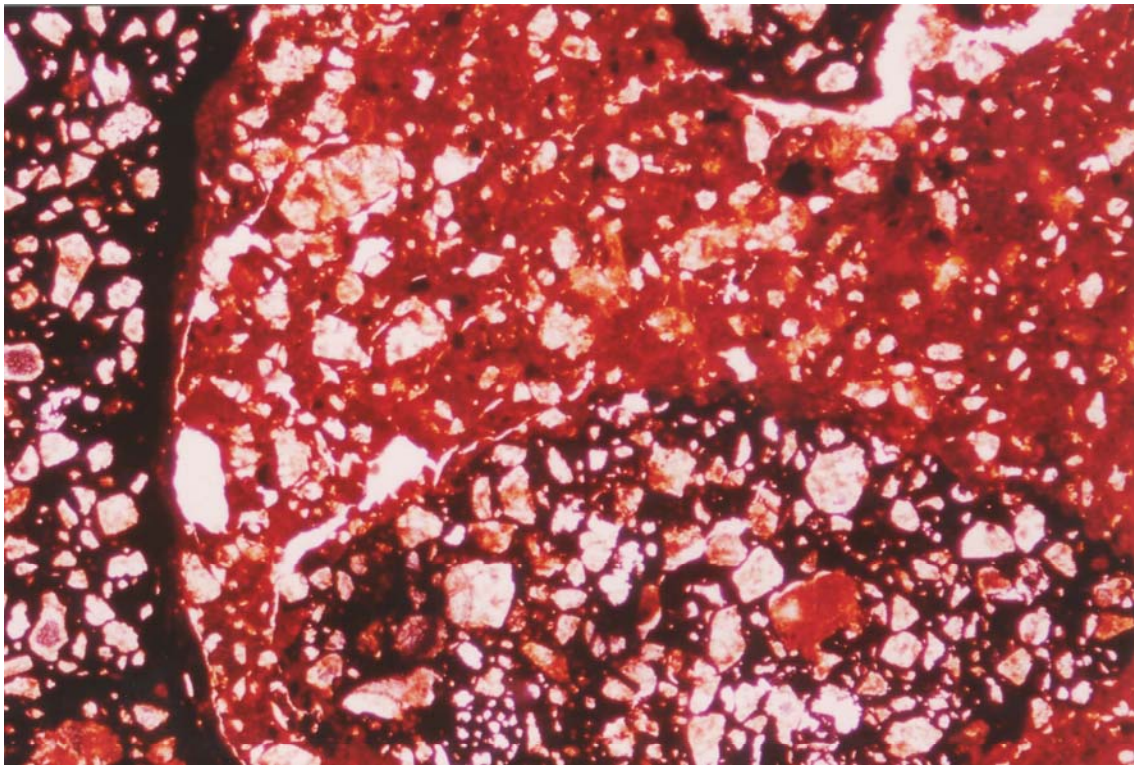


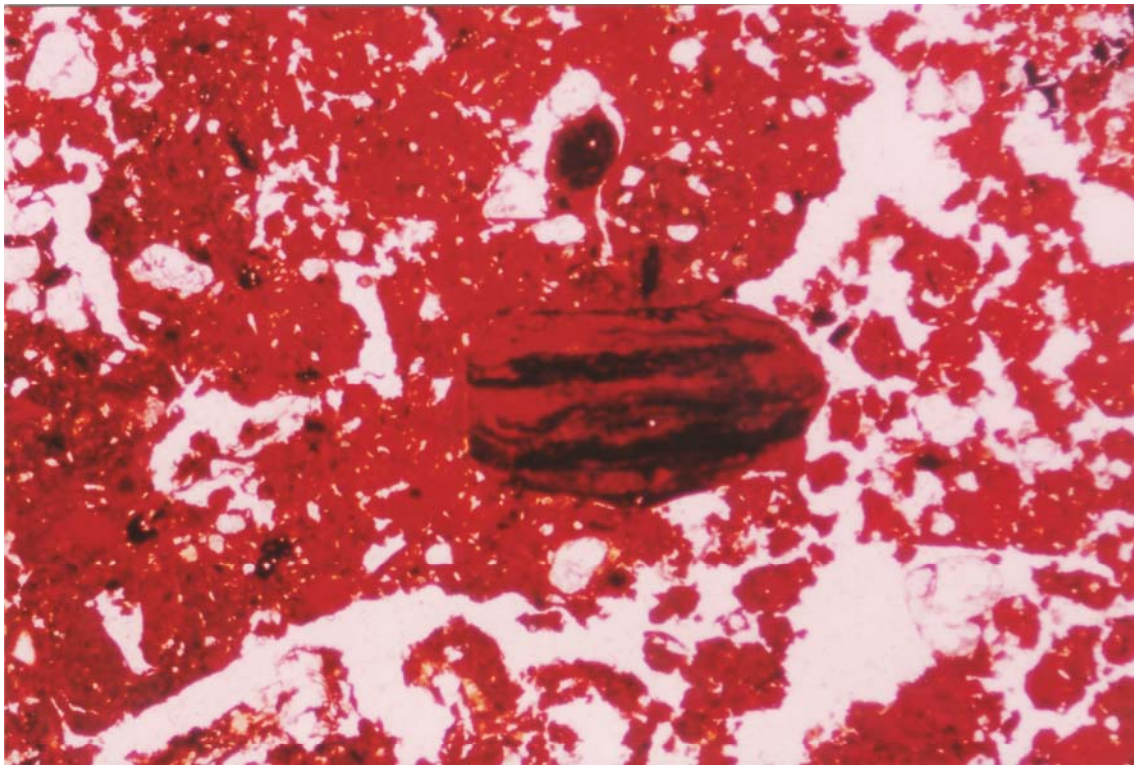


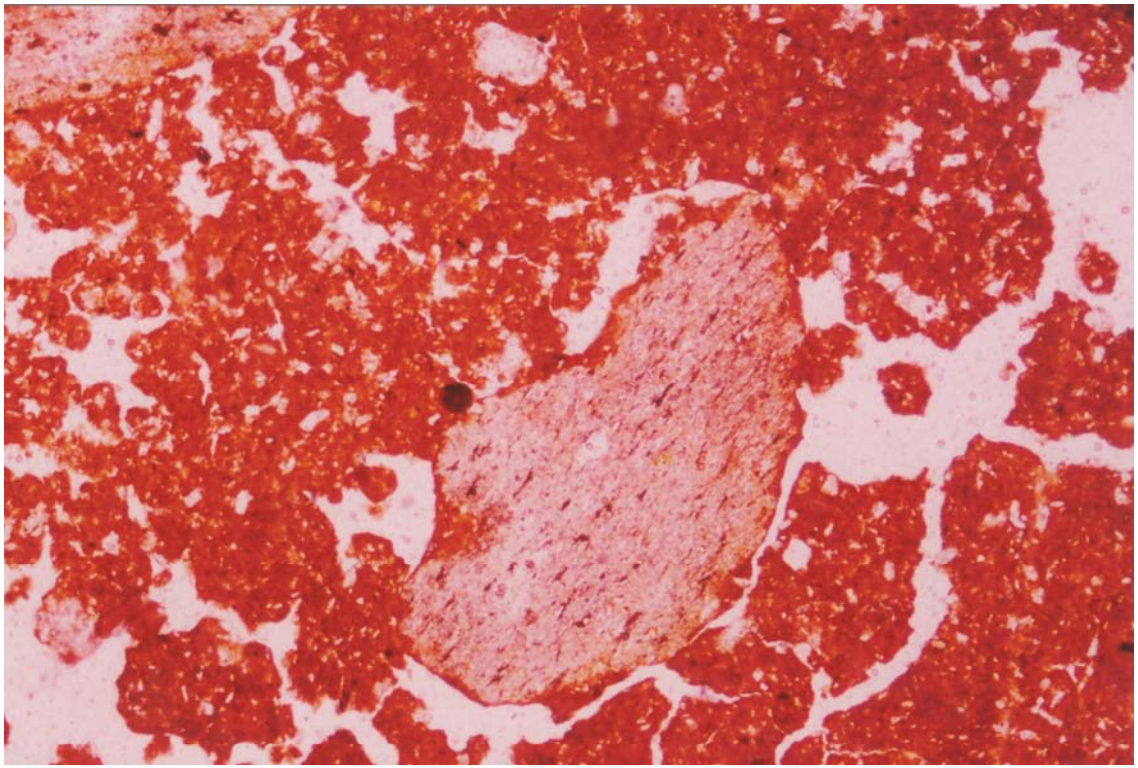


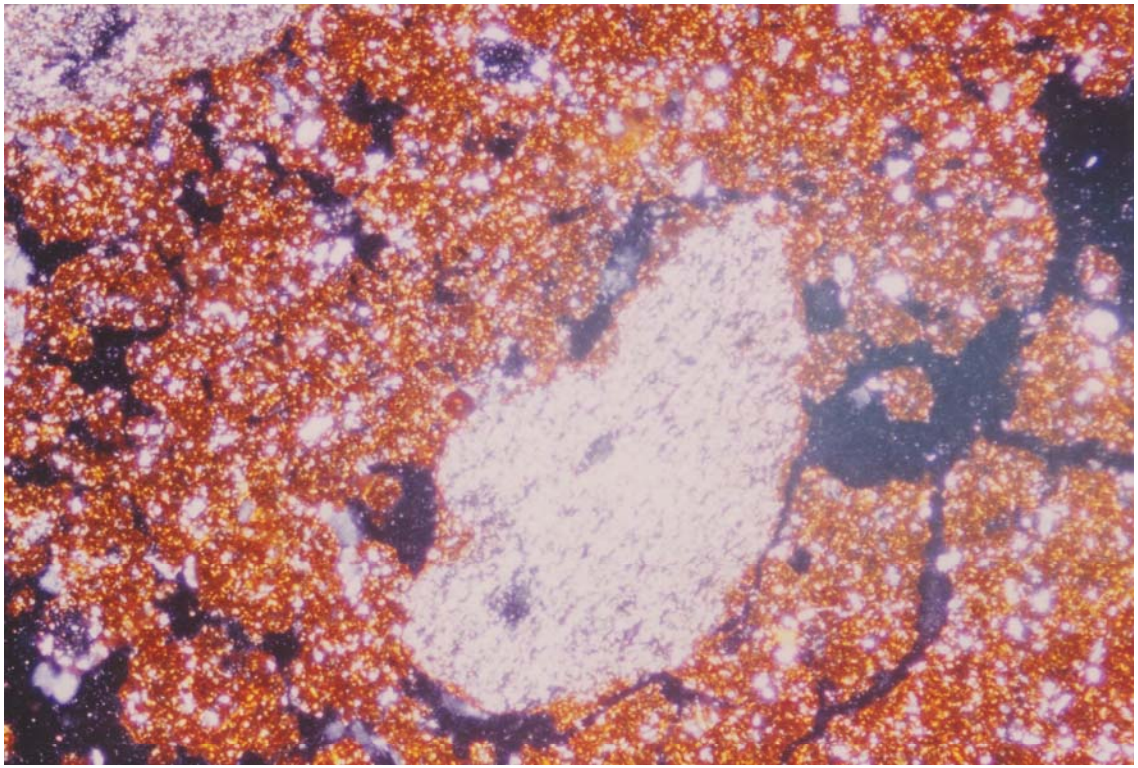












The fine mineral material

a.Nature

Colour

Limpidity

–limpid **–speckled**

–dotted **–cloudy and opaque**

Interference colour

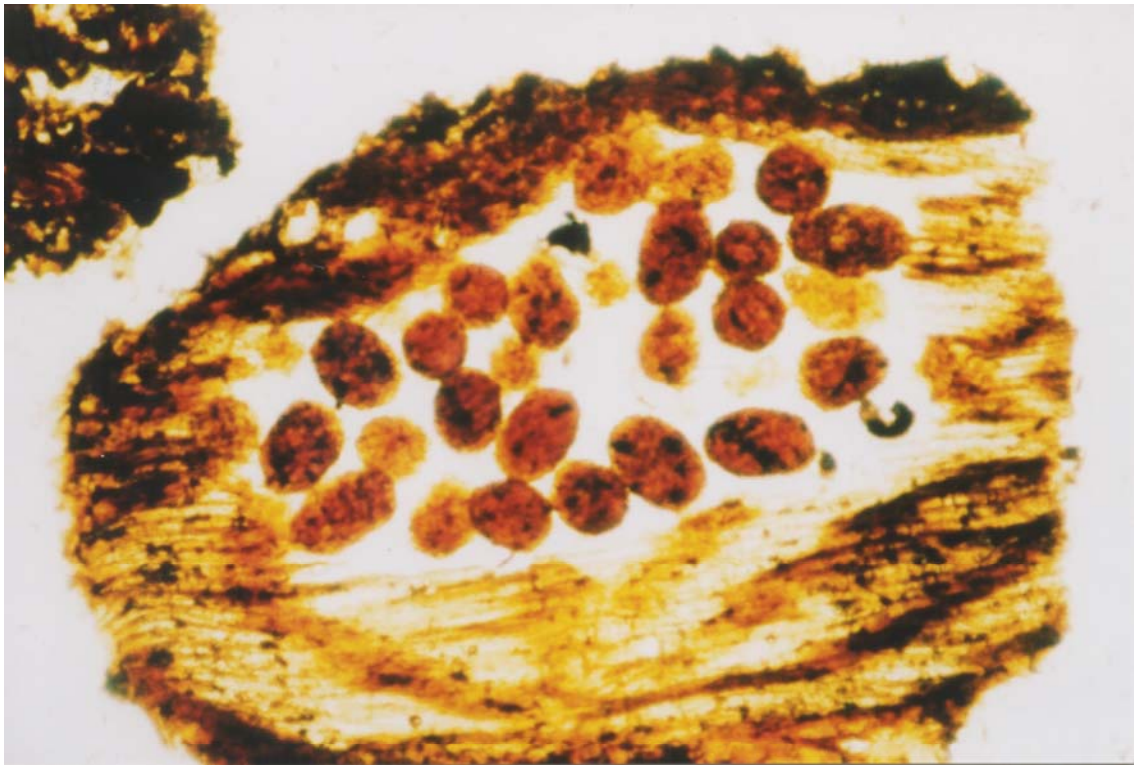
b.Size and shape

The organic constituents

Plant residues

Organic fine material

Organic pigment



C. Groundmass

(is a general term for the coarse and/or fine material which forms the base material of thin section.

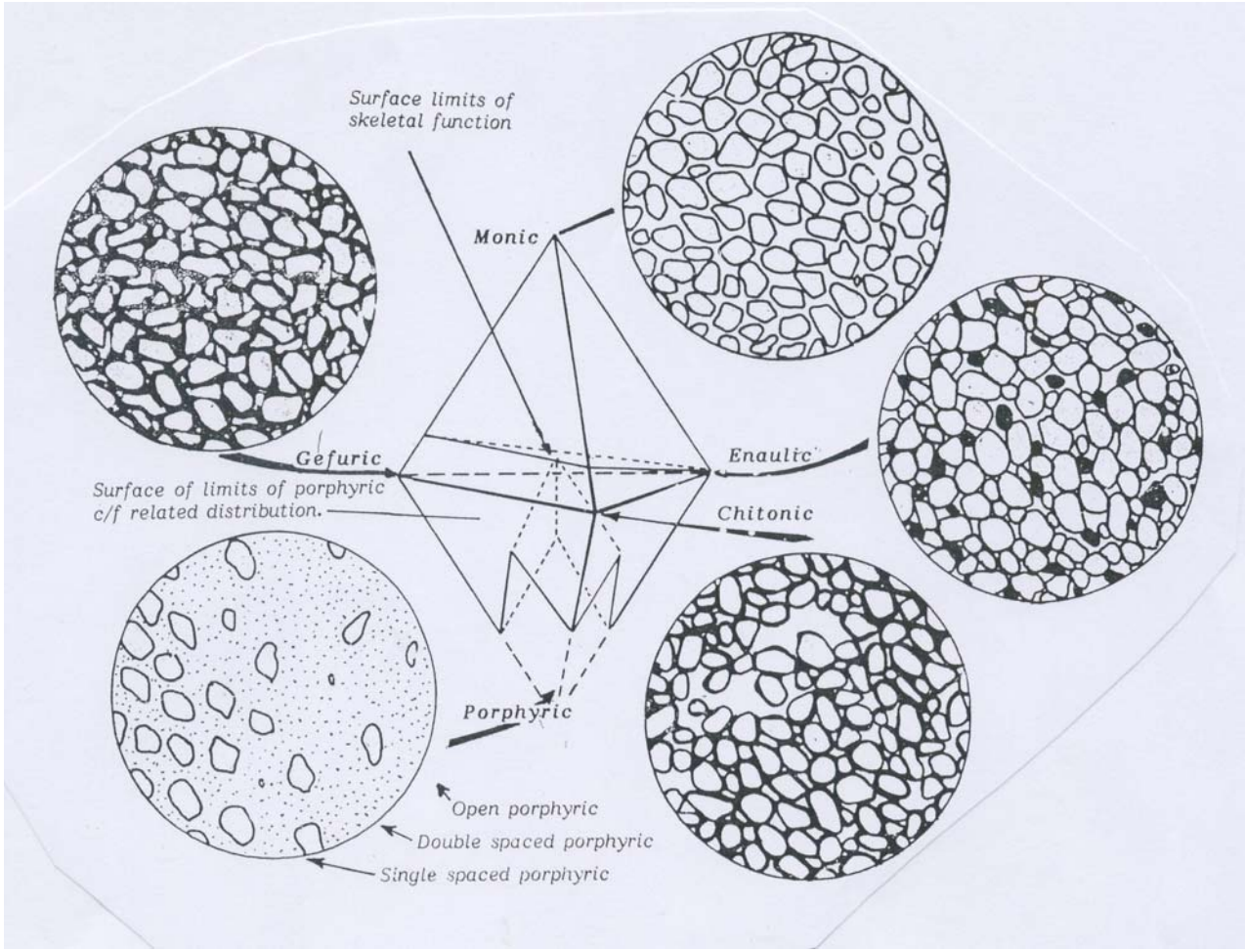
a. Description

–the limit between coarse and fine material and its ratio.

–the c/f related distribution

–Monic –Gefuric –Chitonic

–Enaulic –Porphyric


Surface limits of
skeletal function
Monic
Gefuric
Enaulic
Surface of limits of porphyric
c/f related distribution.
Chitonic
Porphyric
Open porphyric
Double spaced porphyric
Single spaced porphyric

b. The fabric of the micromass

(b–fabric)

i undifferentiated b–fabric

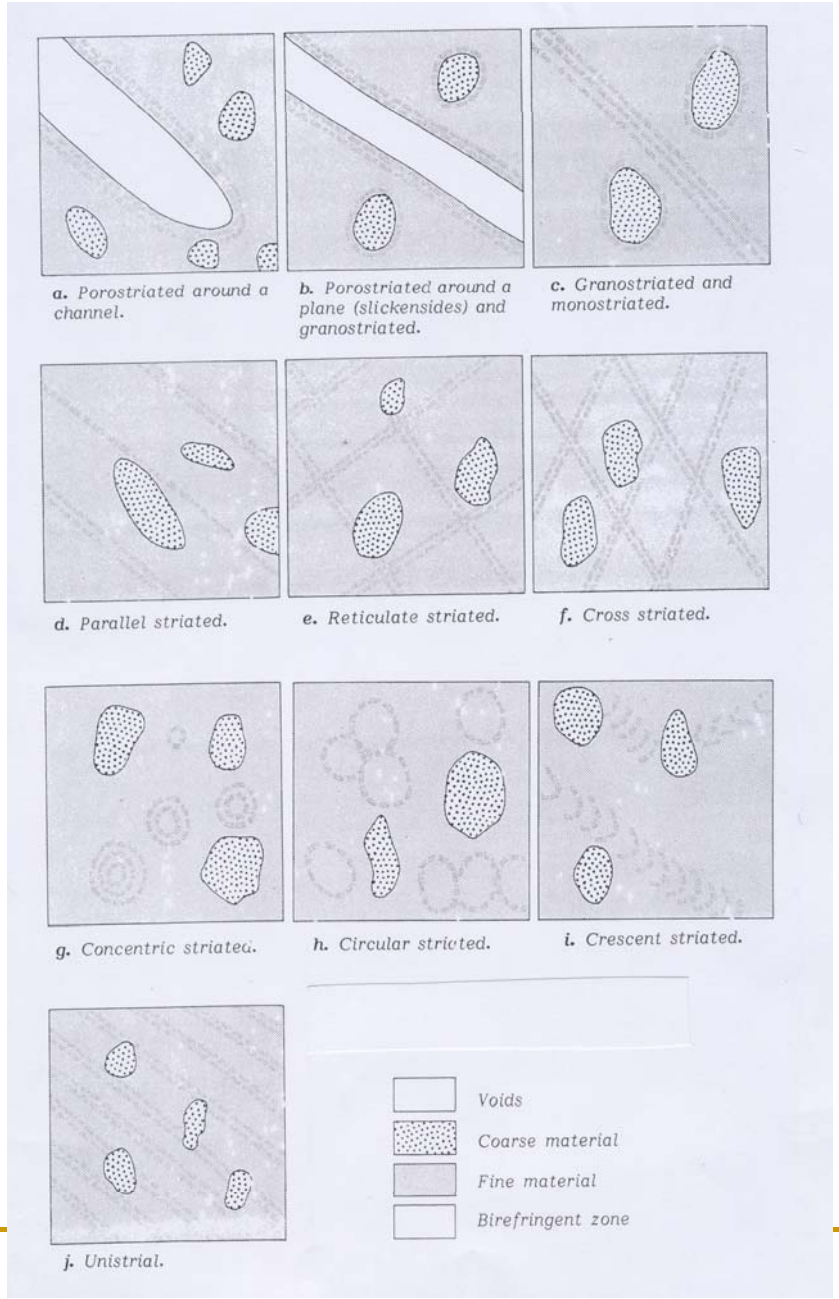
ii crystallitic b–fabric

iii speckled b–fabric

iv striated b–fabric

- –porostriated
- –monostriated
- –reticulate striated
- –random striated
- –concentric striated
- –granostriated
- –parallel striated
- –cross striated
- –circular striated
- –crescent striated

- strial b-fabric (plasma exhibiting as a whole a prefered parallel orientation
  - unistrial (one preferred direction)
  - bistrial (two preferred direction)


a. Porostriated around a channel.
b. Porostriated around a plane (slickensides) and granostriated.
c. Granostriated and monostriated.
d. Parallel striated.
e. Reticulate striated.
f. Cross striated.
g. Concentric striated.
h. Circular striated.
i. Crescent striated.
j. Unistrial.
Voids
Coarse material
Fine material
Birefringent zone

D. Pedofeatures

a. kind of pedofeatures

i Textural pedofeatures

ii Crystalline pedofeatures

iii Amorphous or Cryptocrystalline pedofeatures

iv Depletion pedofeatures

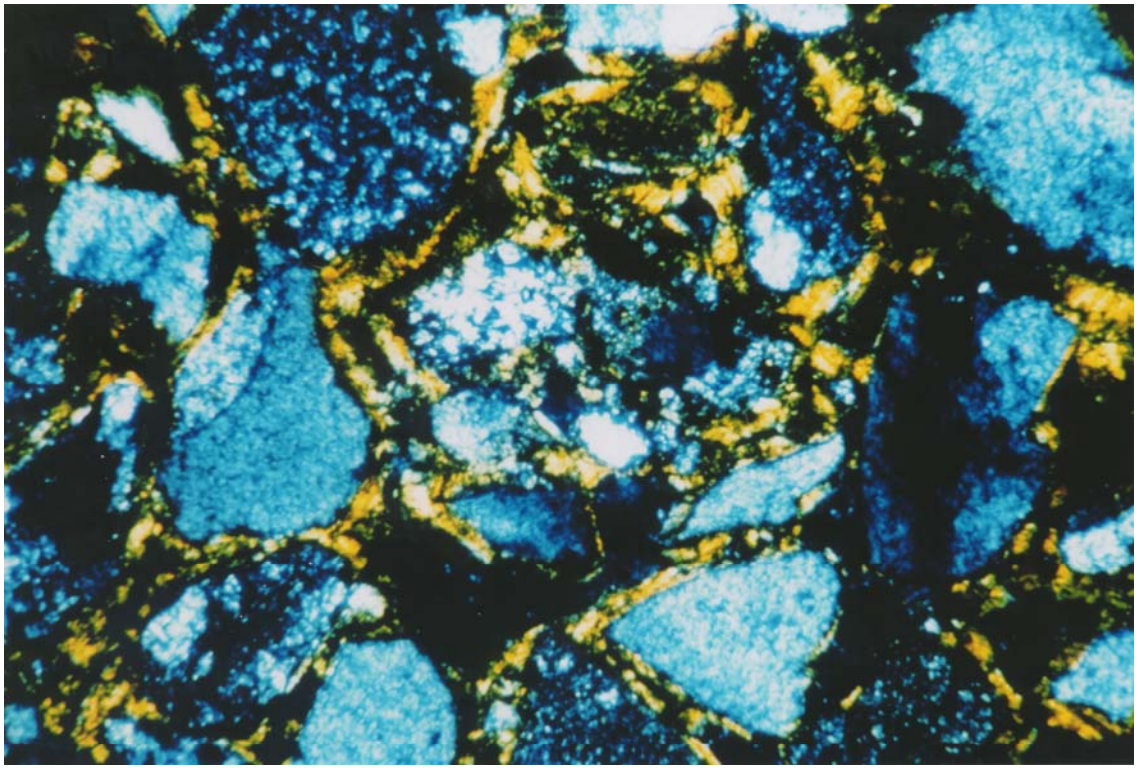
v Fabric pedofeatures

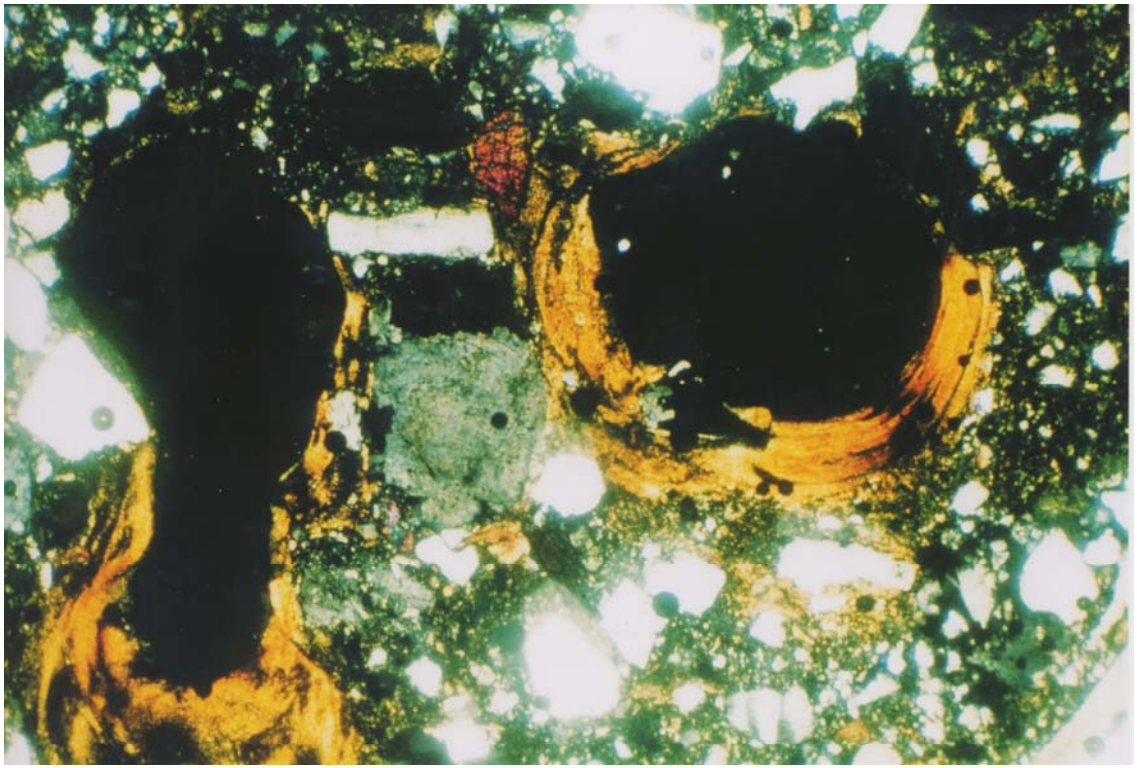
vi Excrement pedofeatures

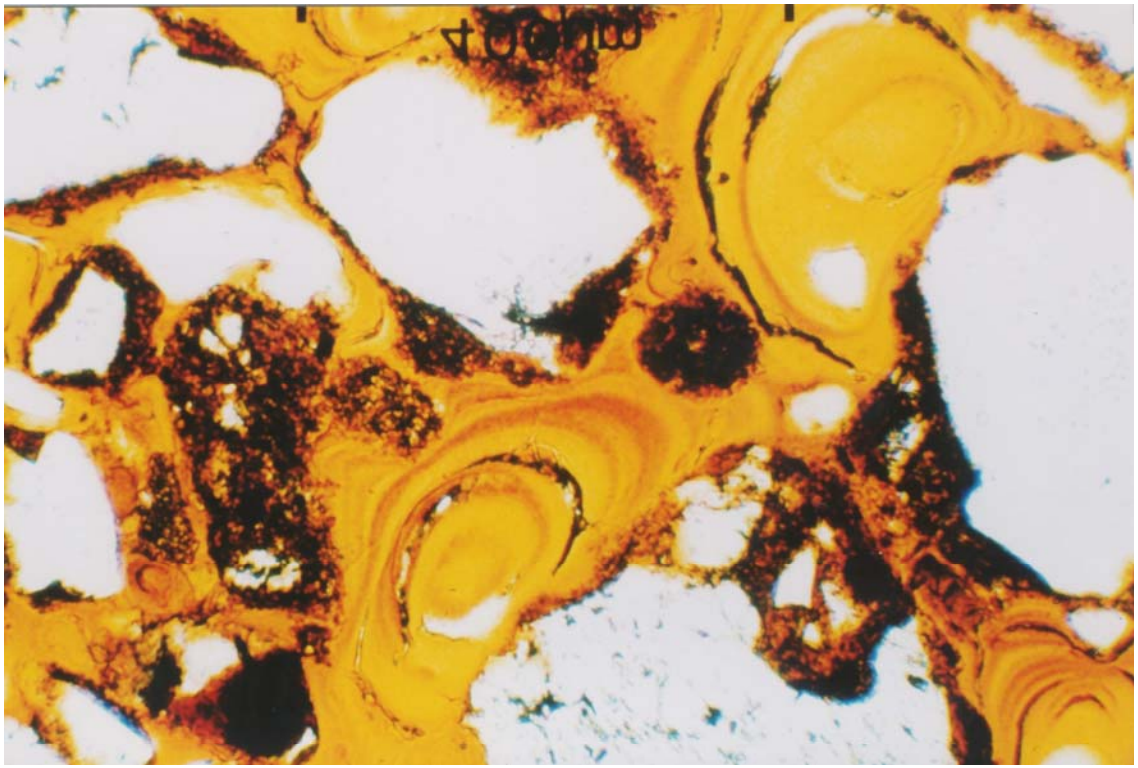
b. Classification

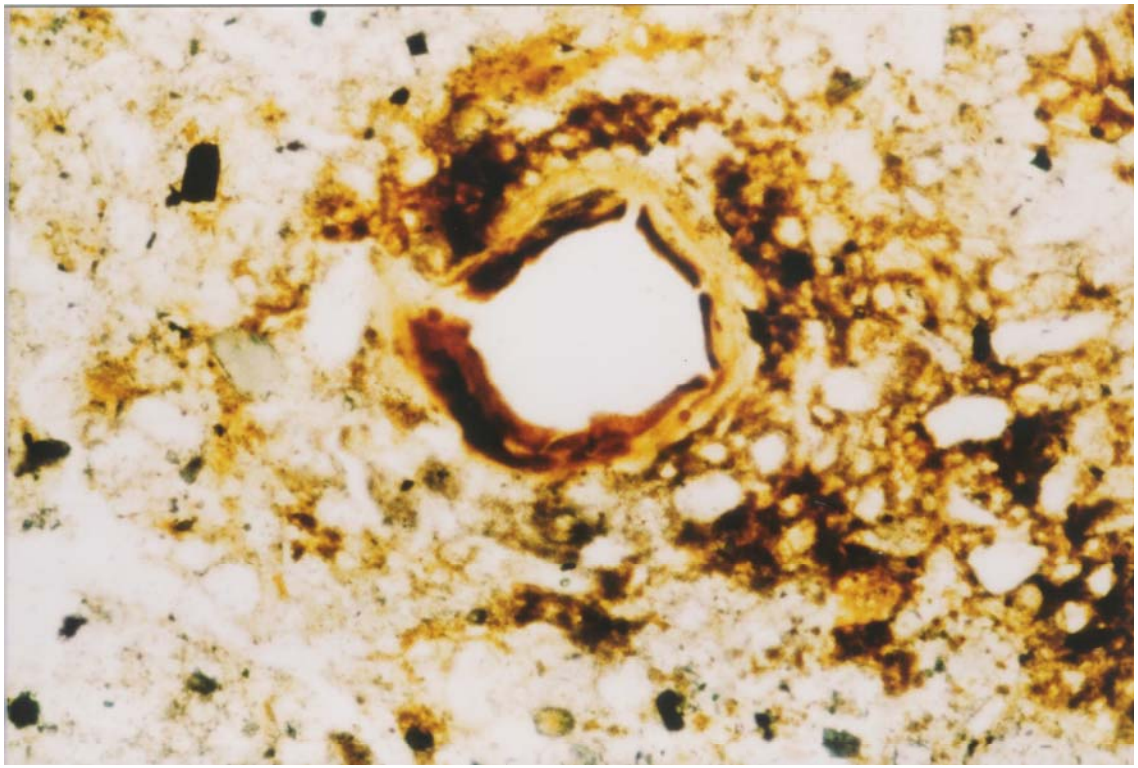
–Related to voids, aggregates and \ grains：

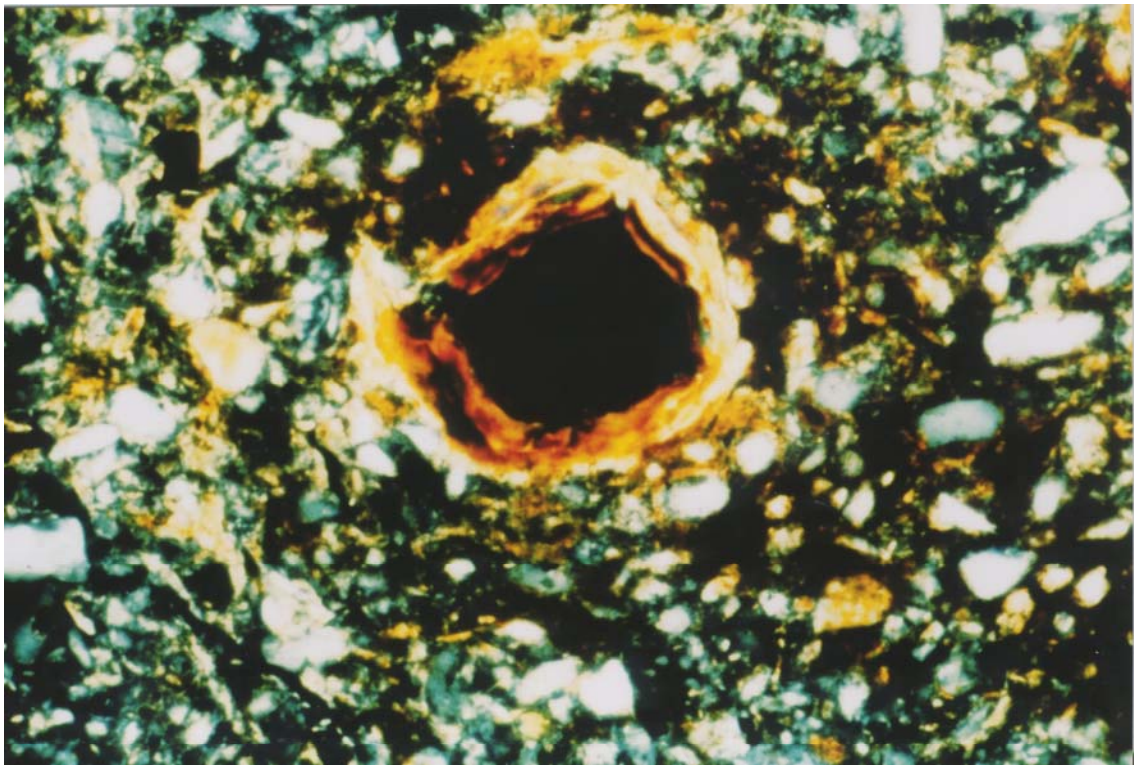
- coating
- hypo–coating
- quasi–coating
- infilling

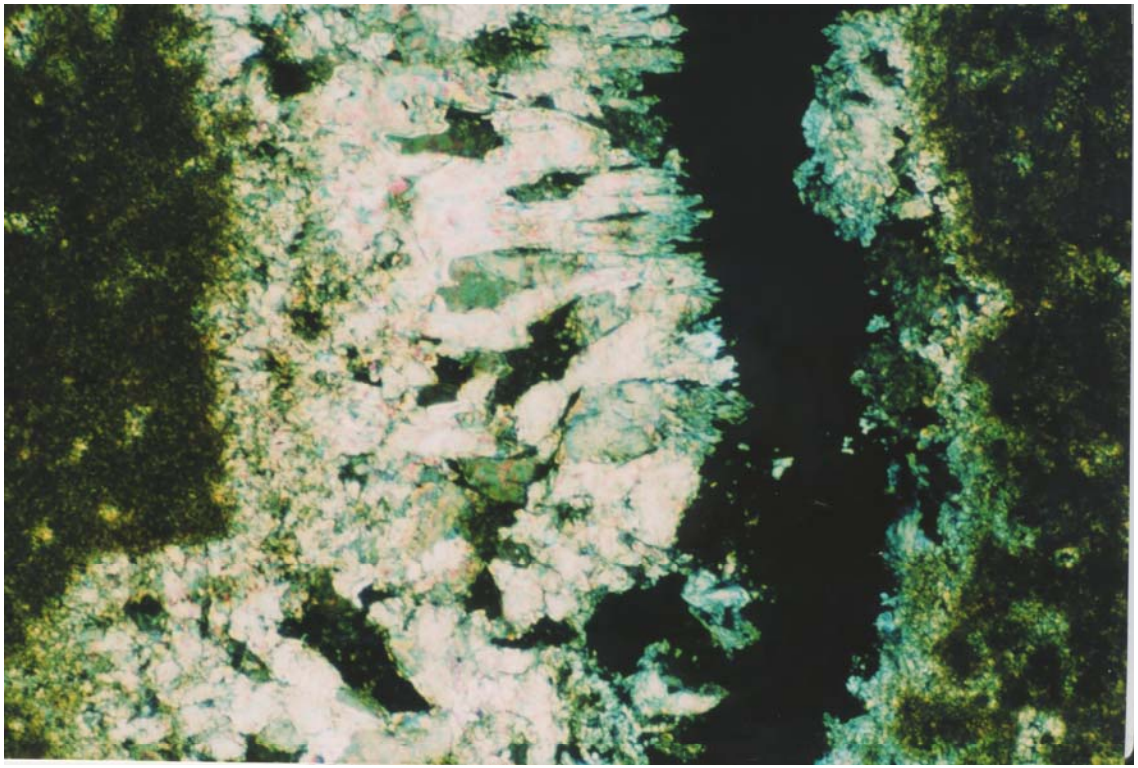


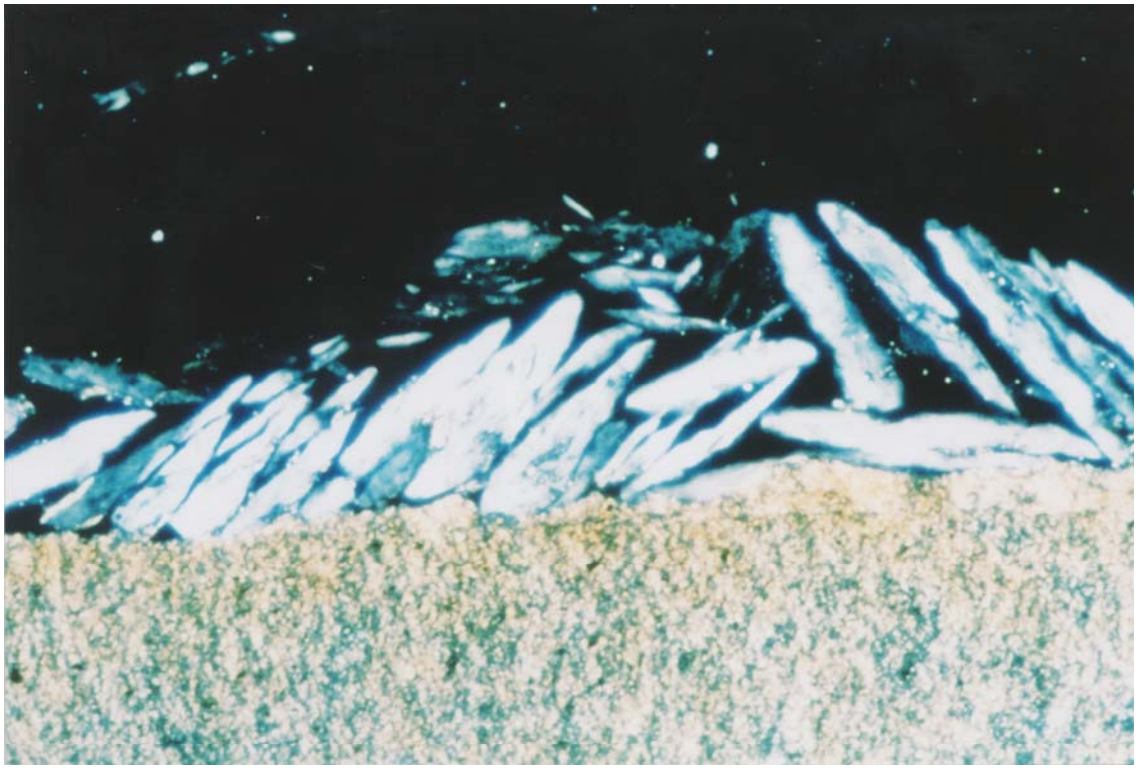


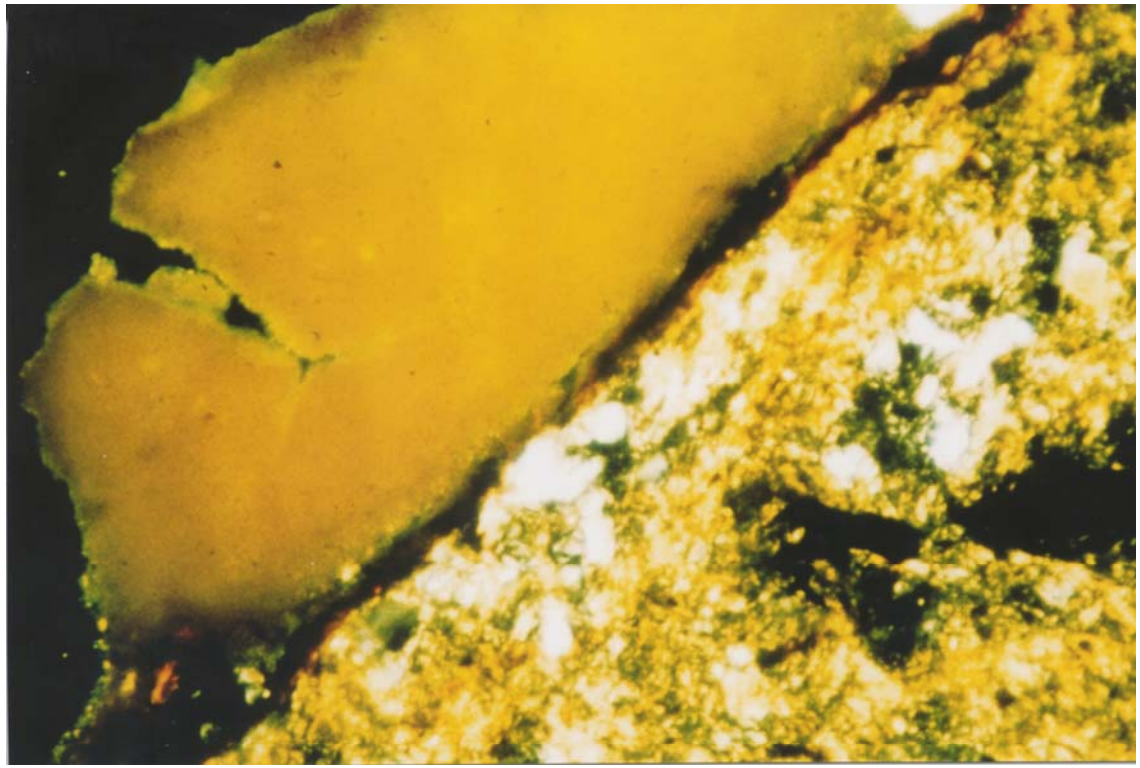




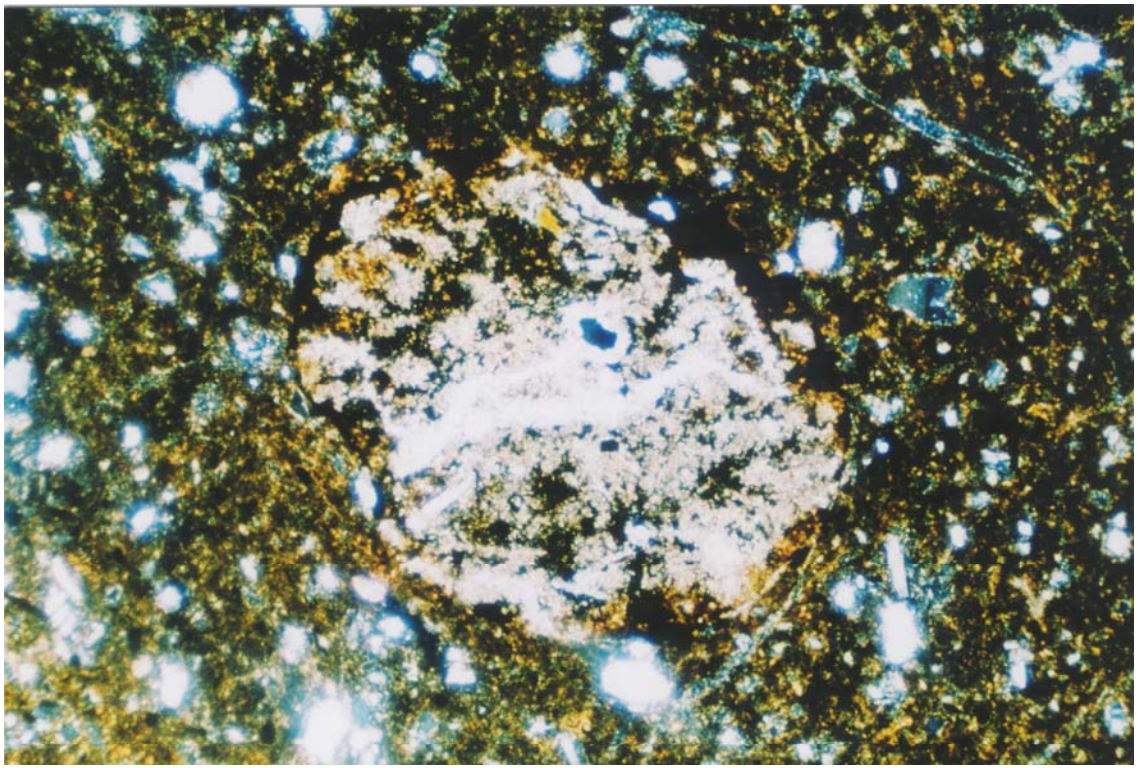


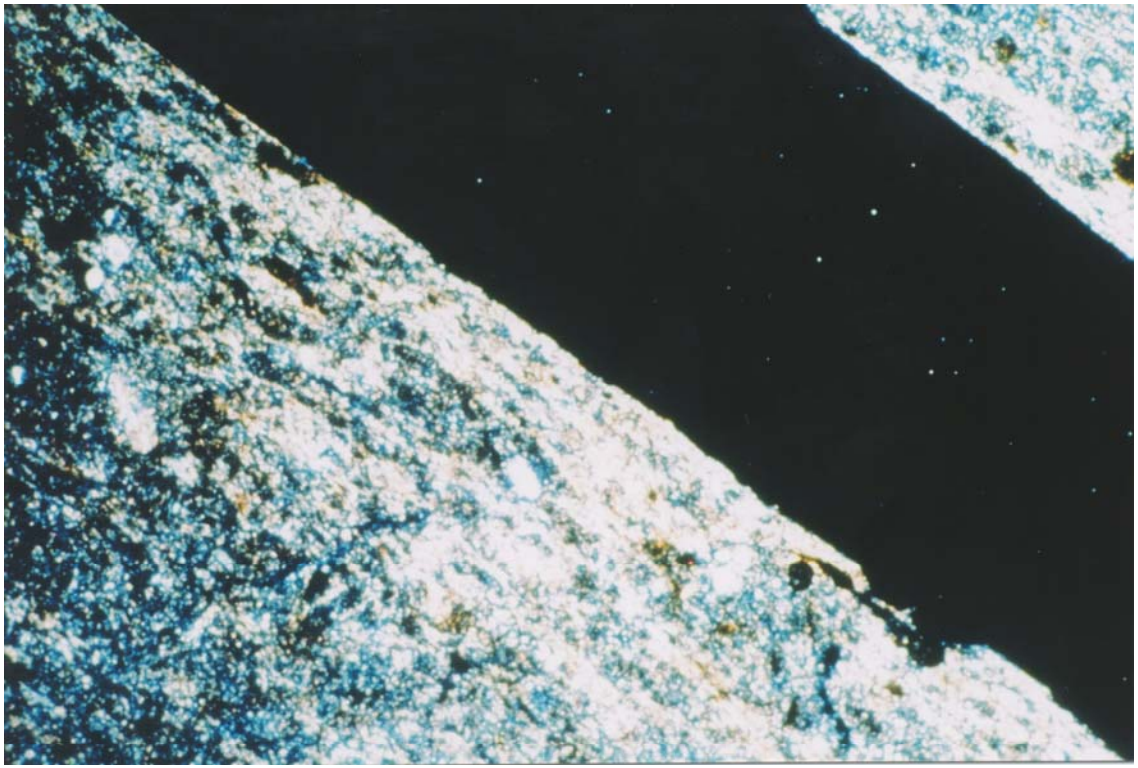






- Unrelated to voids, aggregates and grains :
  - crystals and crystal intergrowth
  - nodules
    - typic nodules
    - concentric nodule
    - nucleic nodules
    - geodic nodules
    - septaric nodules
    - halo nodules
    - pseudomorphic nodules
    - intercalations
- Fragmented and deformed pedofeatures





Entisols	–Coating Could not be observed, usually shows single grain structure, RDP is Monic
Inceptisols	–(Cambic) soil material is fragile and friable –The structure is usually well developed –Argillans do not occur
Vertisols	–Fabric pedofeatures (slickensides)

Spodosols –pellicular grain structure

–RDP Chitonic and Enaulic

Alfisols –textural pedofeatures (clay coatings) and the sesquioxide coatings might be observed in aquic moisture regime or present as soft nodules with diffuse boundaries

Ultisols –textural pedofeatures (clay coatings)

–parent material are almost completely weathered

–Accumulation of Fe is an important process in many Ultisols. Various types of ferrugineous features, mottles and nodules are recognized in Ultisols.

Oxisols –weatherable minerals should be practically absent from the sand and silt fraction

–presence of a microped structure

เอกสารอ้างอิง

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