

Department Of Biomedical And Specialty Surgical Sciences  
Laboratory of Archeo-Anthropology & Forensic Anthropology

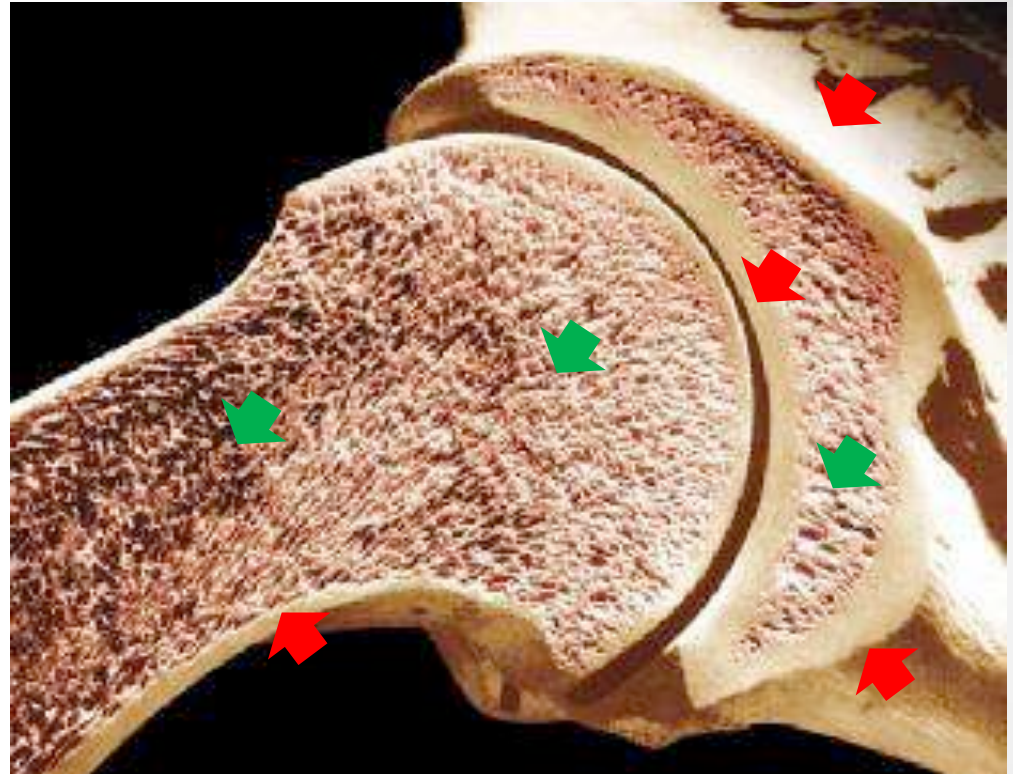
# Microscopic Paleo-Pathology

**Collection, treatment and preparation of  
archaeological human remains for  
histopathological investigation**

# Introduction

**Paleopathology:** studies the pathological conditions found in ancient human and animal remains.

**Hystology:** studies the microscopic structure of animal and vegetal tissues.



## Bone Tissue

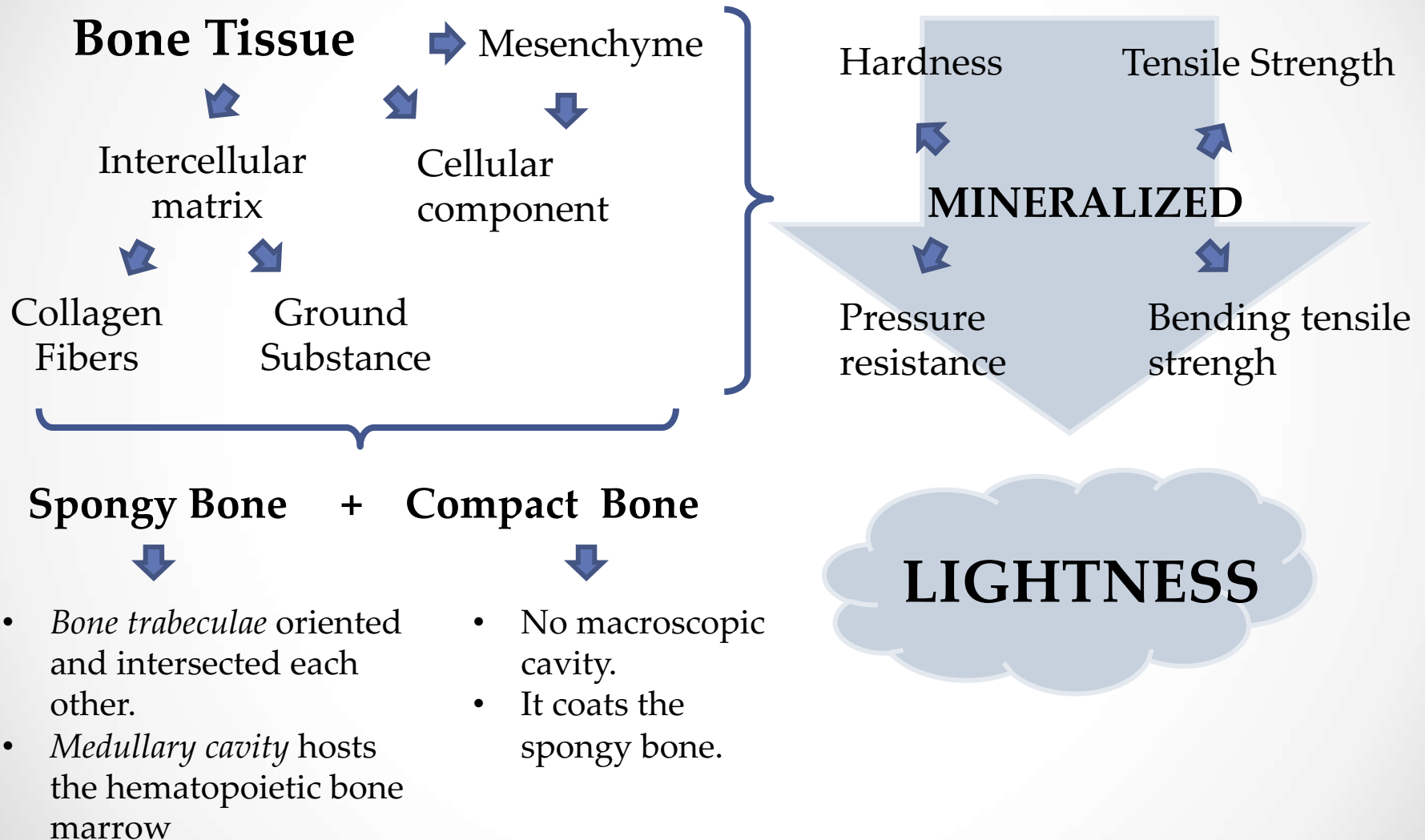


**Compact bone**



**Trabecular bone**

# Bone Tissue

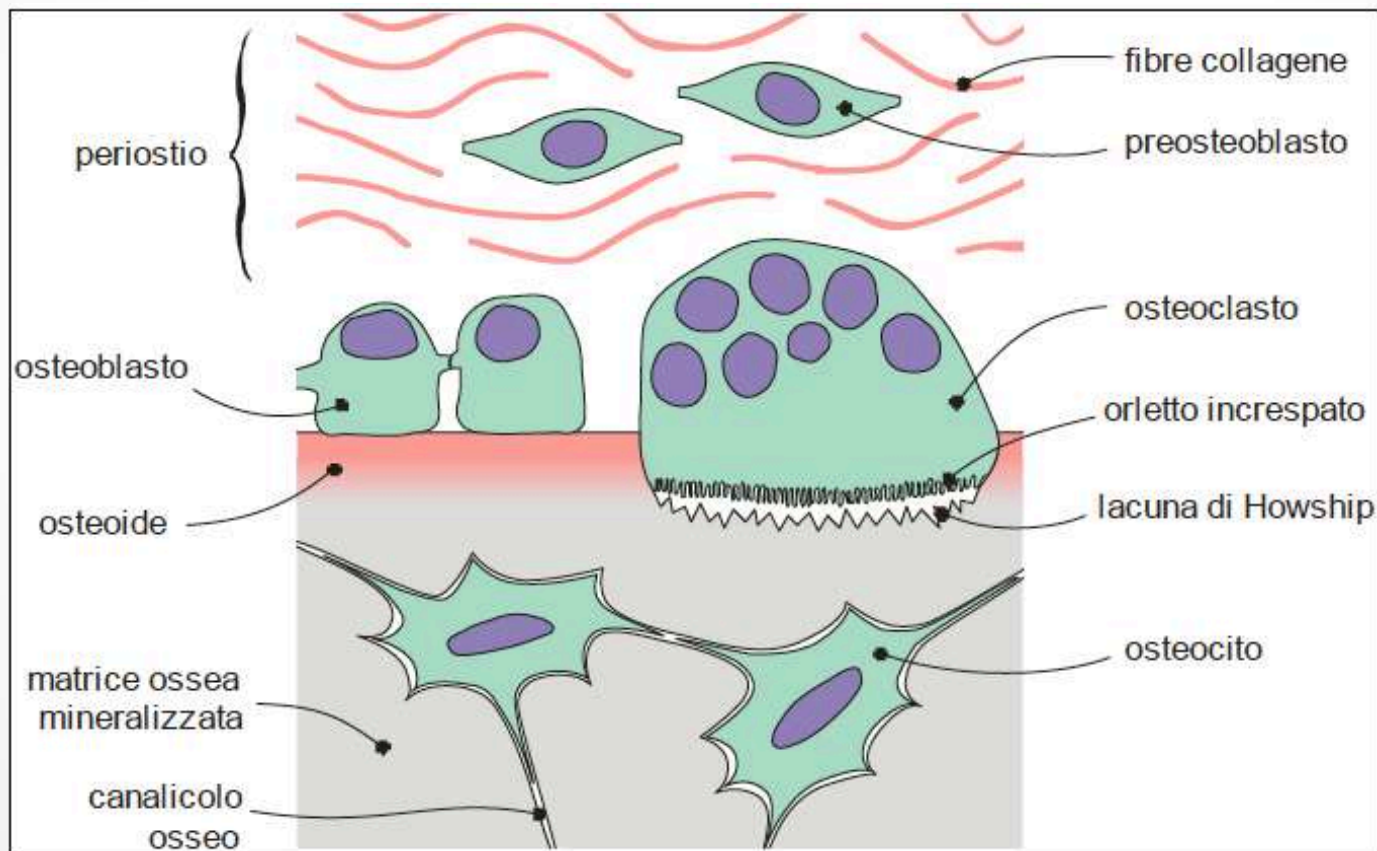


## Mineral component

- Calcium phosphate (Hydroxyapatite)
- Calcium carbonate
- Calcium fluoride
- Magnesium phosphate

## Cellular components

- Pre-Osteoblasts → Osteoblasts
- Osteocytes
- Osteoclasts



# Structure

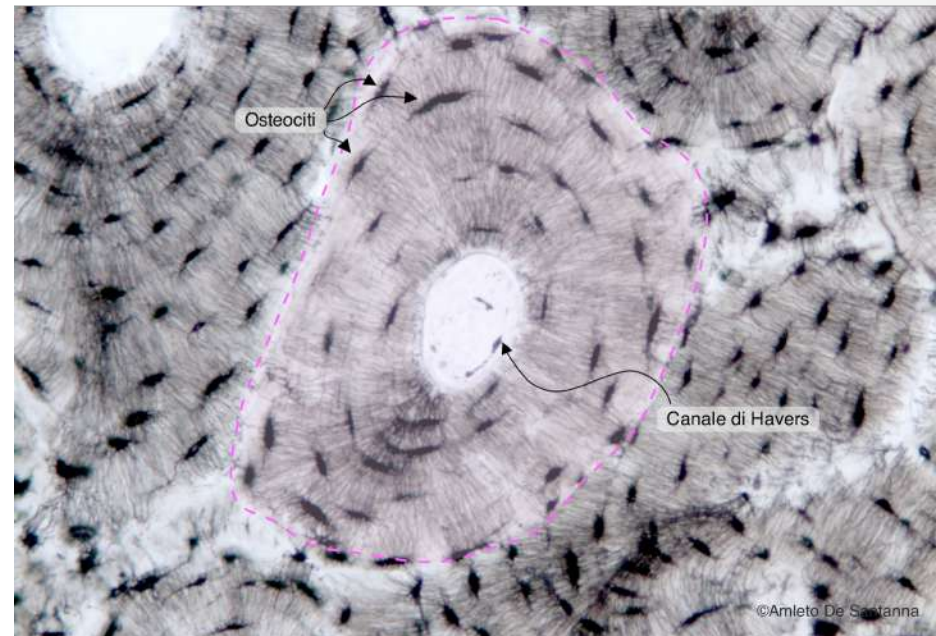
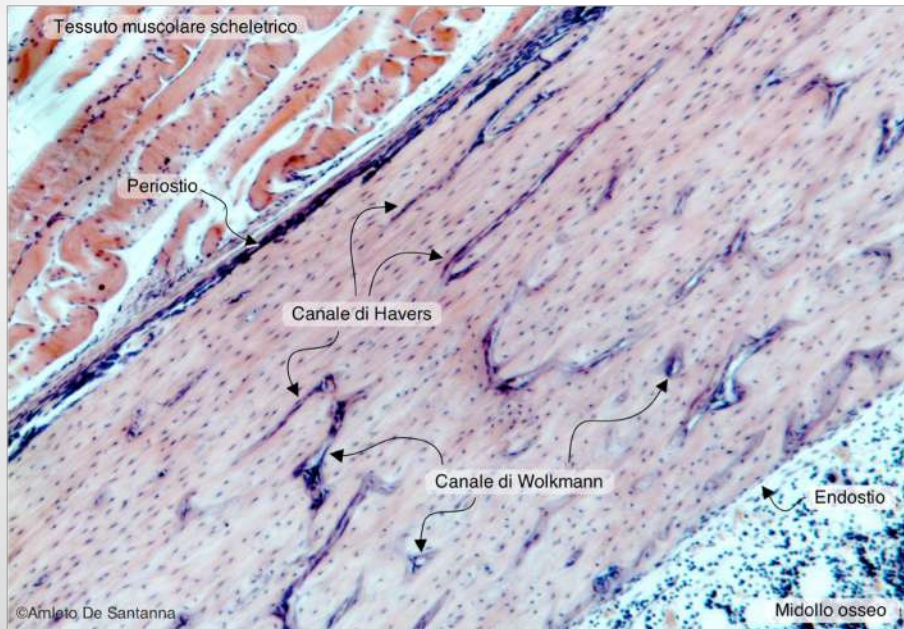


Lamellar bone

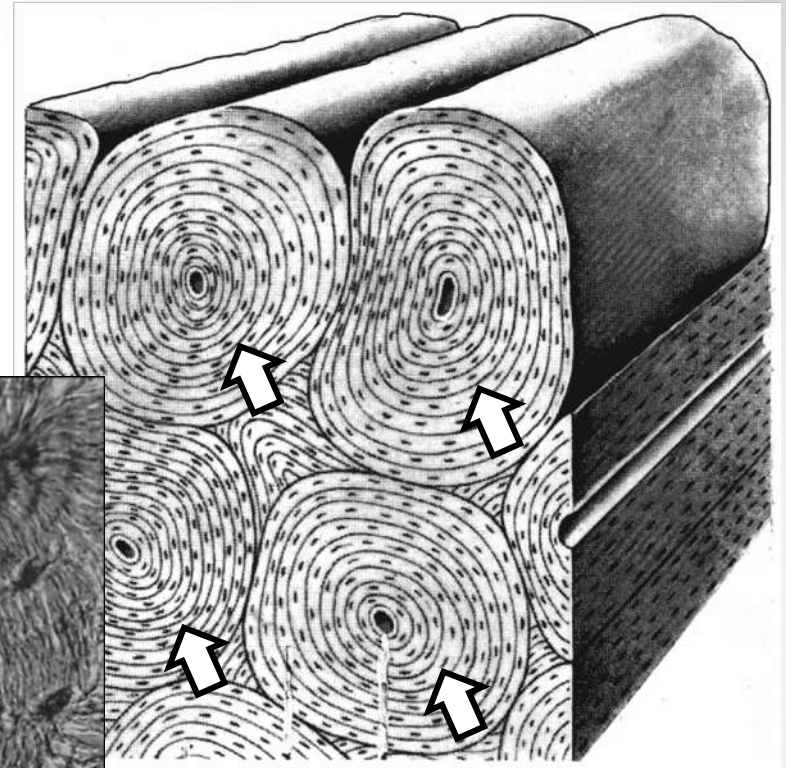
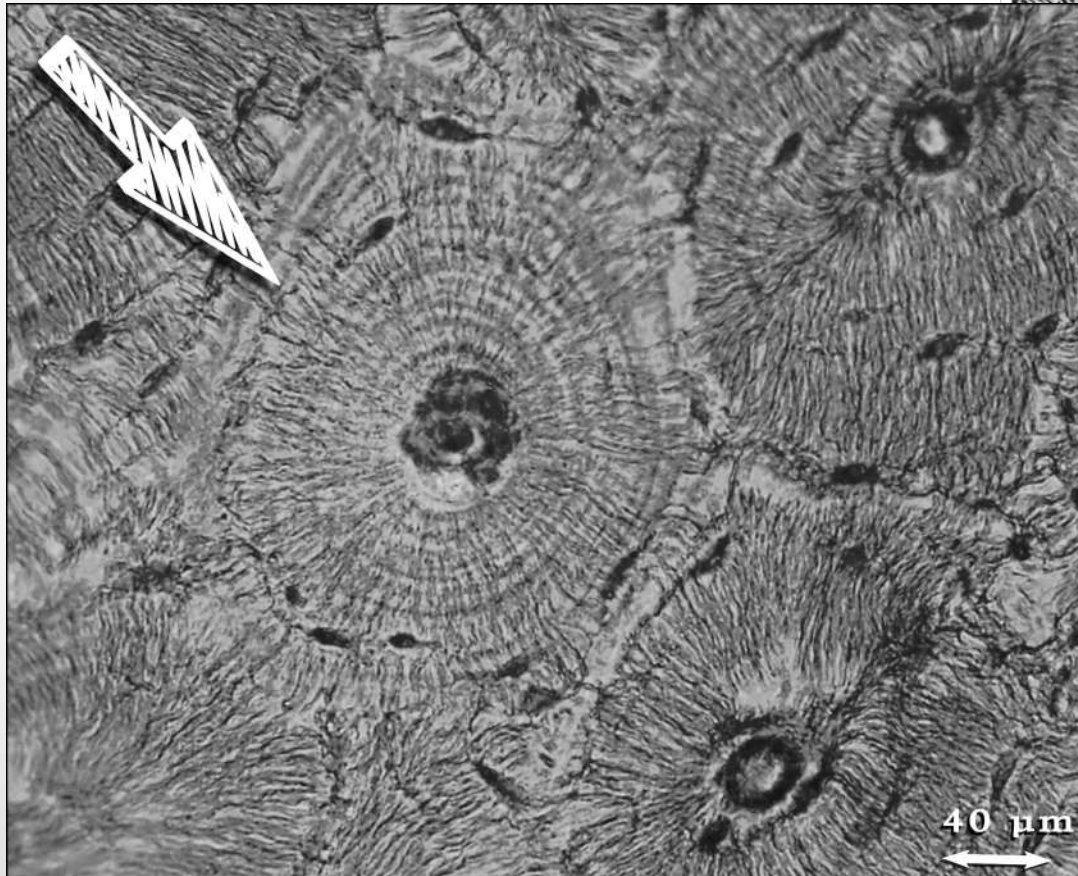


Compact bone

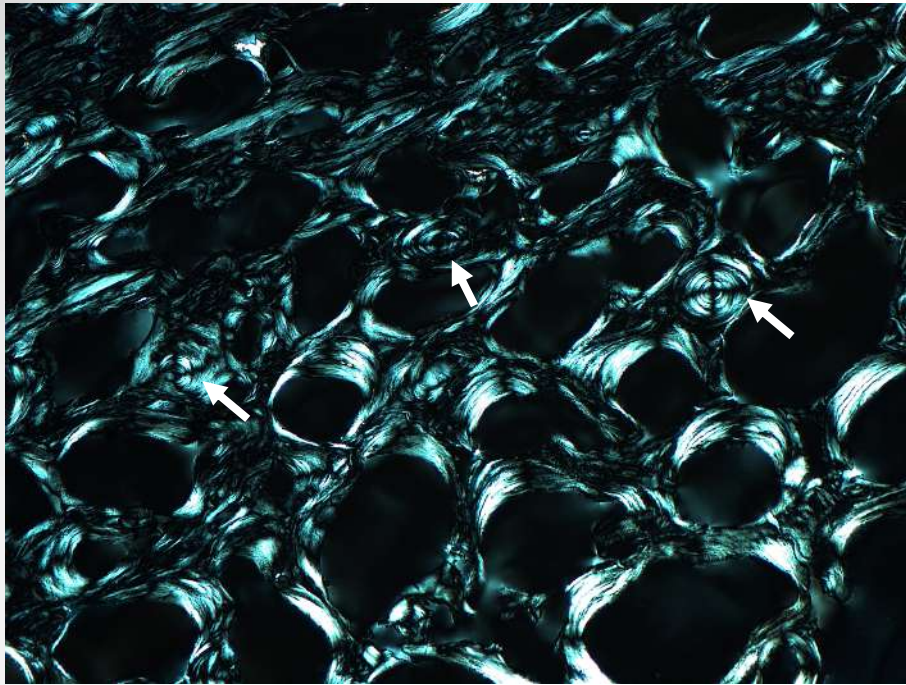
Spongy bone



## Haversian System



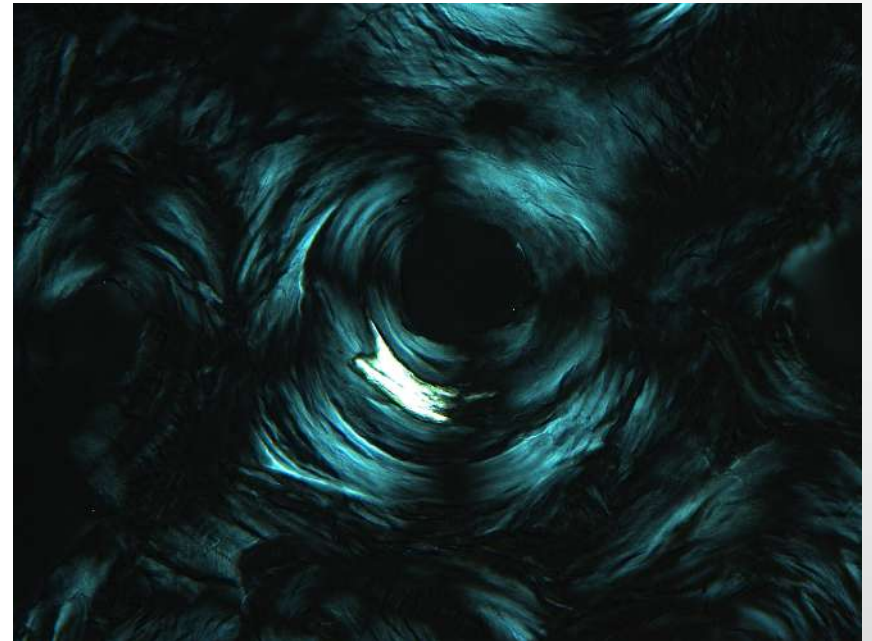
**Tridimensional drawing  
of Haversian Systems:  
Frece = Haversian System**

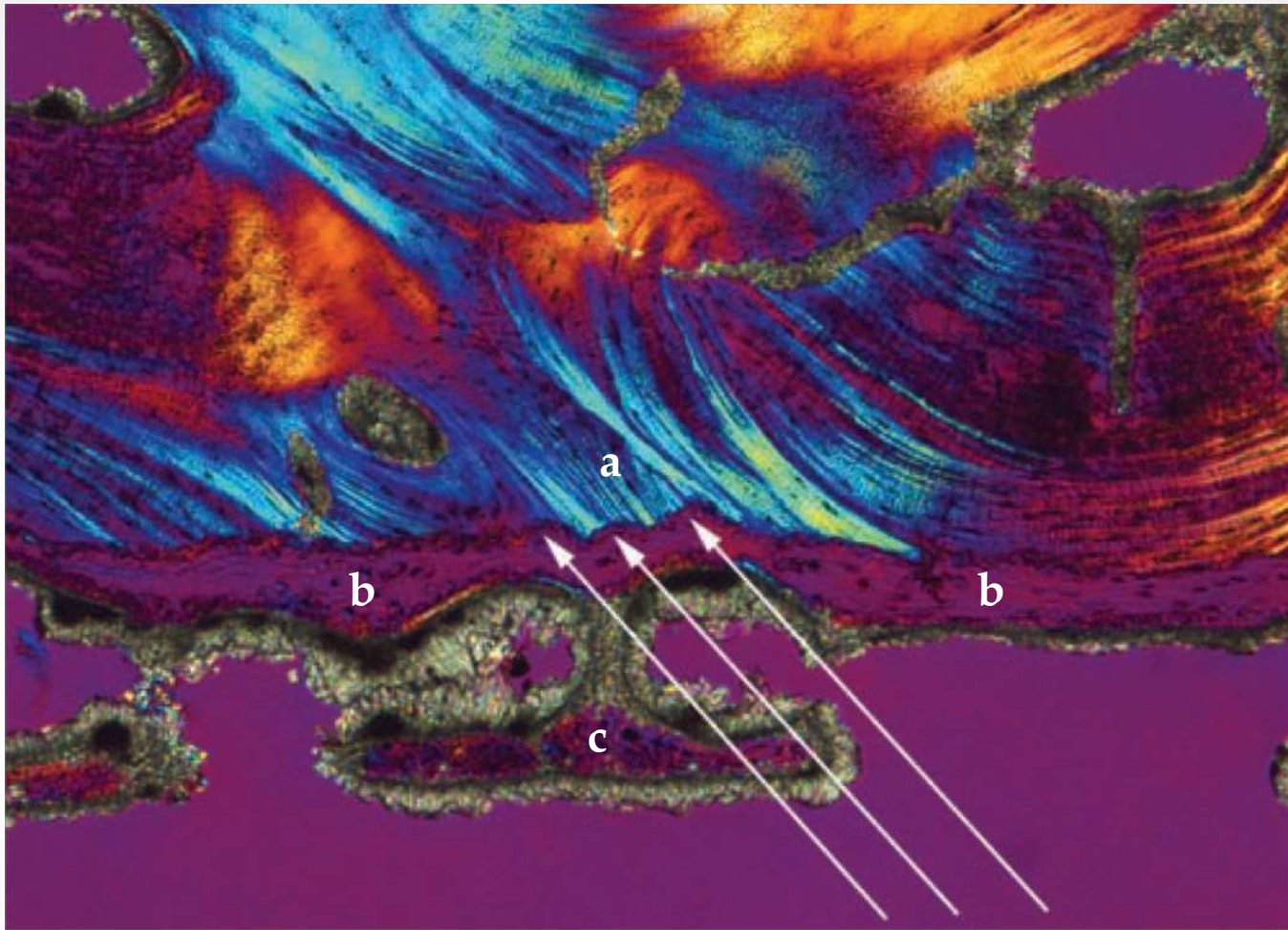


SSM (Italy), US 81, Middle Adult.  
Pariet dx.

**Fig. 1)** Trabecular bone,  
**Arrows** = Osteons. 25x magnification.

SSM (Italy), US 81, Middle Adult.  
Pariet dx..  
**Fig. 2)** Osteons. 100x magnification  
Thin-ground section (50  $\mu\text{m}$ ) polarized  
light microscope.





İkiztepe (Turkey), IT-Türk-145, subadult, III millennium BC. Parietal left.

CC internal lamina, probable meningeal reaction; **a** = lamellar bone  
**b** = new bone formation, **c** = conglomerate made by new bone formation,

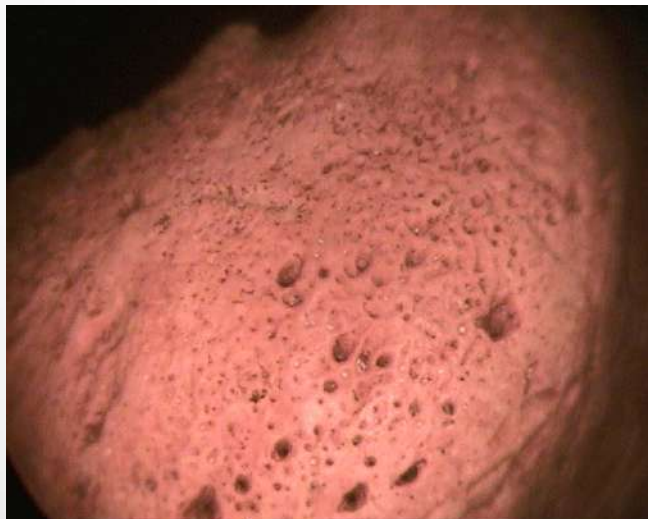
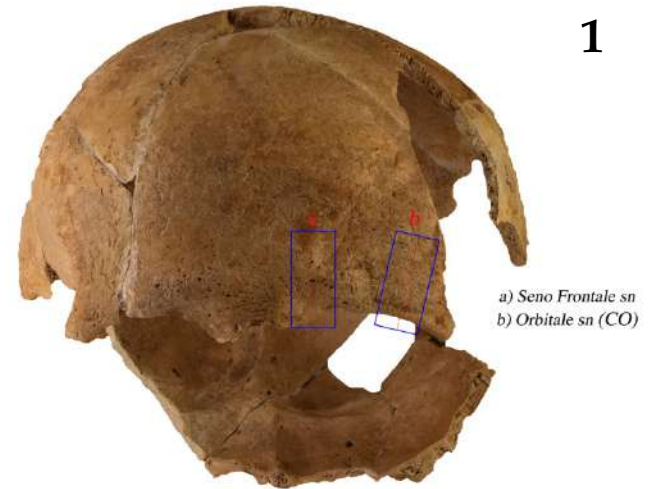
**Arrows** = Howship's lacunae (Thin-ground section (70  $\mu\text{m}$ ) Polarized light microscope with polarizing filter and quartz compensator 100 X magnification. © Schultz M.



# Microscopic Pathology:

Collection, Treatment & Preparation of the archaeological human bones.

1. Photographic documentation
2. Endoscopic/Microscopic documentation
3. Radiologic Documentation



# Sampling methods

Using:

- Manual cutting
- Diamond rotary saw / surgical saw
- Drilling
- Erosion

Measuring and labelling



## Sample's requirement:

- Presence-absence of the lesion
- Possibly cross-cutting
- Minimum sizes: 1 cm<sup>2</sup>
- Maximum sizes: 5 x 7 cm



SSM 81 (Italia) – Sampling steps.



# Microscopic Pathology:

## Collection, Treatment & Preparation of the archaeological human bones.

The bones treatment involves some careful steps before the final inclusion in Biodur©

1. Sediment removal with soft bristle brush
2. Removing traces of adhesives with undiluted acetone
3. Immersion in Methylene Chloride or in increasing alcoholic solutions



# Microscopic Pathology:

## Collection, Treatment & Preparation of the archaeological human bones.

The last step of the treatment consists in the inclusion in resin:

1. Immersion of the samples in Epoxy Resin
2. Drying of samples in vacuum impregnation system
3. Creation of resin discs/cubes with included samples
4. Drying of samples in an oven at 25-30°C



# Microscopic Pathology:

## Collection, Treatment & Preparation of the archaeological human bones.

The drying phase is followed by two simultaneous phases :

↓  
Shaping  
↓

Creation of a polyhedral block with dimensions not exceeding those of the supporting glass.



↓  
Preparation of the  
blocks for  
longitudinal cutting

↓  
Creation of two mirror  
blocks (50µm and 70µm)

↓  
**Regularisation** and Polishing of  
the surface in contact with the  
supporting glass.

↓  
**Arrangement on supporting glass**

# Thin-ground sections:

## How to obtain the thin sections.

After the consolidation subsequent to the previous steps , the final procedure shall be followed:

1. Reducing block volume
2. Thinning to the proper size
3. Sanding and Polishing with leather
4. Cover with cover glass (max thickness  $10\mu\text{m}$ )
5. Labelling of the sample on the slide side





**Sample collection table:**  
Different stages of creating thin sections.



# Microscopy and Paleohistology:

Analysis and possible diagnoses: Some examples

Entire process of creating a  
batch of Thin-ground sections:  
3/4 weeks.



Histological preparations ready  
for microstructural analysis



Recognition of  
microscopic  
structures



Comparison  
with benchmark  
collection



Polarized light microscope Leica DMRXP,  
Camera Leica DFC 500.  
Infraview© for digital rendering on PC.

# Reconstruction work:

## How to repair damage from sampling activities

Tissue collection for histological analysis



Intrusive operation



Destructive action



Total or partial restoration with plaster reproduction



Sculpting a block of plaster (single)



Creation of a silicone negative (multiple)



Coloring with natural pigments or water-based colors



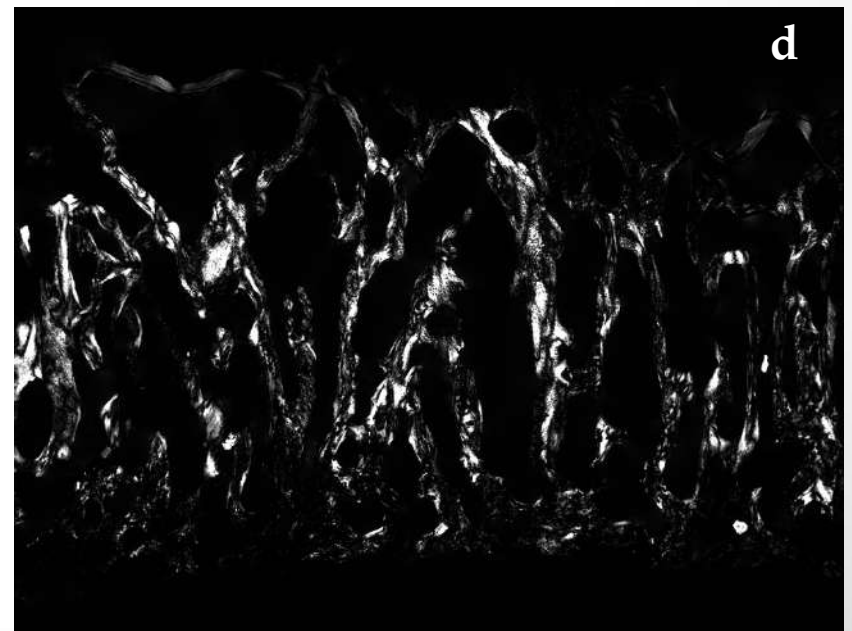
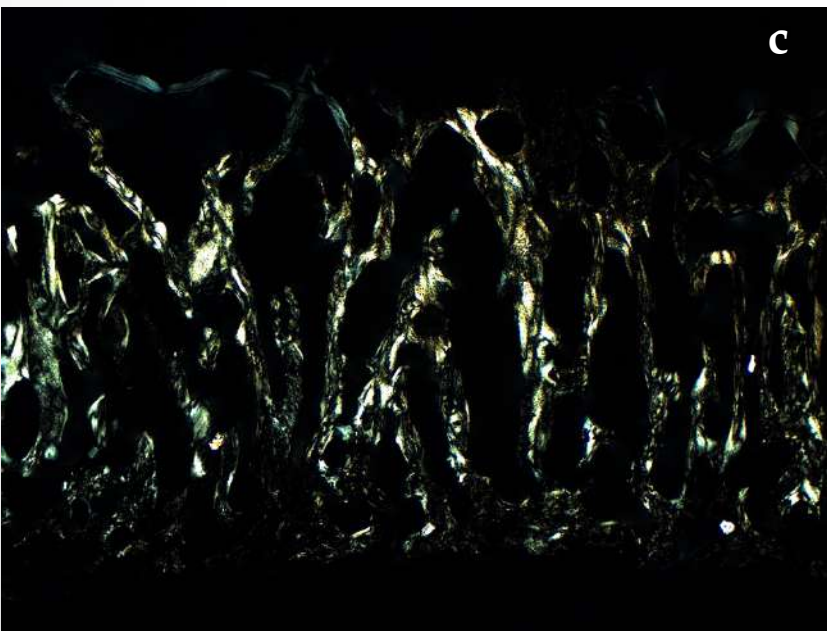
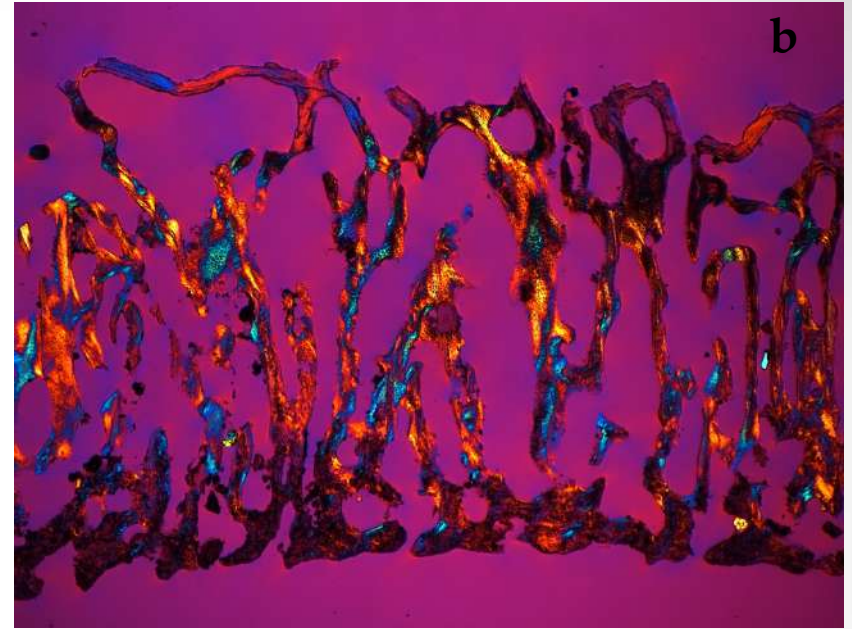
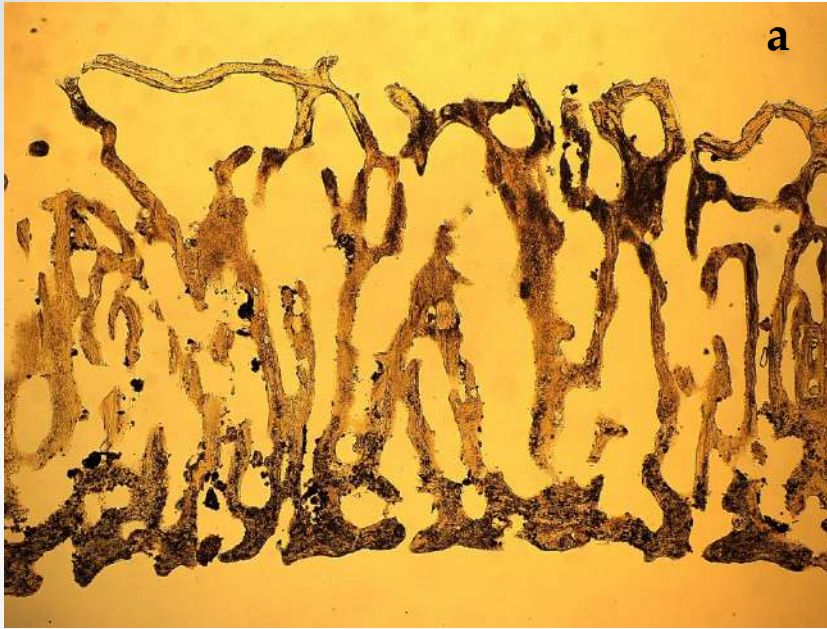
SSM 42 (Italy) – Reconstruction phase.

# Case 1:

SSM 4IIa – Subadult Orbital roof



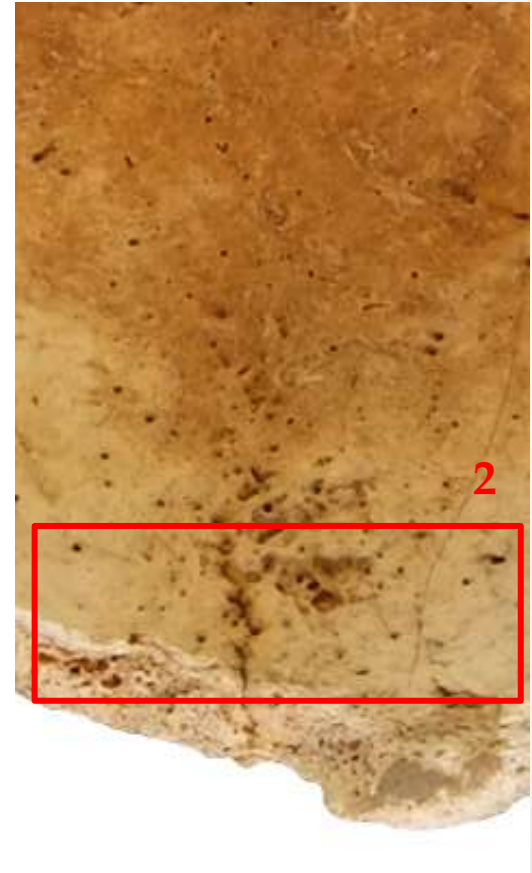
## SSM 4IIa- LT Orbital Roof



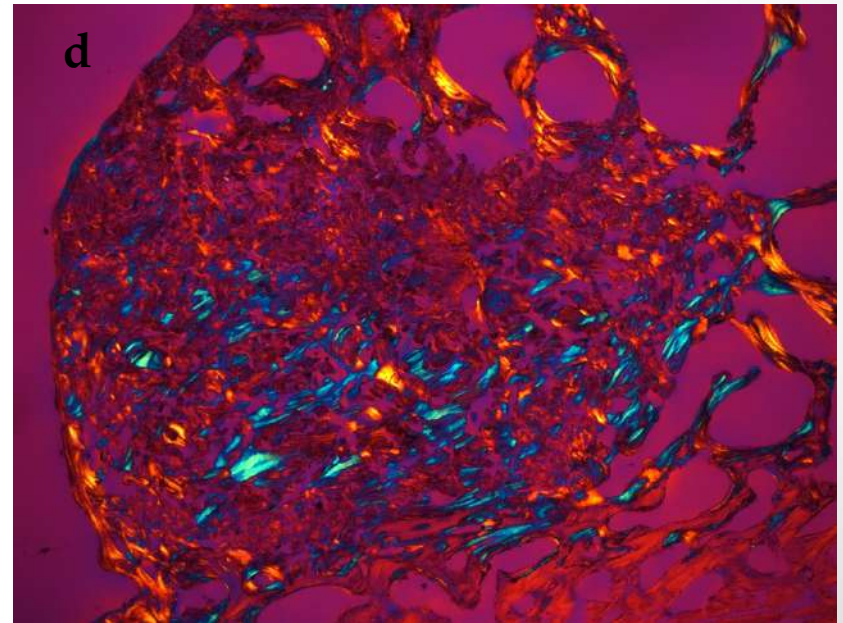
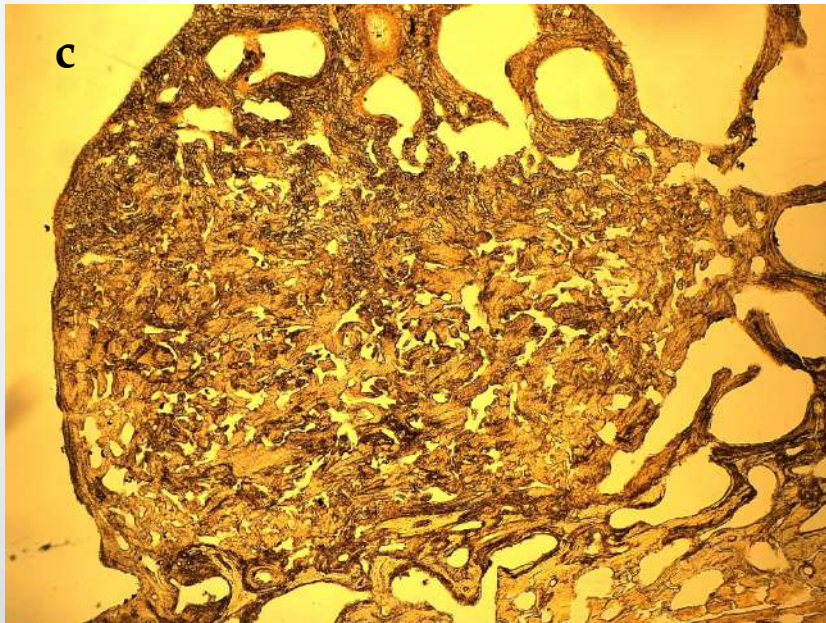
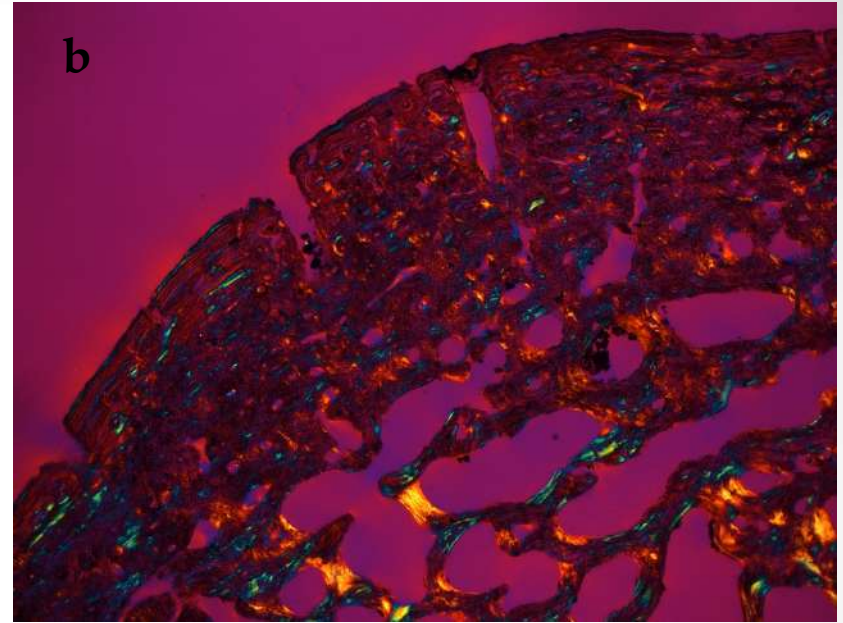
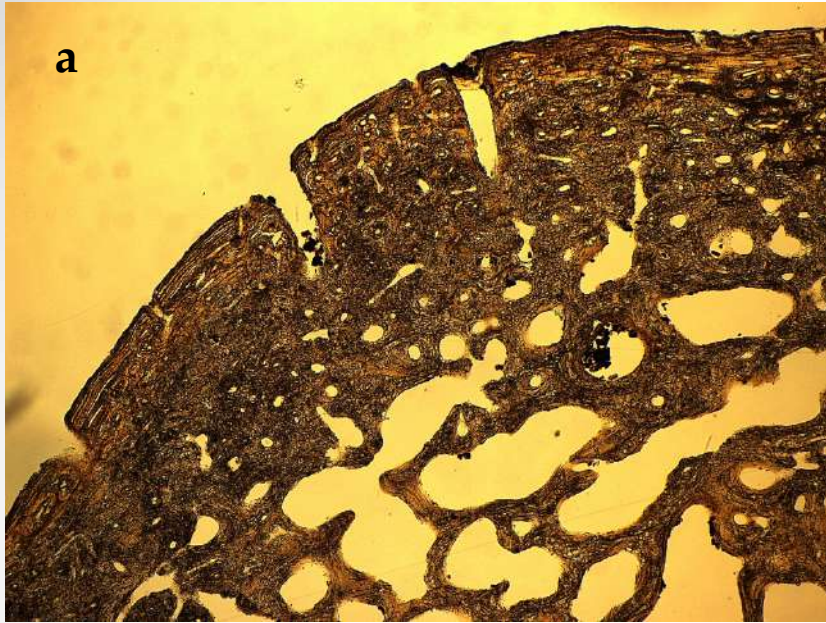
- **Thin-ground section (50 μm):** polarized light microscope using **a)** transmission light; **b)** polarizing filter; **c)** polarizing filter & quartz as compensator; **d)** polarizing filter (de saturated image). 16X magnification
-

# Case 2:

SSM 92 – RT Frontal Sinus + RT Parietal

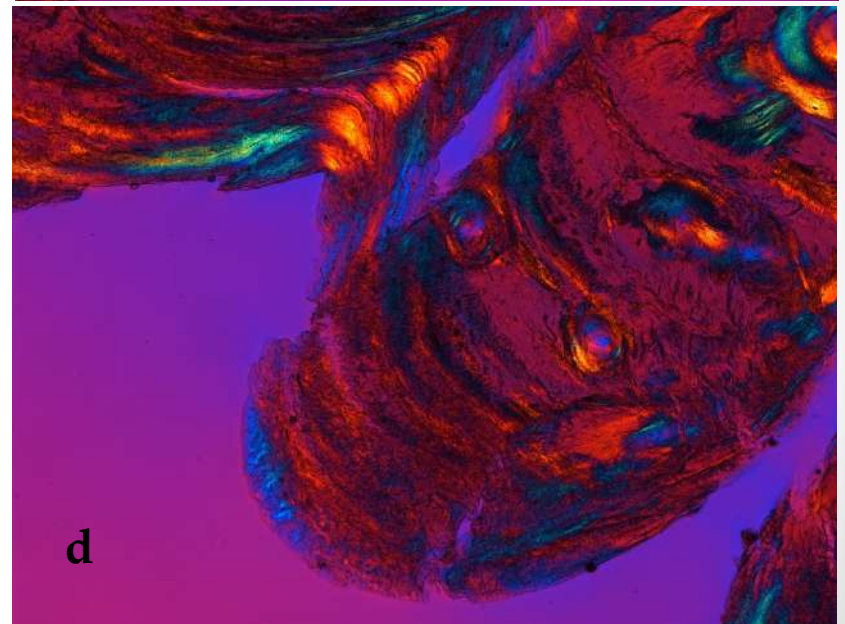
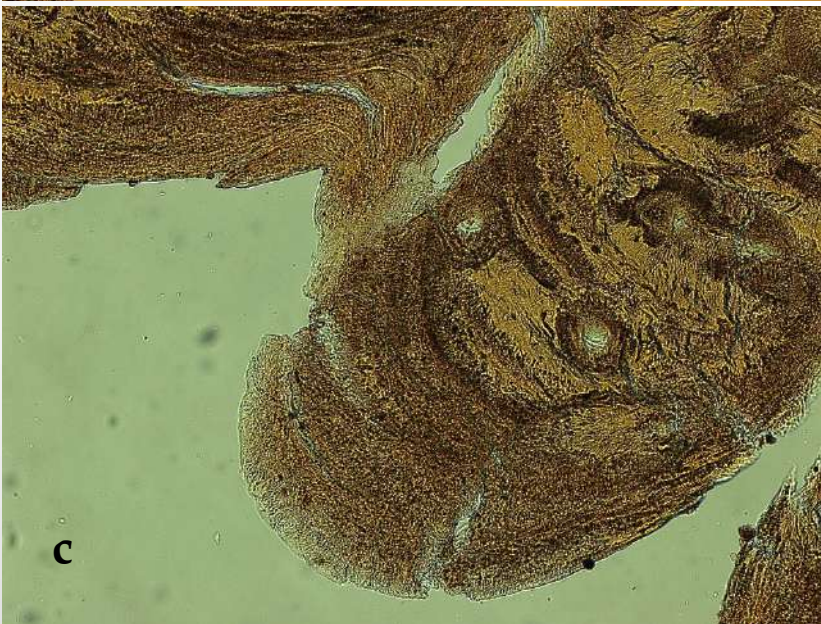
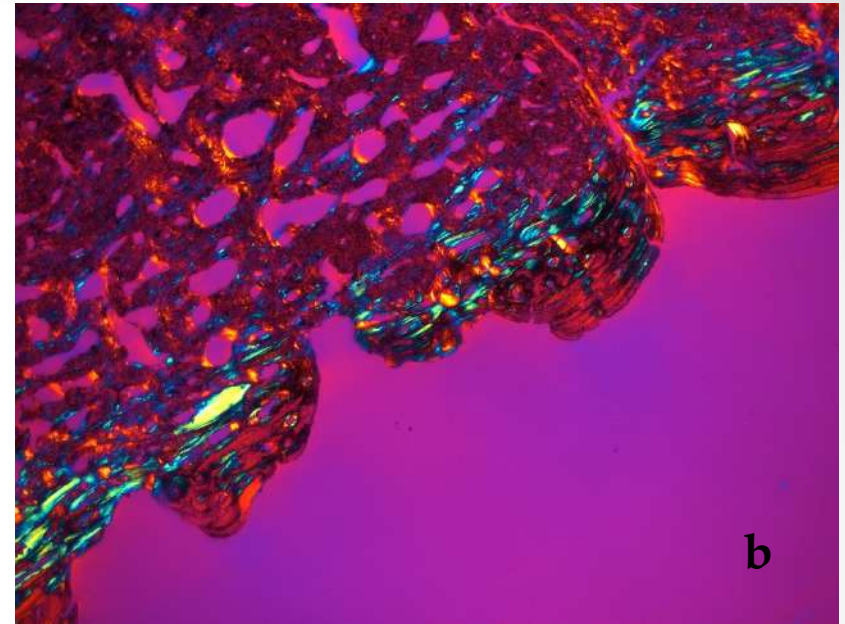
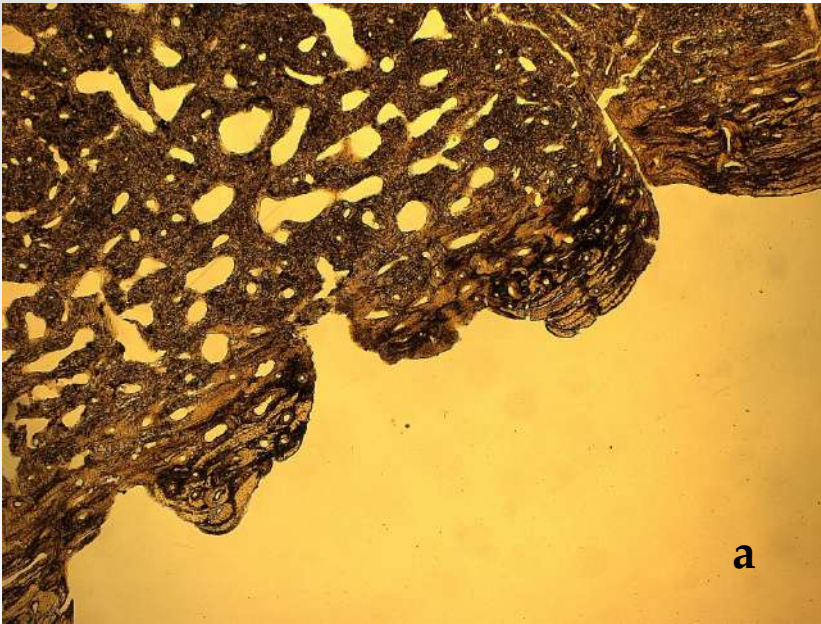


## SSM 92- RT Frontal Sinus



- **Thin-ground section (70  $\mu\text{m}$ ):** polarized light microscope using **a - c)** transmission light; **b - d)** polarizing filter and quartz as compensator. 16X magnification ●

SSM 92- RT Parietal



● **Thin-ground section (70  $\mu\text{m}$ ):** polarized light microscope using **a)** transmission light; **b)** polarizing filter & quartz as compensator. 16X magnification; **c)** transmission light; **d)** polarizing filter and quartz compensator. Magnification 100X ●

Thanks for your attention!

