A Technique for Microscopical Soil Examinations

Skip Palenik

Microtrace
Elgin, IL USA

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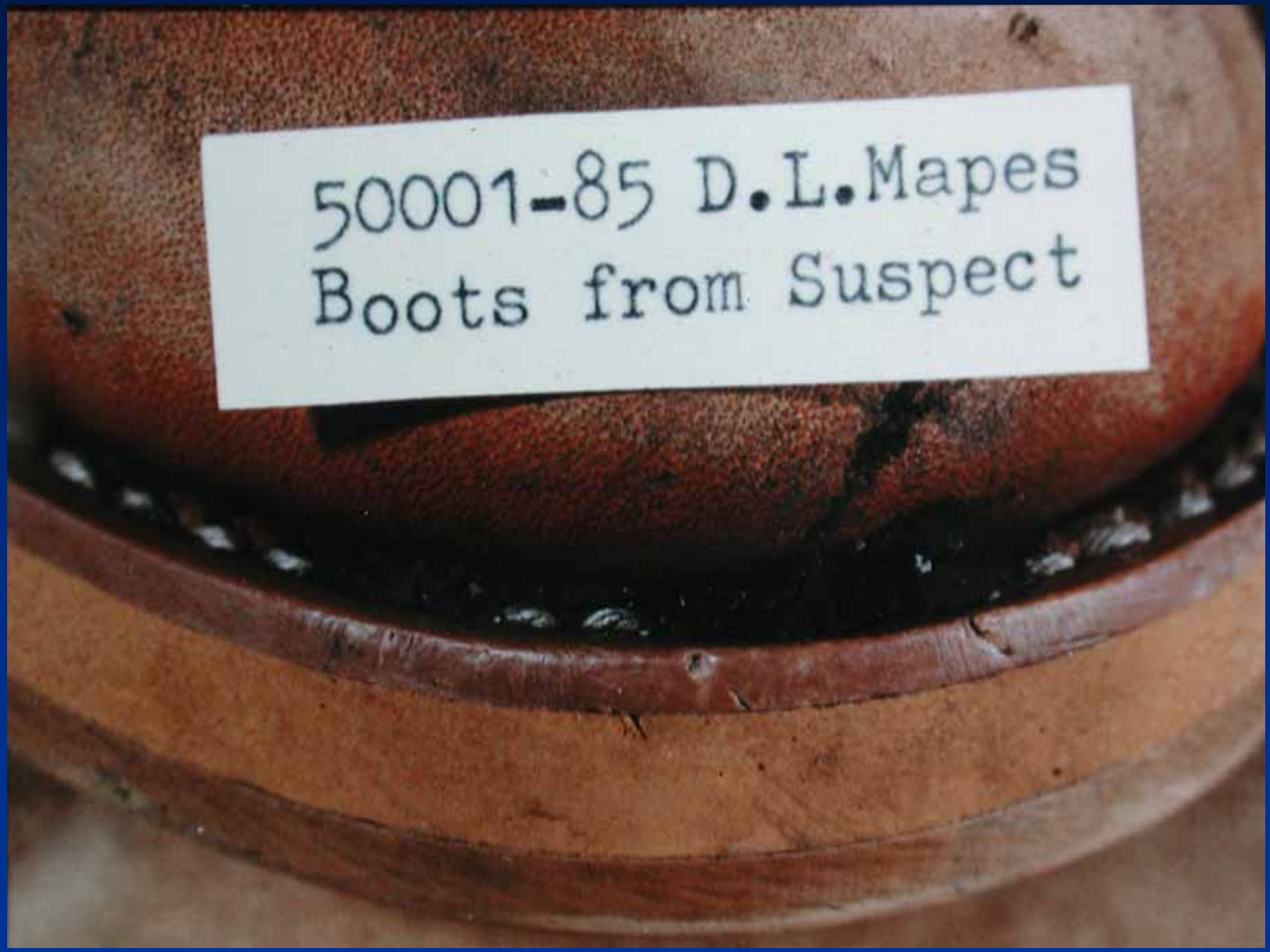
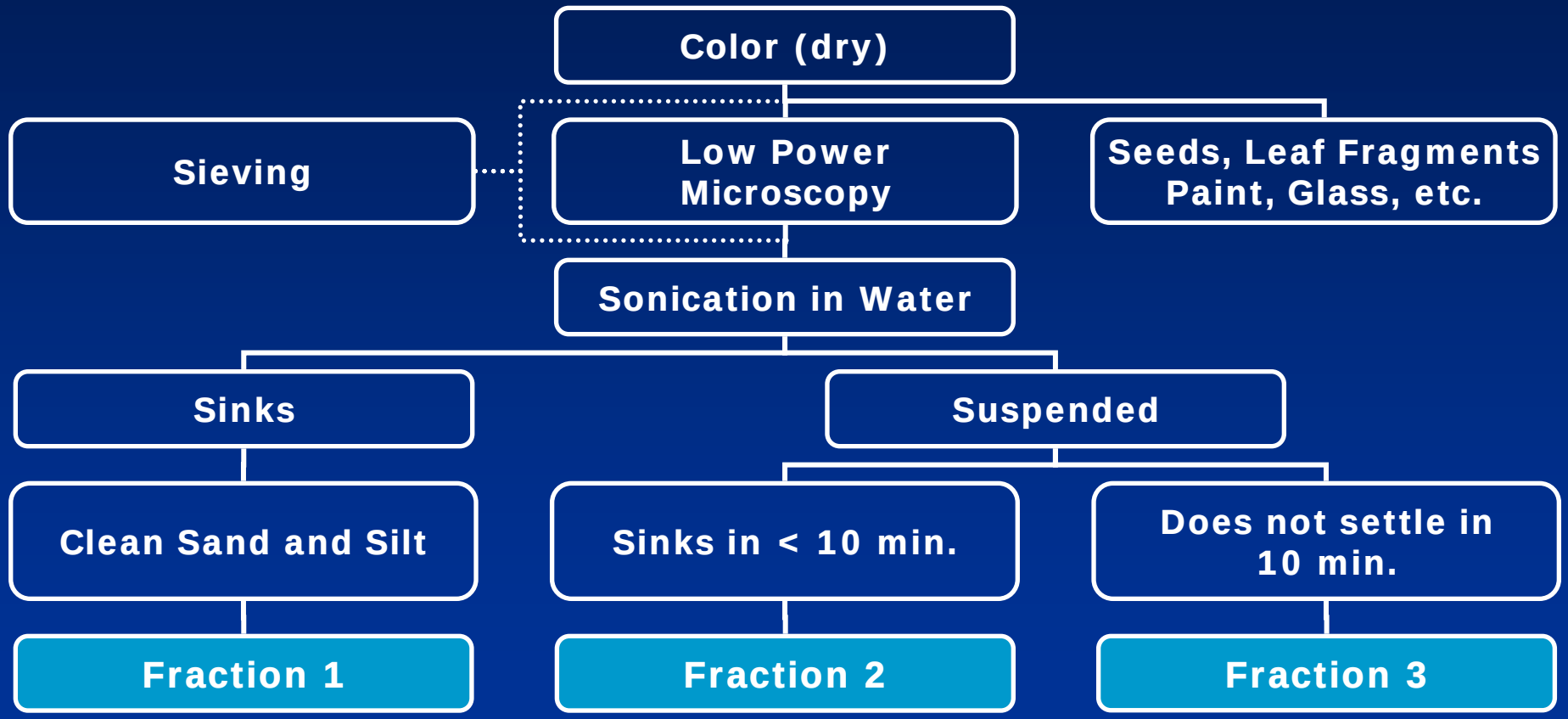
Microtrace

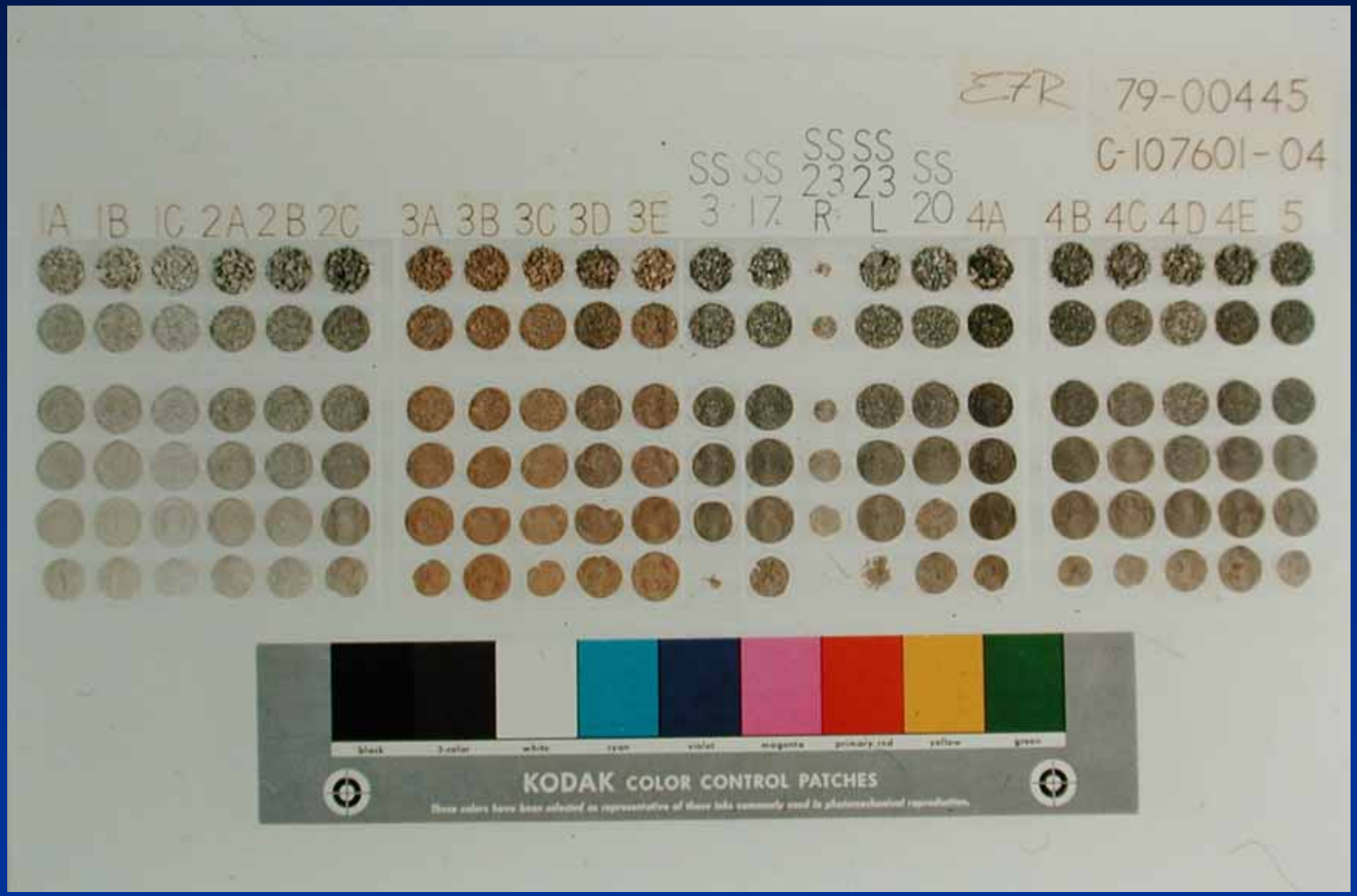

50001-85 D.L.Mapes
Boots from Suspect

Edmond Locard

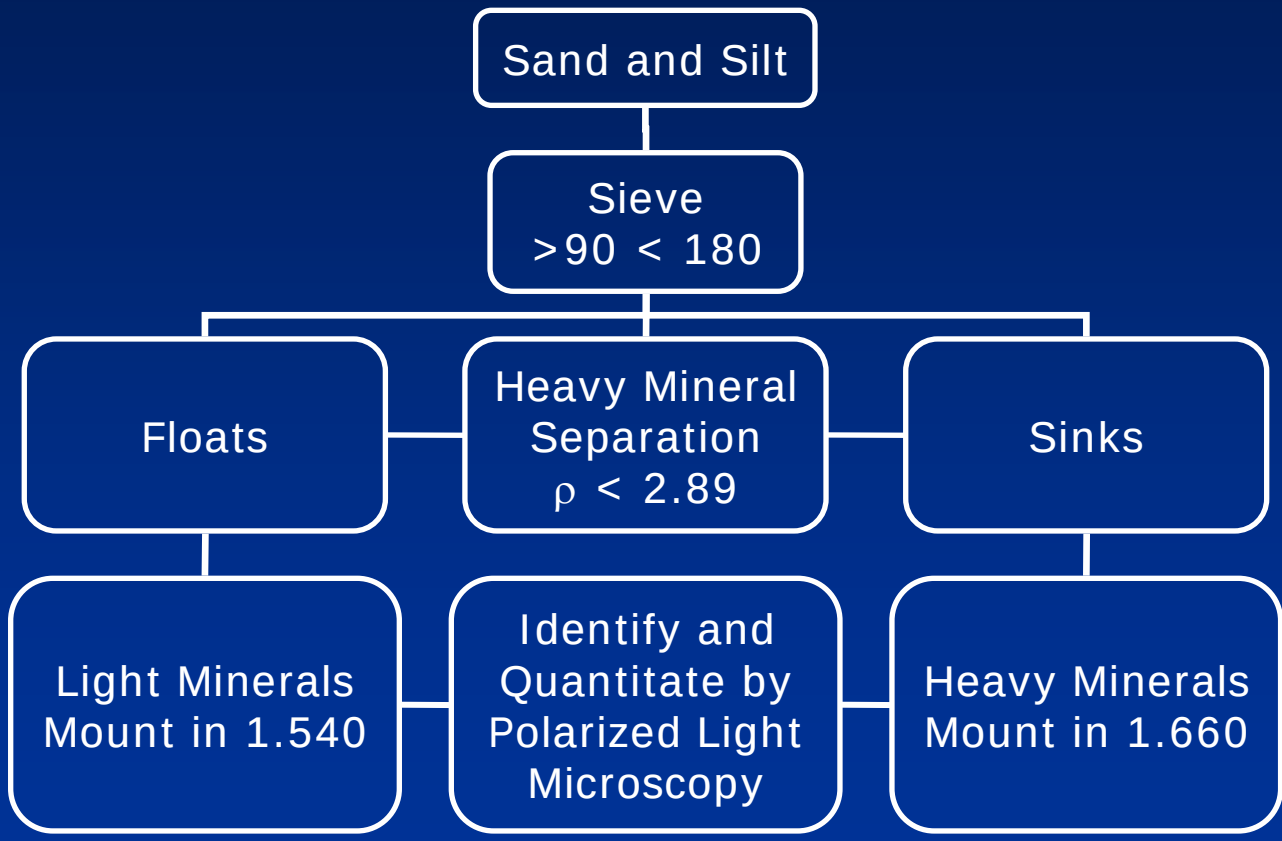
Preliminary Separation



Color


EFR 79-00445
C-107601-04
1A 1B 1C 2A 2B 2C 3A 3B 3C 3D 3E SS 3 SS 17 SS 23 R SS 23 L SS 20 4A 4B 4C 4D 4E 5
KODAK COLOR CONTROL PATCHES

Fraction 1


Sand and Silt
Sieve
>90 < 180
Floats
Heavy Mineral Separation
ρ < 2.89
Sinks
Light Minerals Mount in 1.540
Identify and Quantitate by Polarized Light Microscopy
Heavy Minerals Mount in 1.660


DECOTTS LTD.
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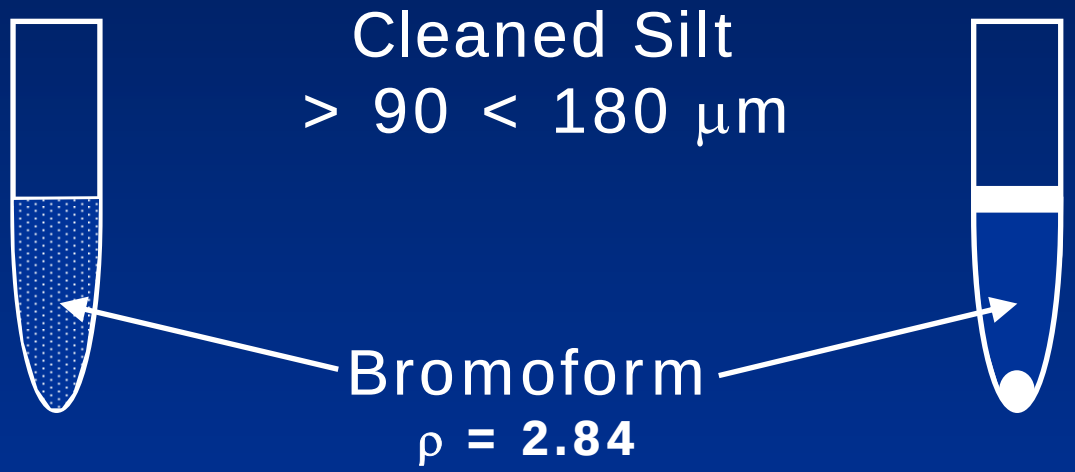
Heavy Mineral Separation



Mineral Separation in Heavy Liquids

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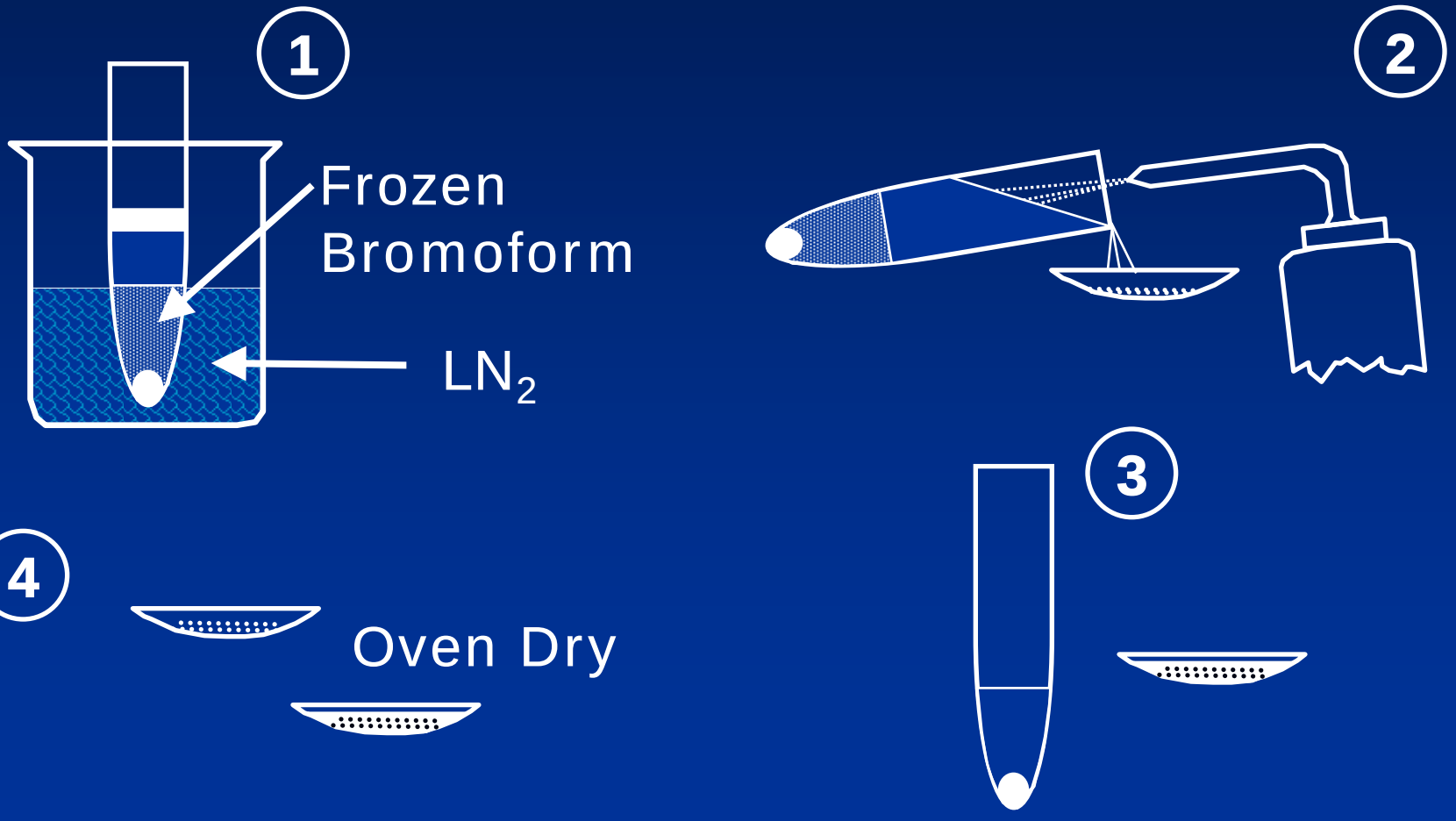
Freezing Heavy Minerals in Tip of Tube with LN2

Isolation of Mineral Separates

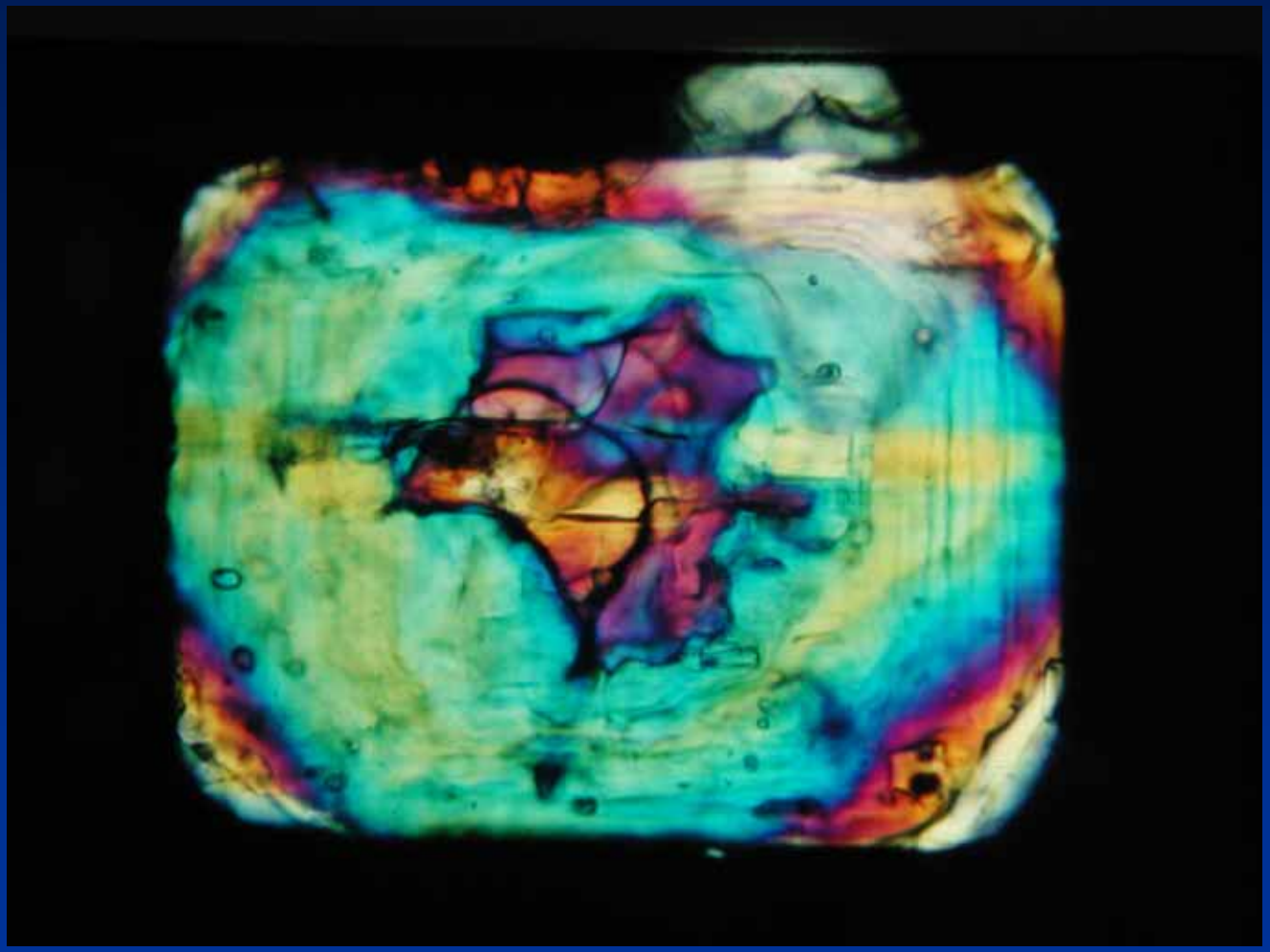


Heavies Frozen in Bottom of Microcentrifuge Tube

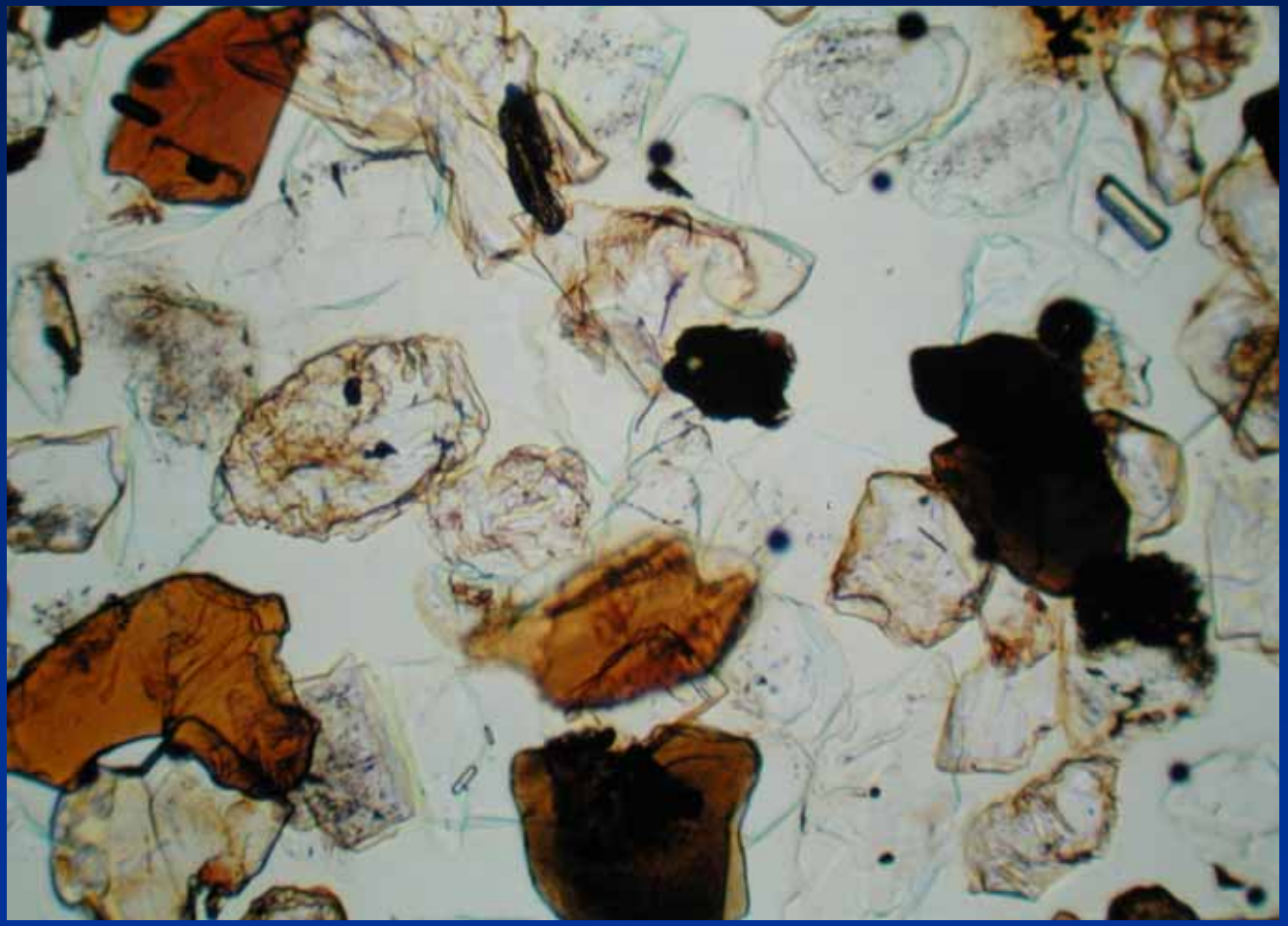
Light Mineral Fraction Washed from Tube

Light and Heavy Fractions Ready for Mounting

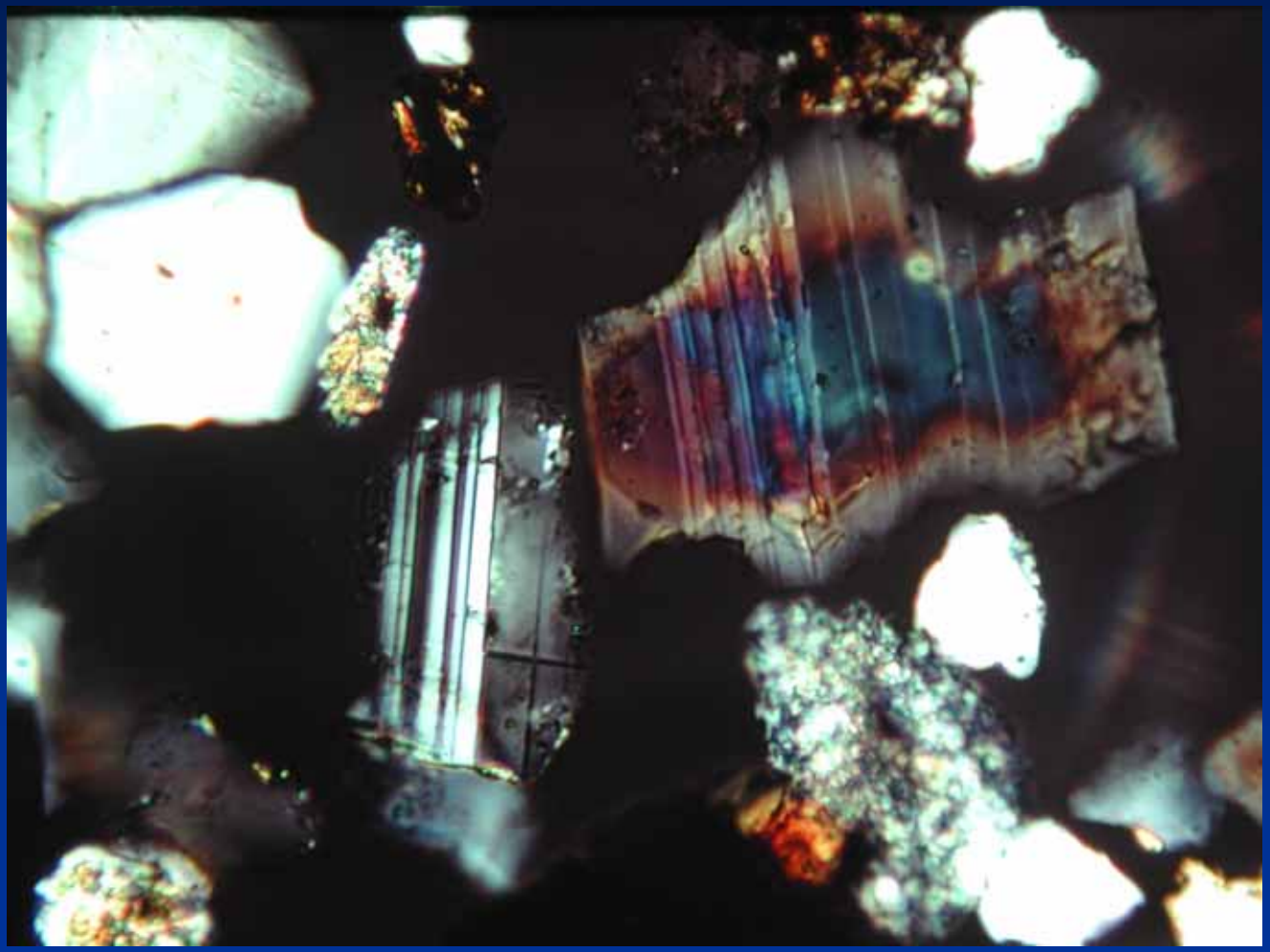
PLM Study of Density Fractions



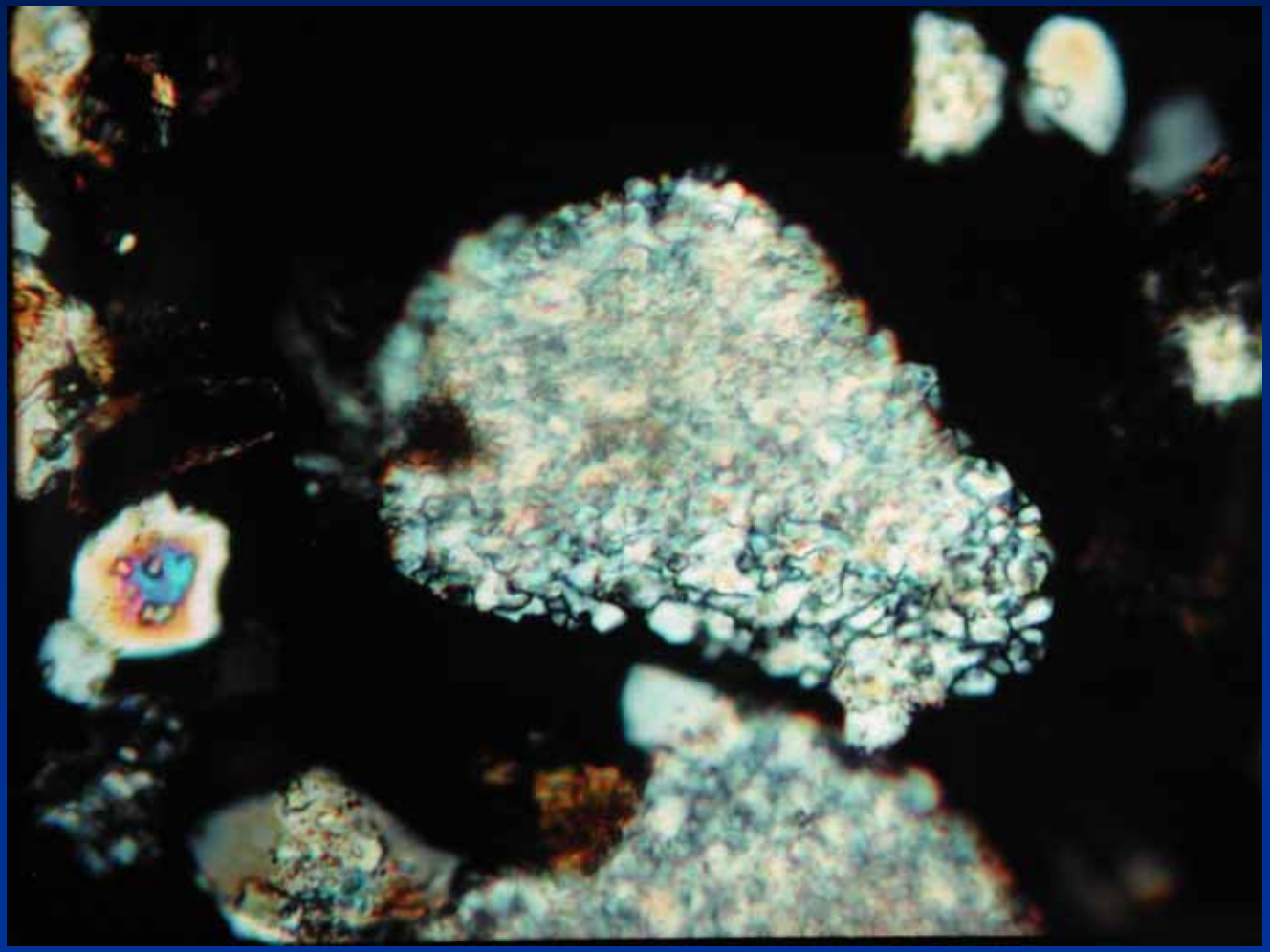
Light Mineral Fraction in 1.540 Cargille Liquid



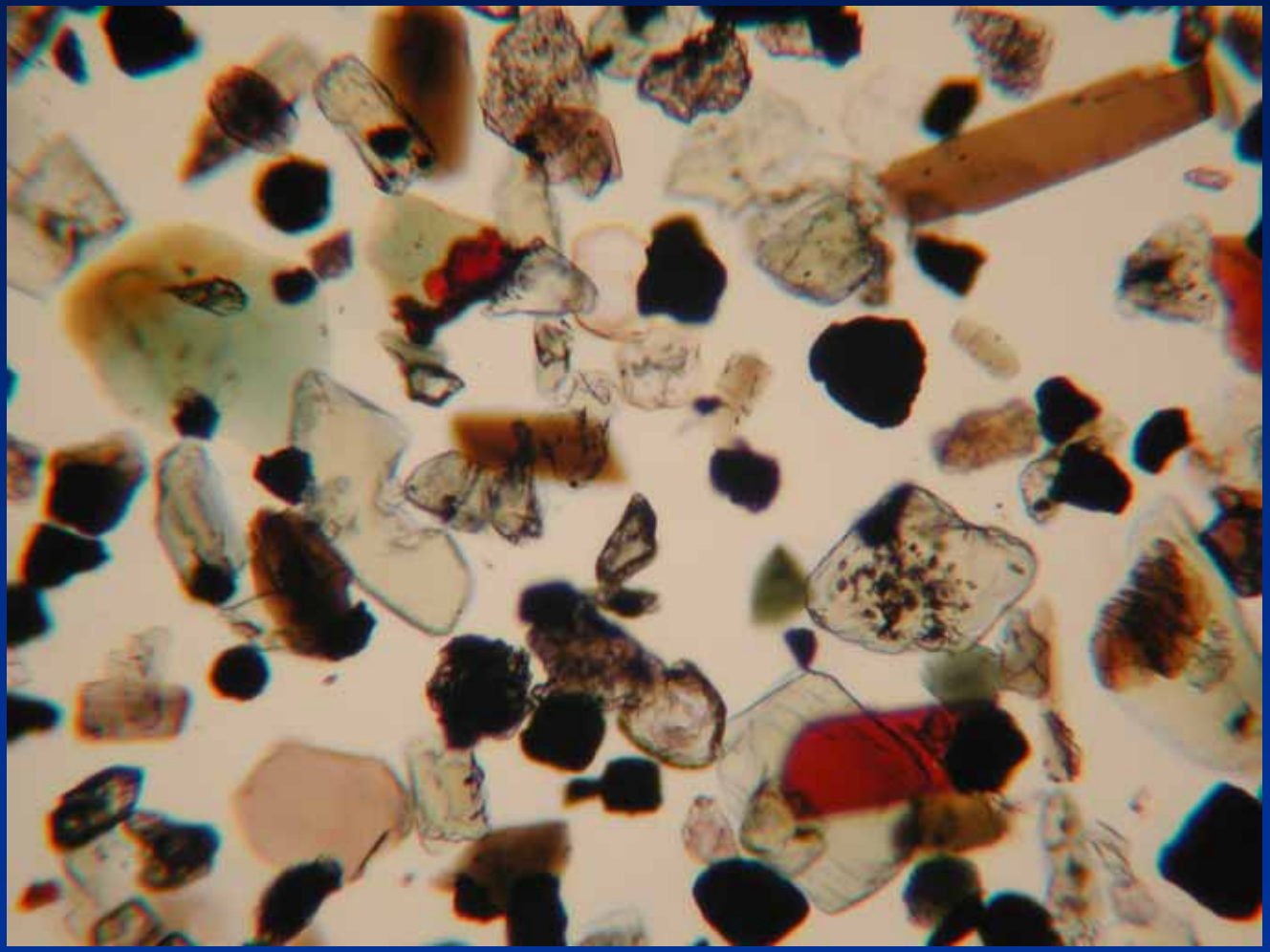
Plagioclase Feldspars Crossed Polars



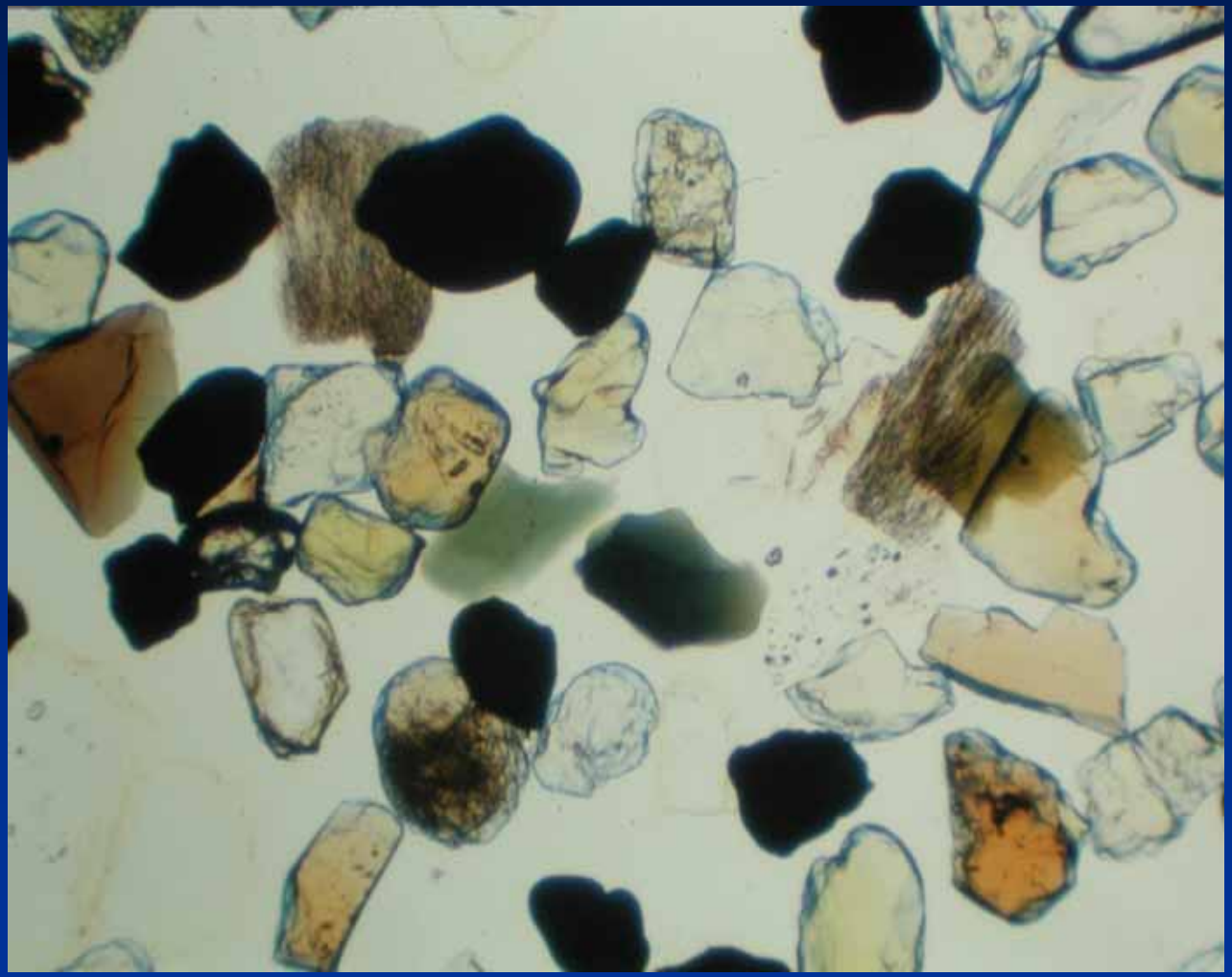
Rock Fragments



Heavy Mineral Suite
Plane Polarized Light



Mineral Suite Varies by Provenance of Source Rocks

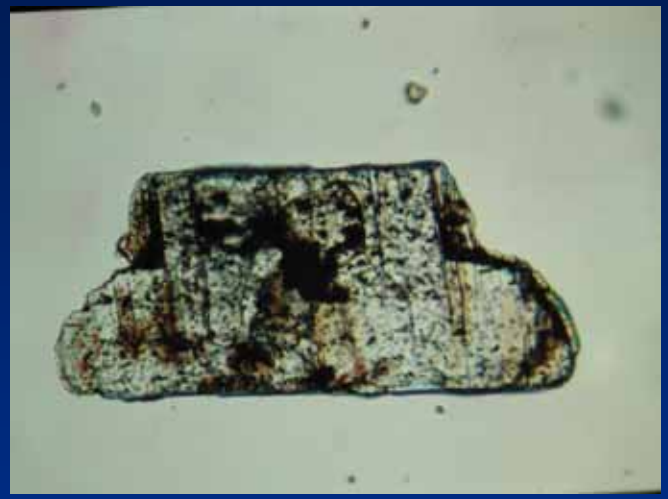


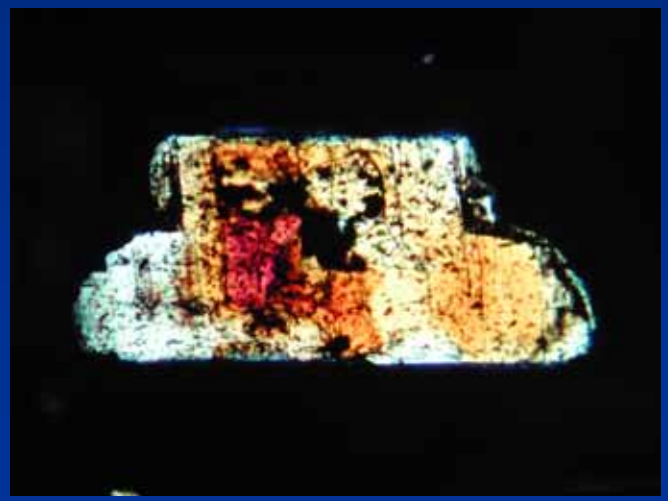
Refractive Index and Dispersion Colors

- Top. Apatite grain in 1.660 refractive index oil. Plane polarized light.
- Bottom. Crossed polars.

Birefringence

- Top. Kyanite in 1.660 index of refraction oil.
- Bottom. Crossed polars

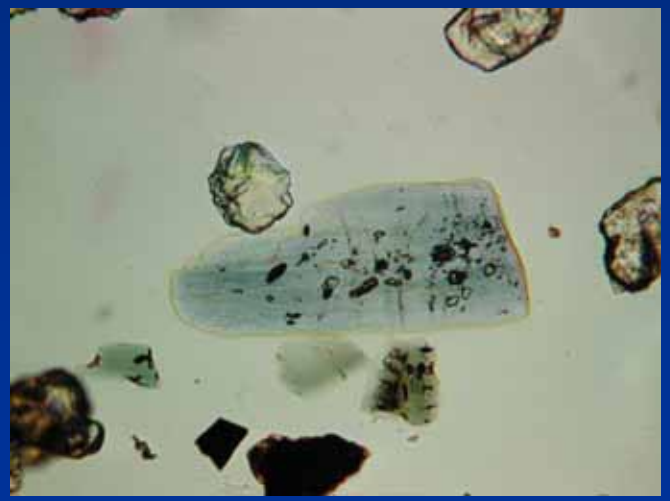




Pleochroism

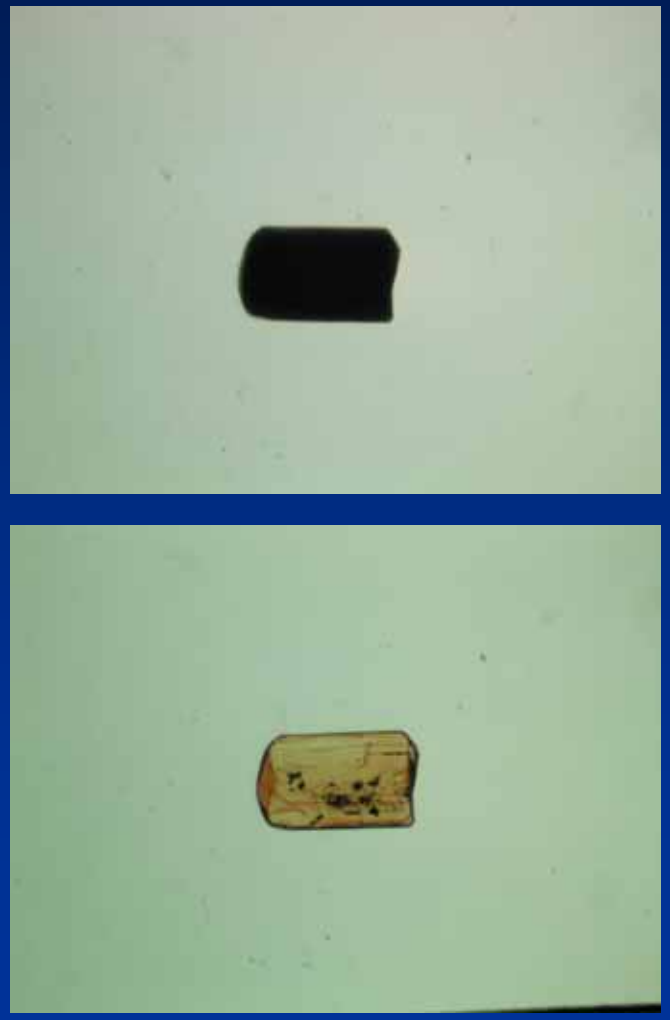
- Top. Glaucophane 1.660 refractive index oil. N-S polarizer.

- Bottom. E-W polarizer.



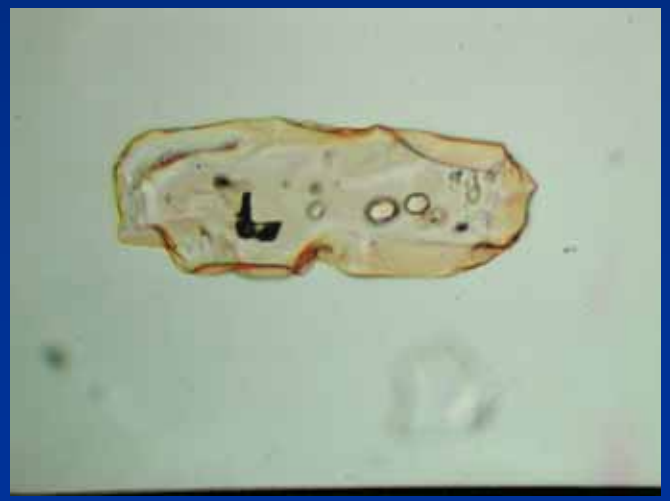
Pleochroism

- Top. Euhedral tourmaline in 1.660 index of refraction oil. N-S polars
- Bottom. E-W polars.



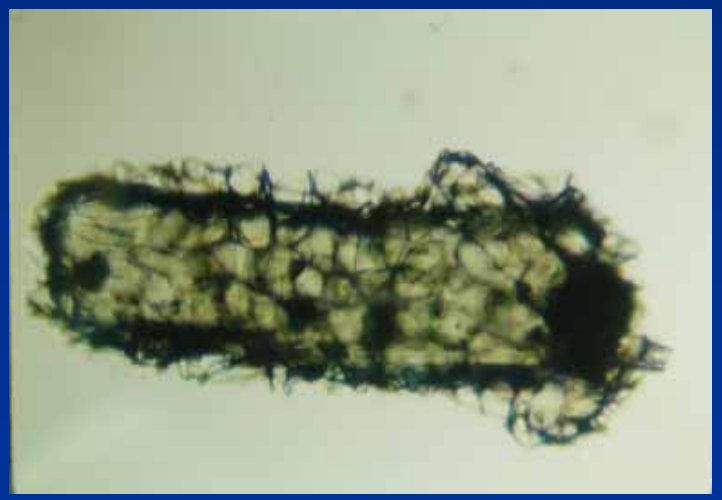
Pleochroism

- Top. Subhedral tourmaline in 1.660 refractive index oil.
- Bottom. E-W polars.



Mineral Varieties

- Hypersthene from Mount St. Helens eruption collected from Yakima, WA days after the event. 1.660 index of refraction oil. Top. N-S polars. Bottom. E-W polars.

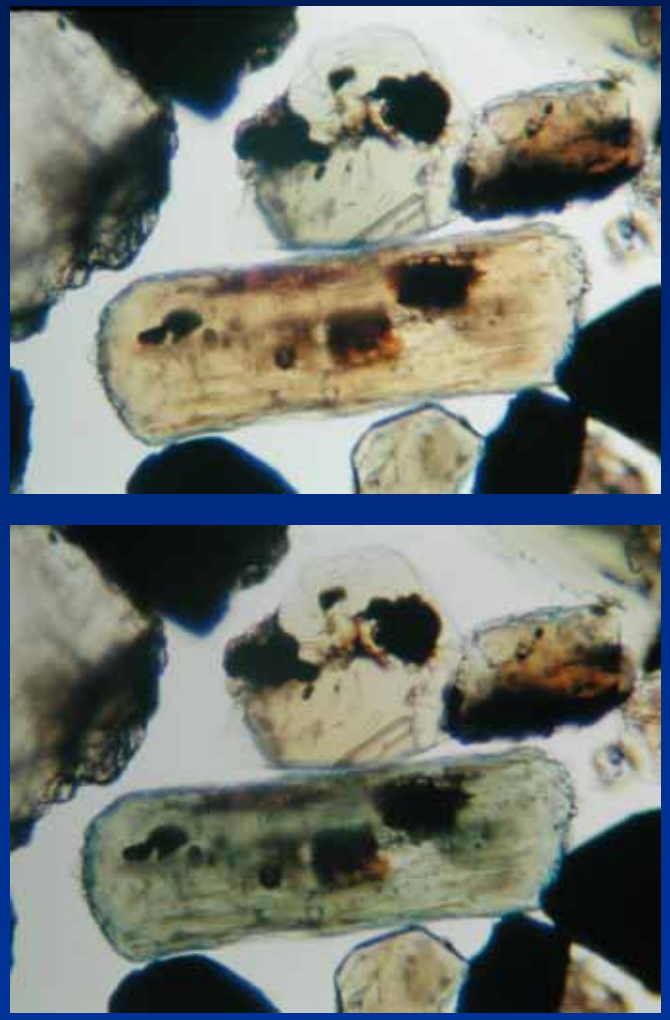


Mineral Varieties

- Hypersthene from Africa. 1.660 refractive index oil.

  Top. N-S polars.

  Bottom. E-W polars.



Mineral Varieties

- Hypersthene from Martinique. 1.660 refractive index oil.

  Top. E-W polars.

  Bottom. N-S polars.

Coarse Mineral Fractions

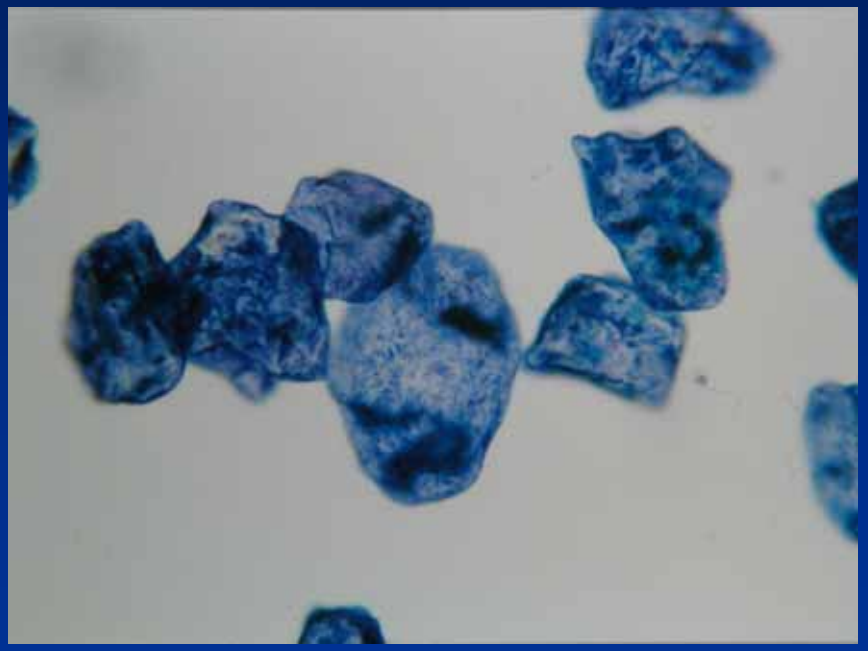
- Examination for identification and surface texture.
- Stereomicroscopy
- Scanning Electron Microscopy
- Cathodoluminescence

Light Microscopy

- Monahan Sand Dunes in West Texas. Mounted in 1.660 refractive index oil for contrast.

Stains and Reagents

- Sahara sand stained with methylene blue to show distribution of amorphous silica (silicic acid) on grain surfaces.

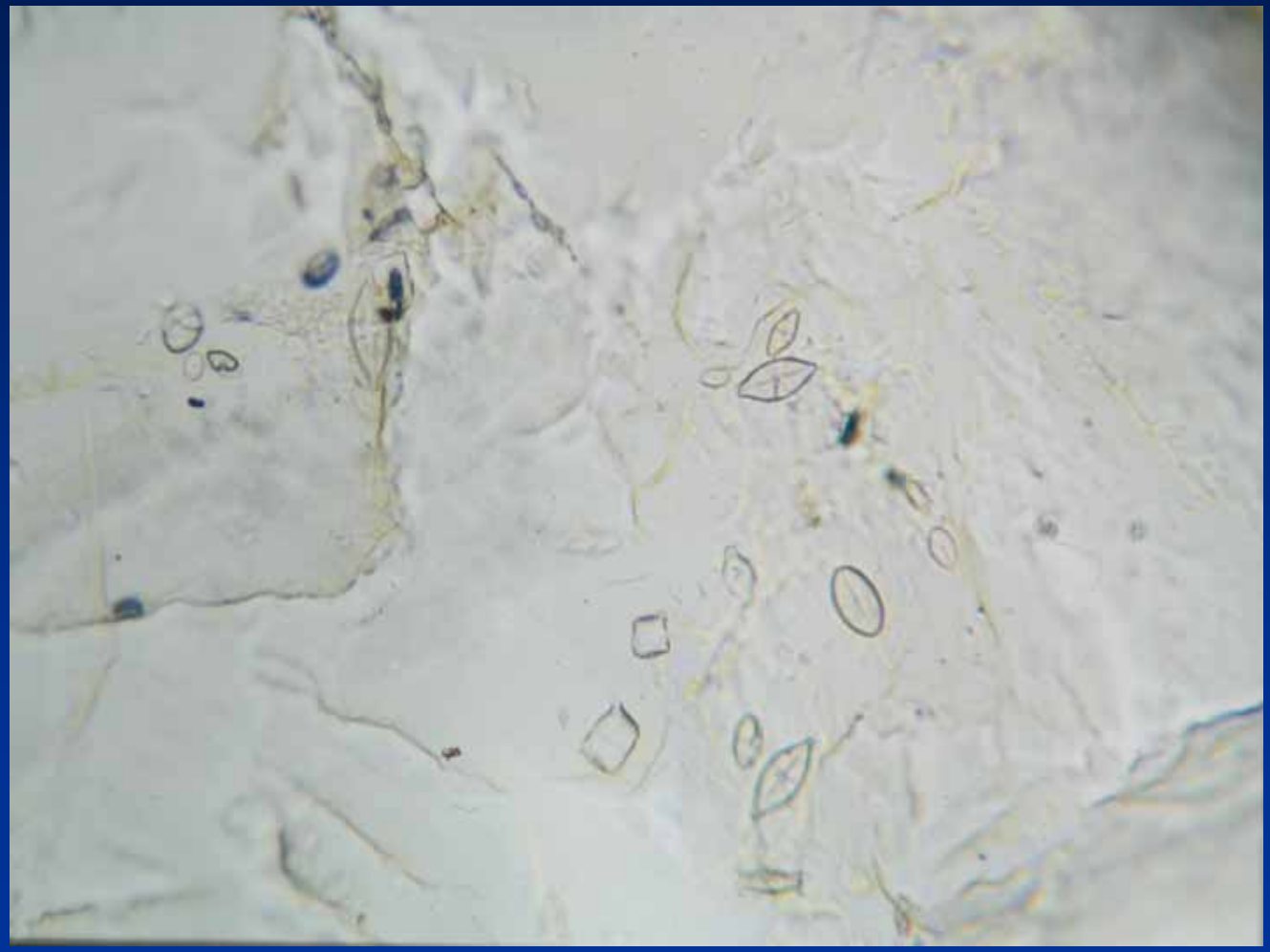


SEM / EDS

SEM of Grain Surfaces

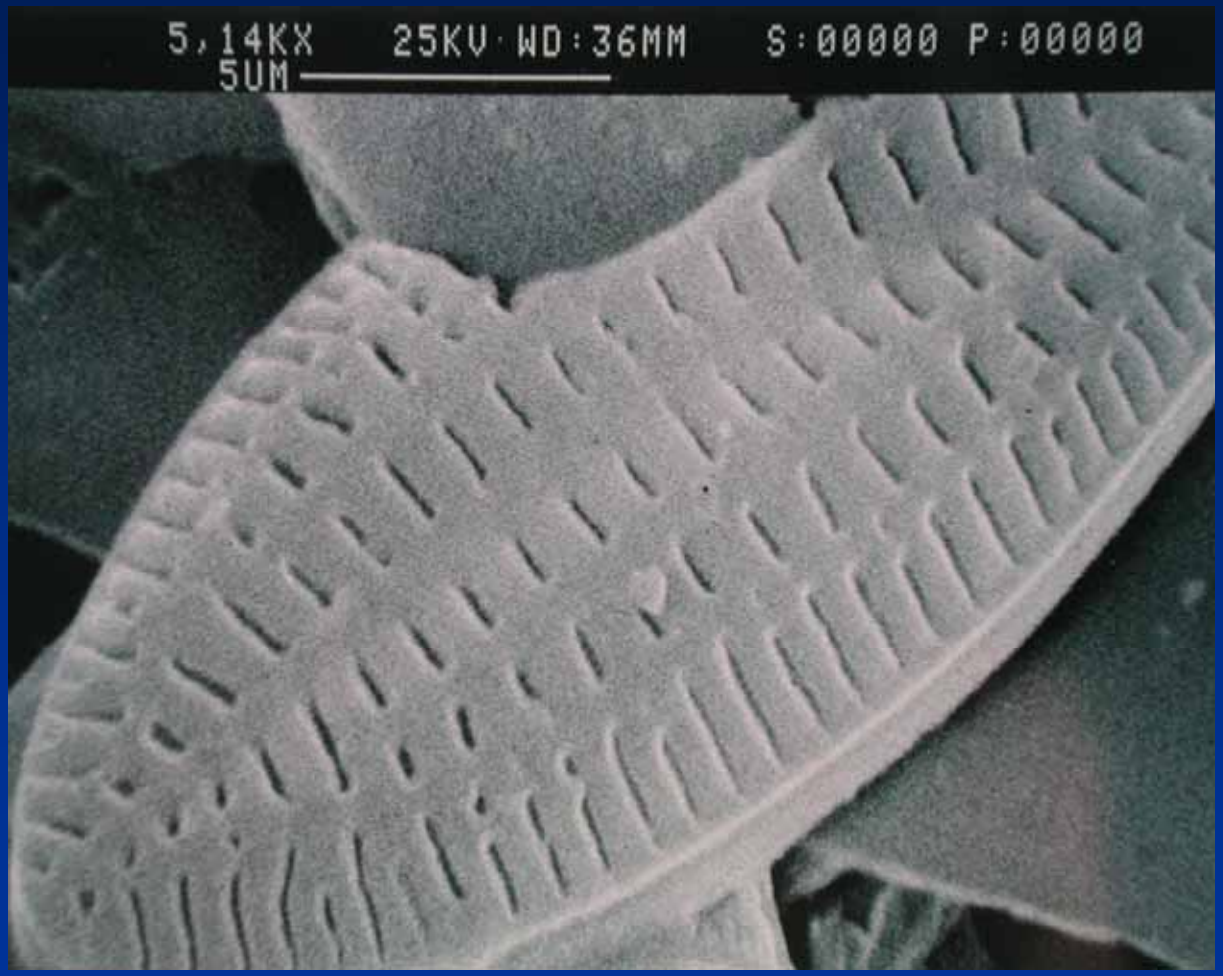
- Rounded quartz grain from Monahan Dunes in Texas showing surface coating.

Indicators on Quartz Grain Surfaces

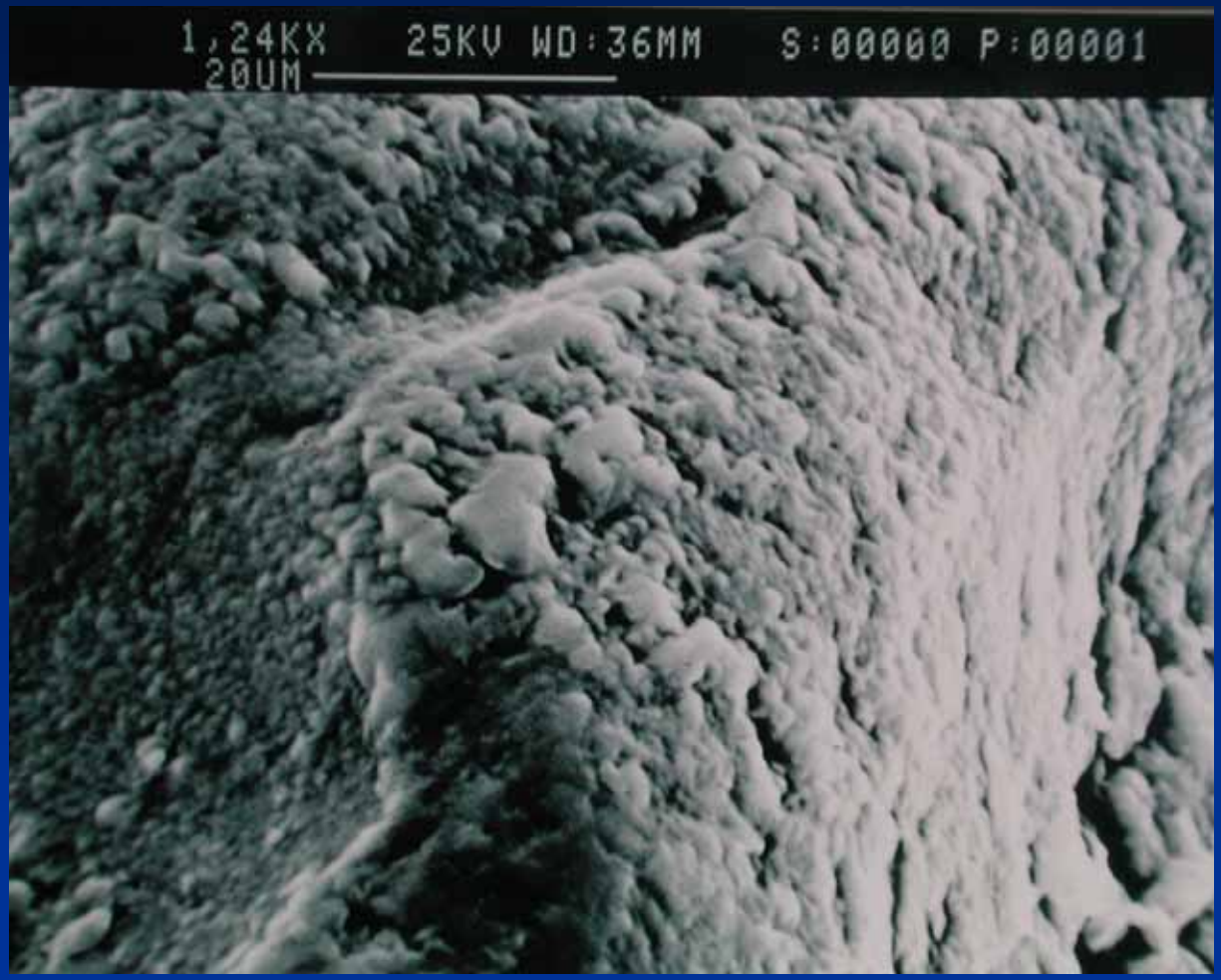


Diatoms on Marine Quartz Grain Surface

Detail of Diatom on Quartz Grain Surface



“Silica Flowers” Deposited on Quartz Grain Surface



Microtrace

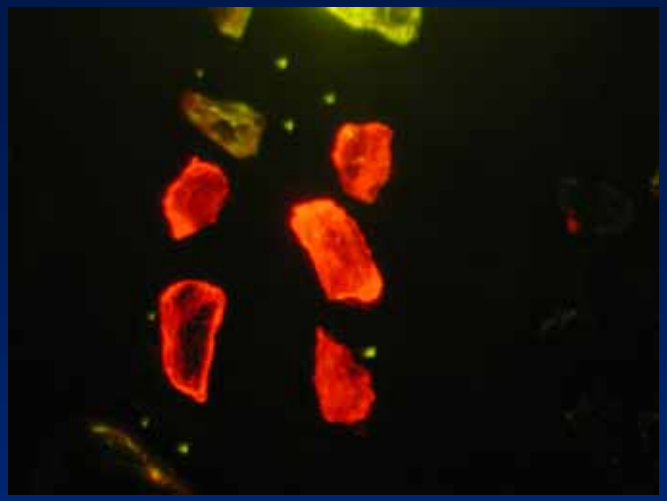
Etching and Dissolution of Silica on Quartz Surface

Microtrace

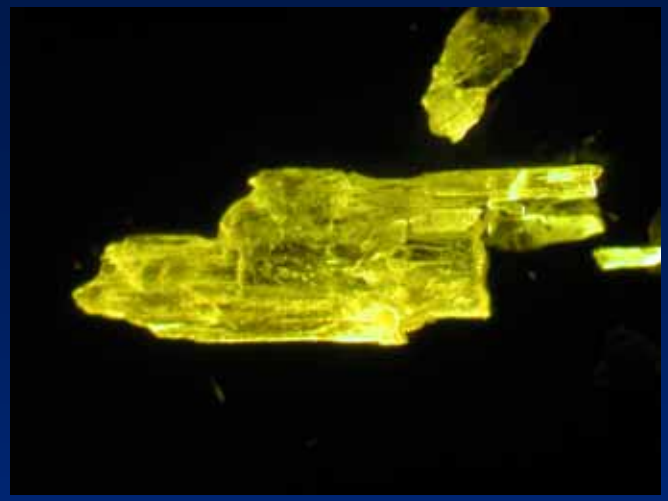
Deep Etching on Quartz Grain Surface

Fresh Quartz Grain from Glacier in Canada

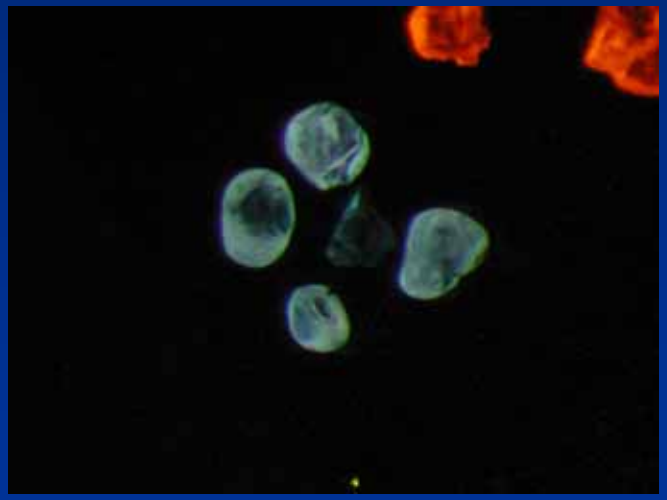
Cathodoluminescence



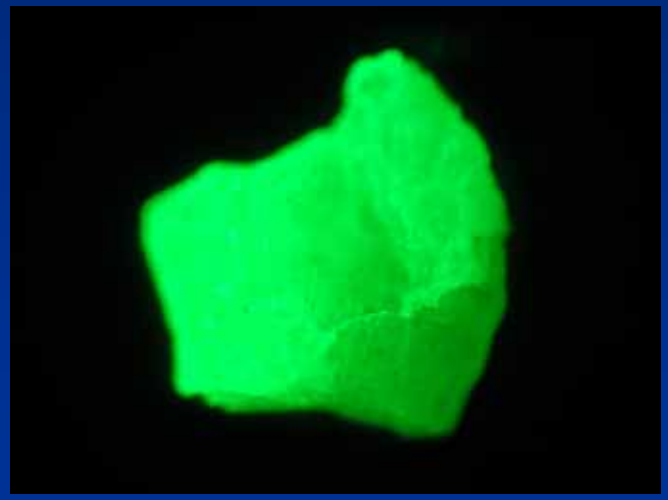
Calcite



Wollastonite

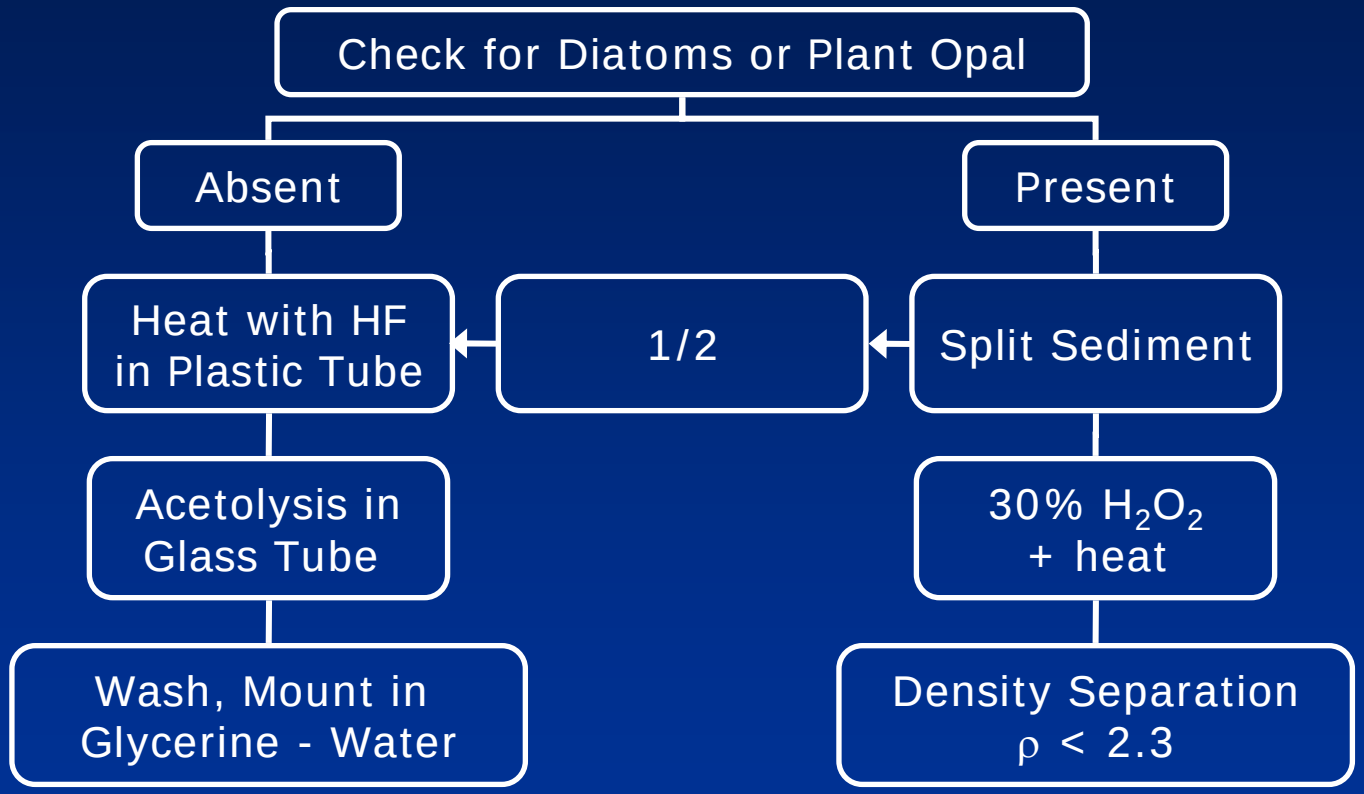


Zircon

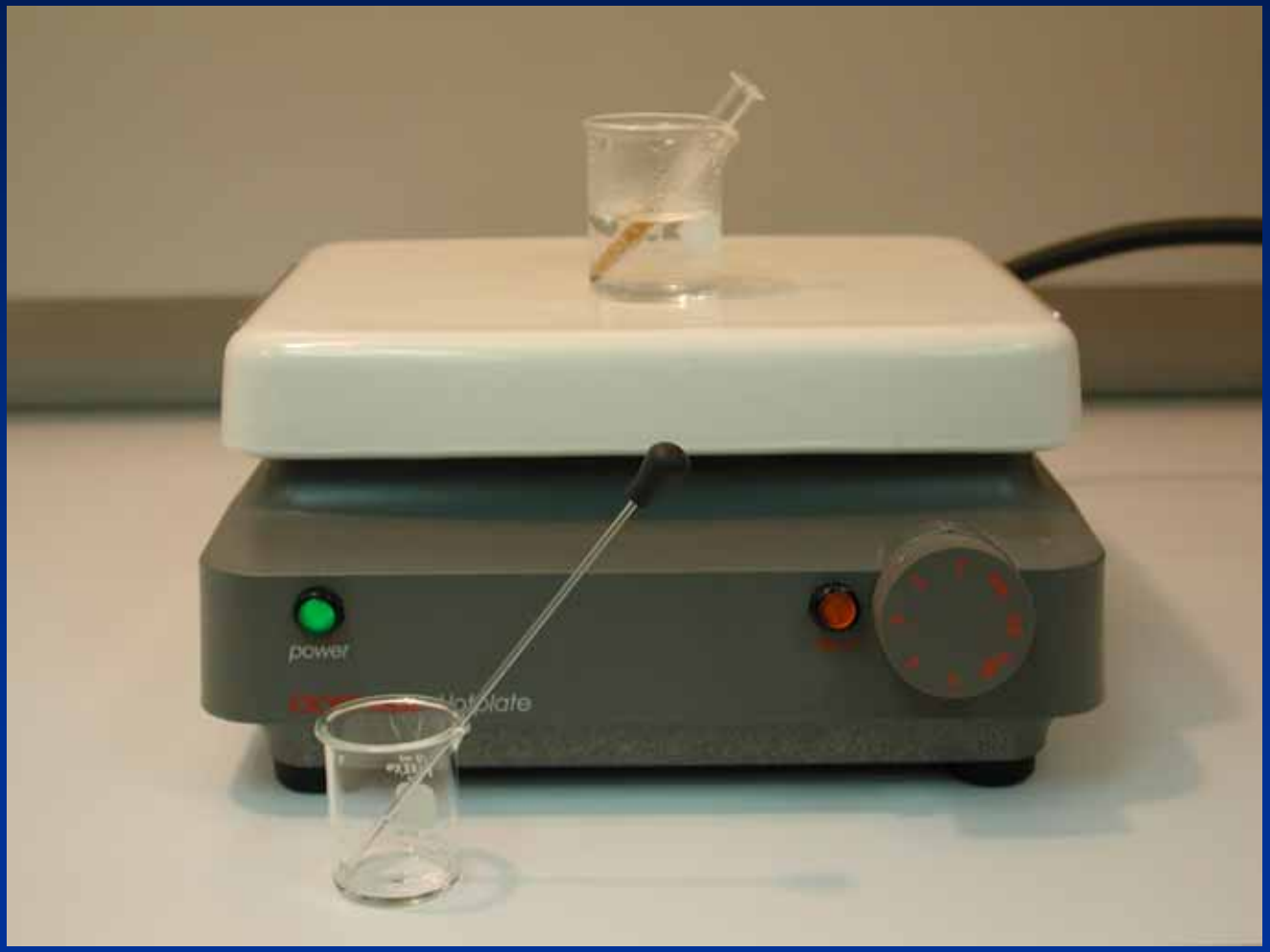


Willemite

Fraction 2


Check for Diatoms or Plant Opal
Absent
Present
Heat with HF in Plastic Tube
1/2
Split Sediment
Acetolysis in Glass Tube
30% H_2O_2 + heat
Wash, Mount in Glycerine - Water
Density Separation $\rho < 2.3$

Acetolysis in 1.5 mL Glass Microcentrifuge Tube



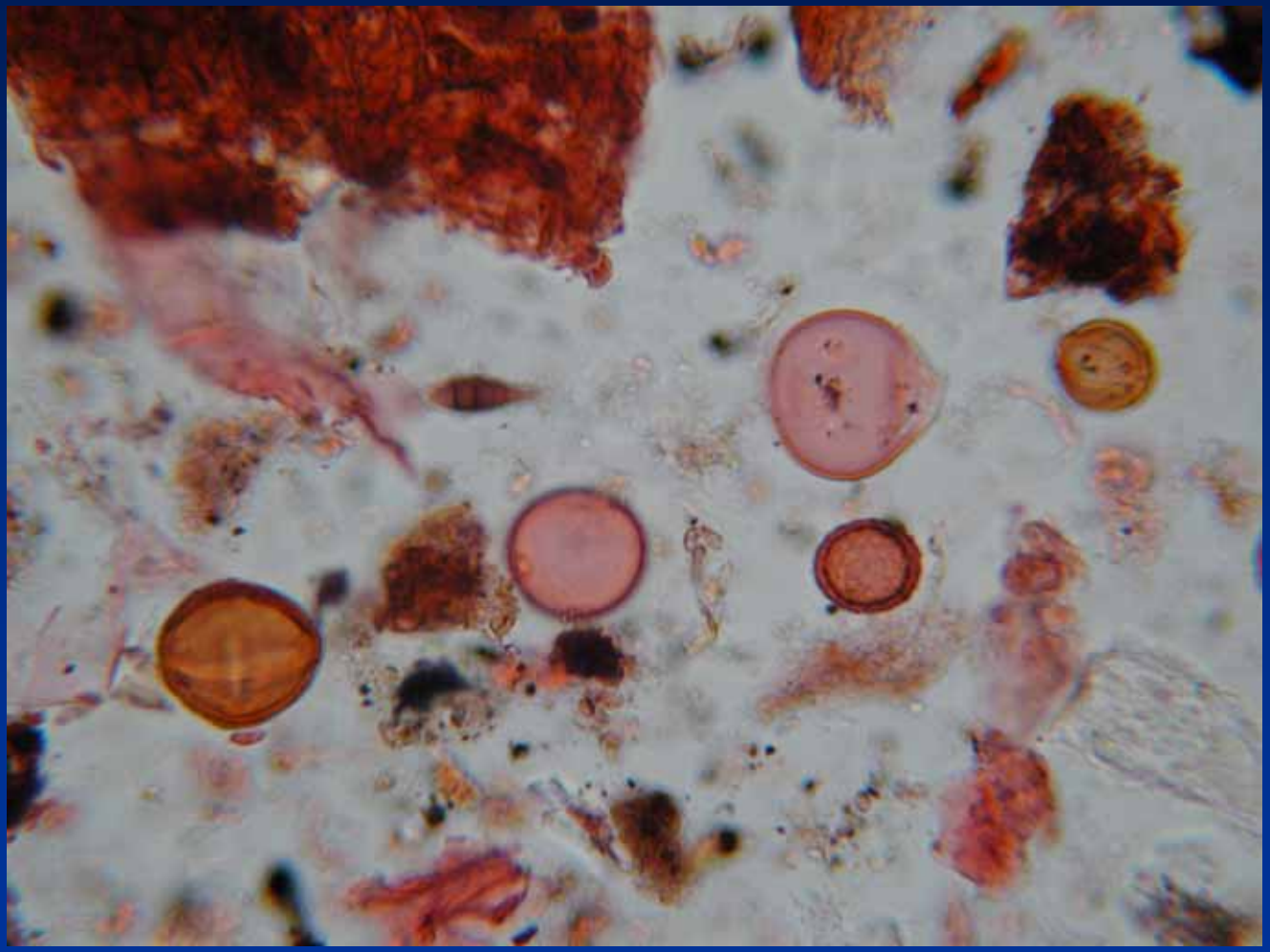
Microtrace

Fraction 2
Identification of Isolates

Optical Microscopy

- Pollen and spores
- Resistant plant tissue
- Tire rubber
- Combustion soot
- Diatoms and plant opal

Pollen Fraction after Acetolysis and Staining

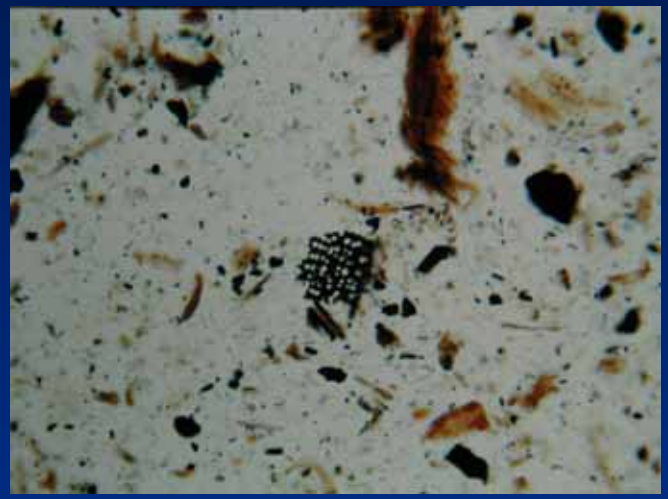


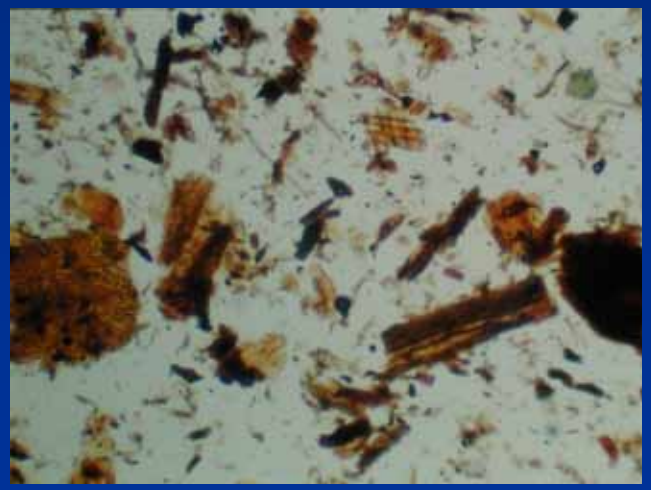
Study of Internal Structure at High Magnification

Examination of Exine Sculpturing

Pollen Fraction without Staining

- Top. Charcoal particle.
- Bottom. Difficultly identified plant tissue.





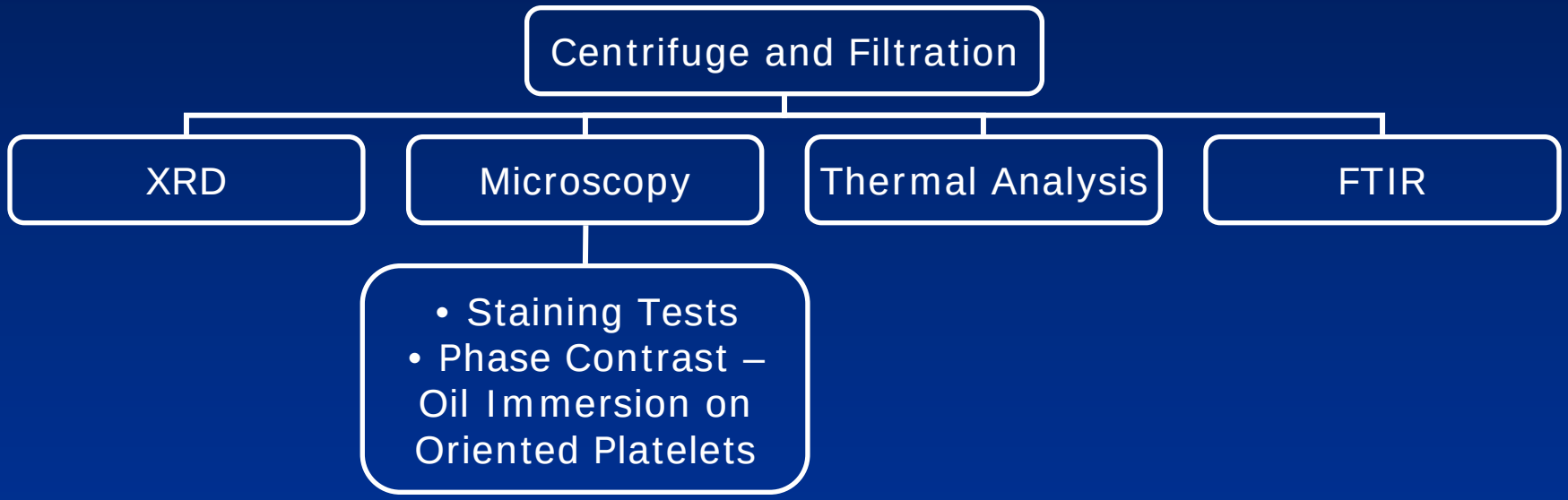
Pollen Fraction without Staining

Opal Phytoliths

- Distinctive morphology.

Plant Opal

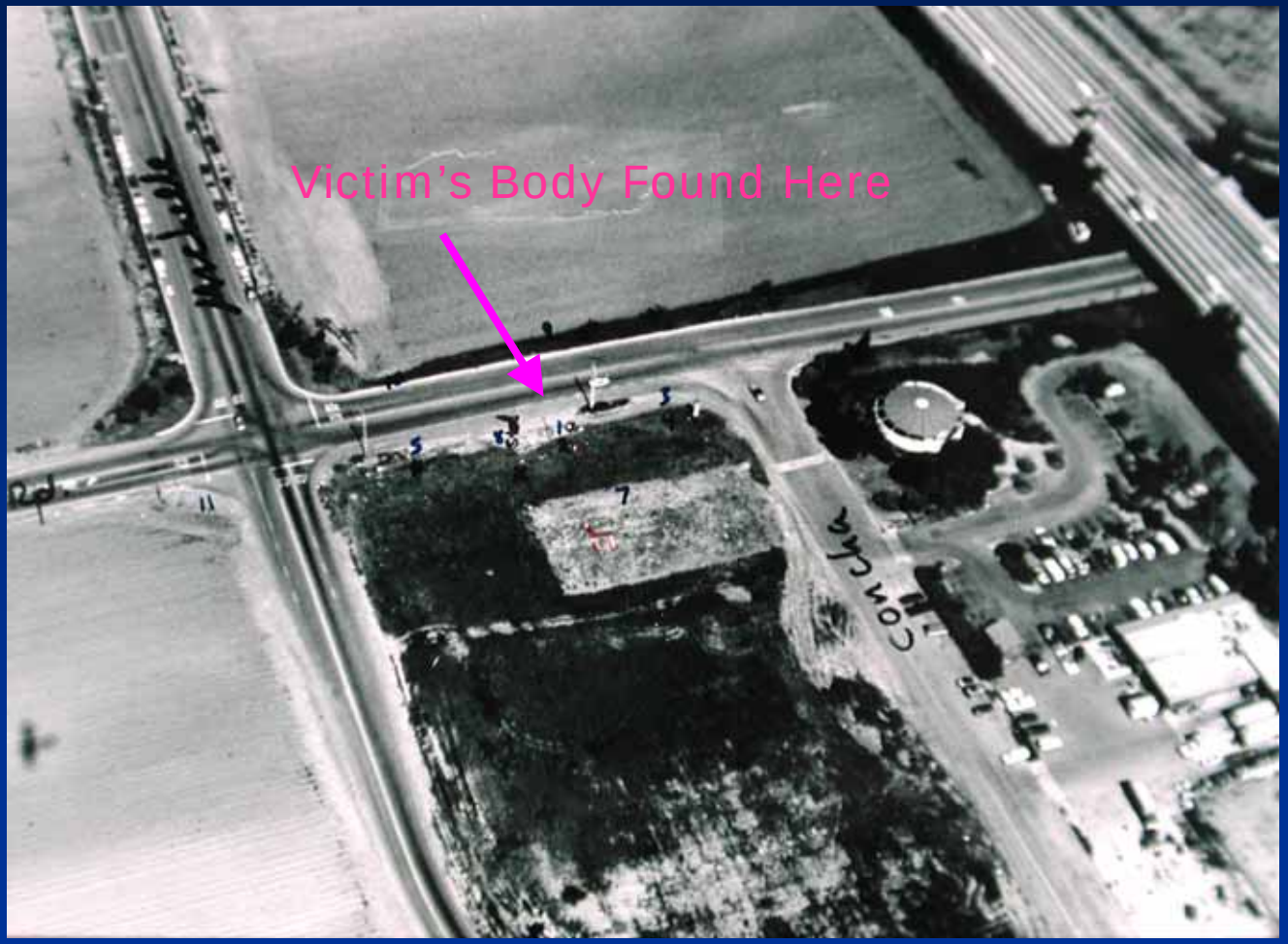
Fraction 3 (clays)



X-Ray Diffraction

FTIR Spectroscopy

Murder Scene Outside Disneyland in California



Concrete Block Substituted for Computers

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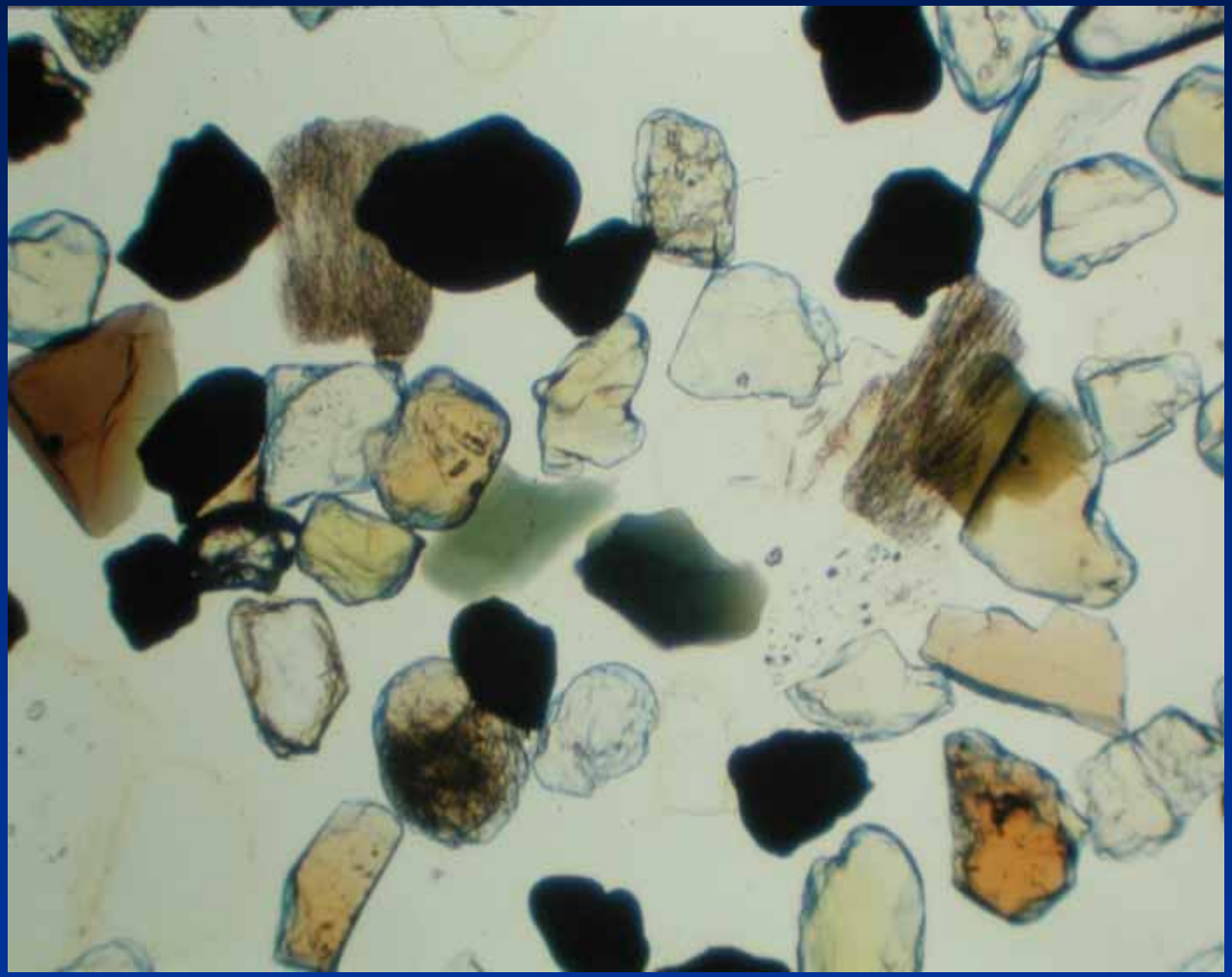
Heavies Isolated from Concrete Block



Microtrace