

PRIN 2017

“Fibres: a multidisciplinary mineralogical, crystal-chemical and biological project to amend the paradigm of toxicity and cancerogenicity of mineral fibres” (Prot. 20173X8WA4).

Meeting martedì 29 giugno 2021

Unità

Università di Modena e Reggio Emilia

Unità UNIMORE

Attività di ricerca 2021

Filone di ricerca principale

Correlazione **parametri del modello FPTI** relativi ai **3 campioni** (crisotilo russo, crocidolite UICC e wollastonite) con i **dati IARC 10 KCs** (*pathobiological effects*);

- 1) Aliquote di crisotilo russo $L < 5 \mu\text{m}$ e $L > 5 \mu\text{m}$ sono stati consegnati alle altre unità
- 2) Classificazione dei campioni di crisotilo russo classati ($< 5 \mu\text{m}$ e $> 5 \mu\text{m}$) secondo il modello FPTI
- 3) Caratterizzazione e classificazione secondo il modello FPTI della wollastonite fibrosa NYAD G da utilizzare come standard negativo



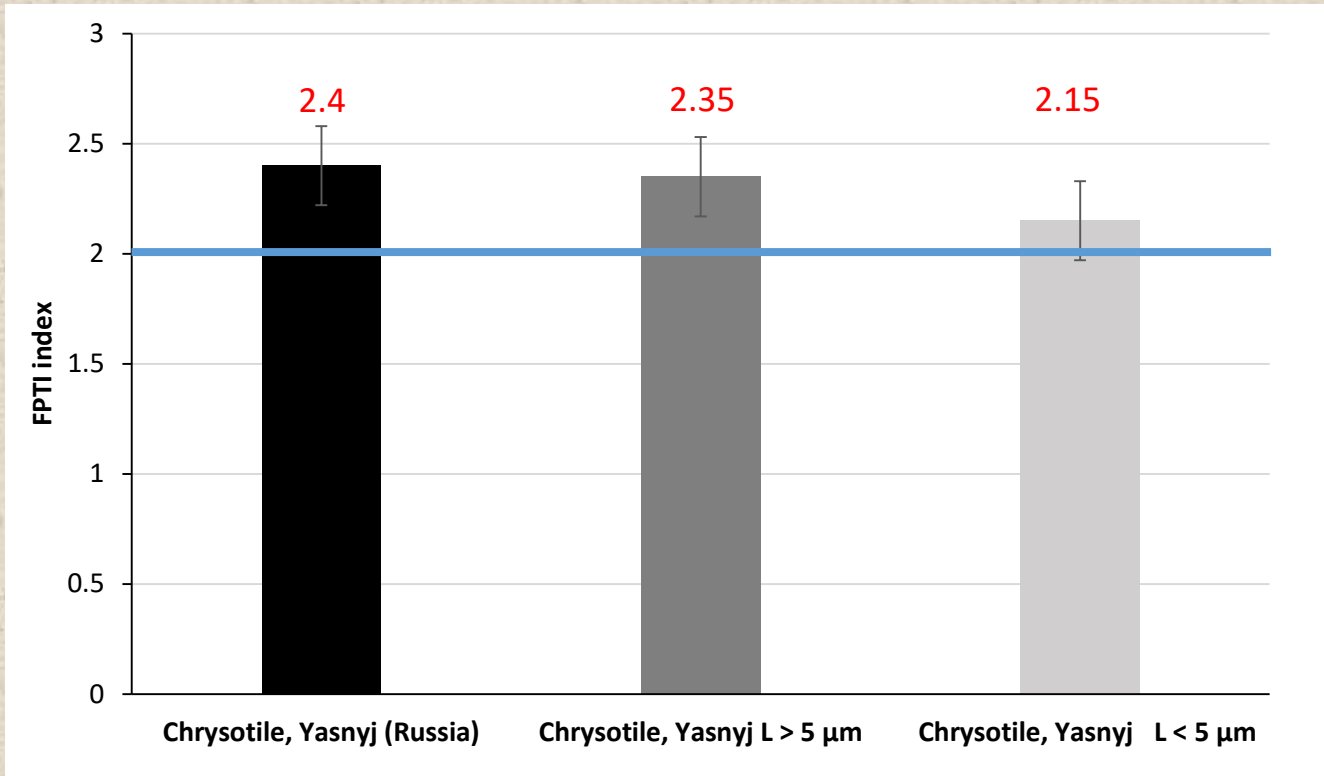
Progetti secondari

- 1) Studio della tossicità acuta delle tre principali fibre minerali, erionite fibrosa, crisotilo e crocidolite
- 2) Studio sulla contaminazione da amianto della brucite commerciale
- 3) Struttura erionite turca (Tuzkoy)
- 4) Collaborazione alle linee di ricerca dell'unità UNIGE e UNIURB

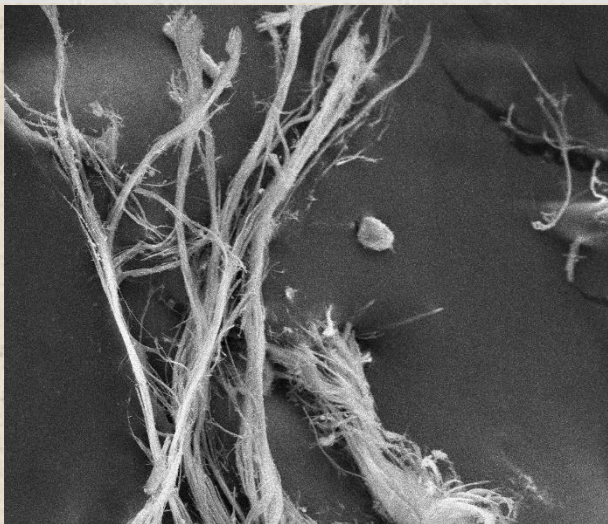


Chrysotile, Yasnyj (Russia)

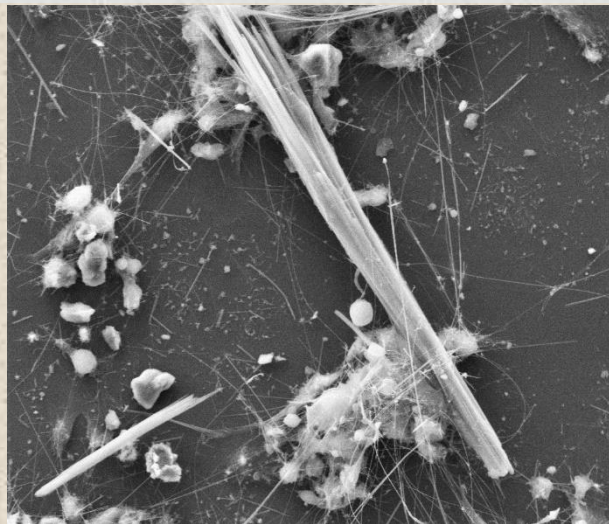
| FPTI model | Campione grezzo | Crisotilo L < 5 μm | Crisotilo L > 5 μm |
|--------------------------------------|------------------------|------------------------|------------------------|
| Parameter | | | |
| Morphometric | | | |
| length L | 33.9 μm | 2.04 μm | 29.8 μm |
| diameter D | 0.70 μm | 0.15 μm | 0.40 μm |
| crystal curvature | | | |
| crystal habit | | | |
| fiber density | | | |
| hydrophobic character of the surface | | | |
| surface area | 18.4 m ² /g | 30.3 m ² /g | 29.9 m ² /g |
| Chemical | | | |
| Total iron content | | | |
| ferrous iron | | | |
| Surface ferrous iron/iron nuclearity | | | |
| content of metals other than iron | | | |
| Biodurability | | | |
| Fiber dissolution rate | | | |
| velocity of iron release | | | |
| velocity of silica dissolution | | | |
| velocity of release of metals | | | |
| Surface activity | | | |
| ξ potential | | | |
| fibers' aggregation | | | |
| Cation exchange in zeolites | | | |



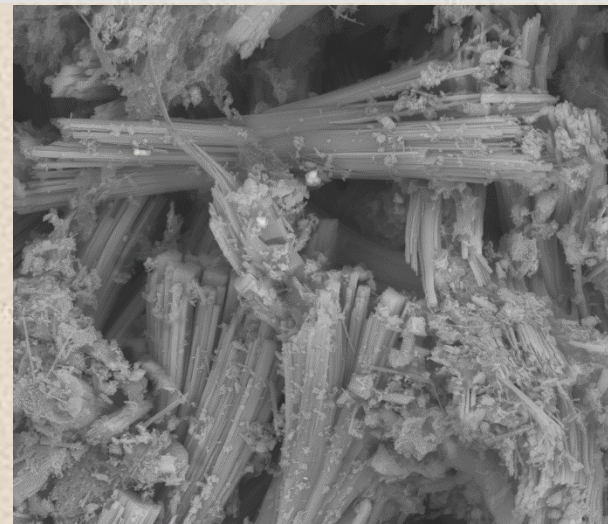
crisotilo



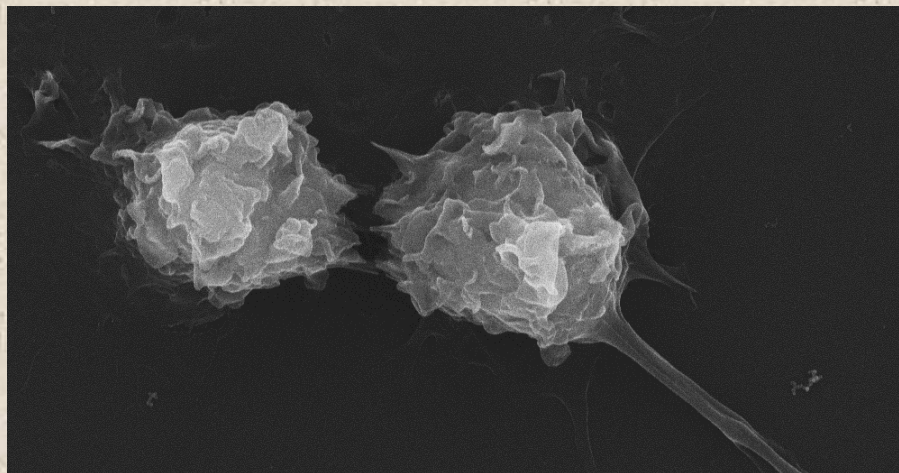
crocidolite



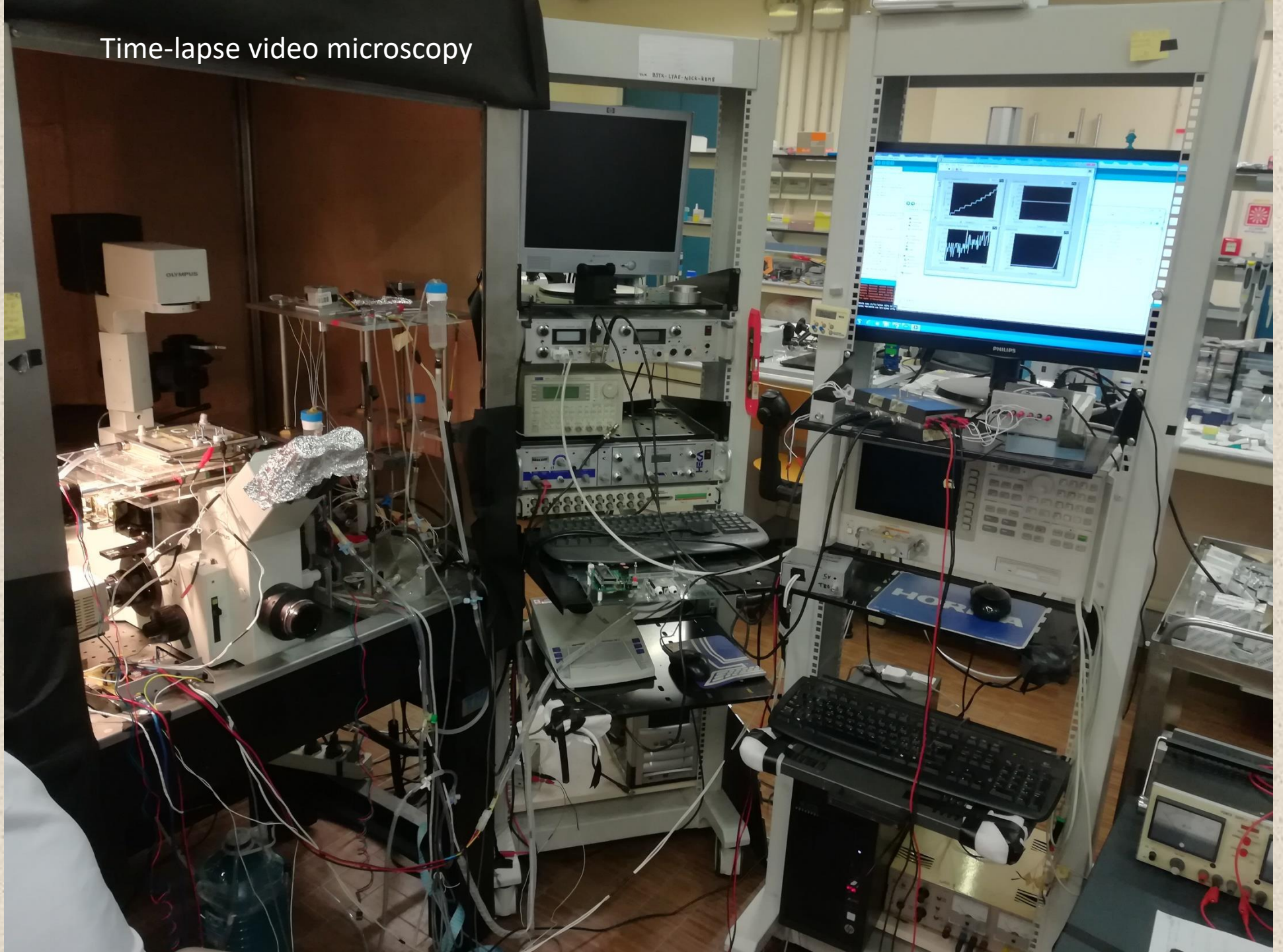
erionite



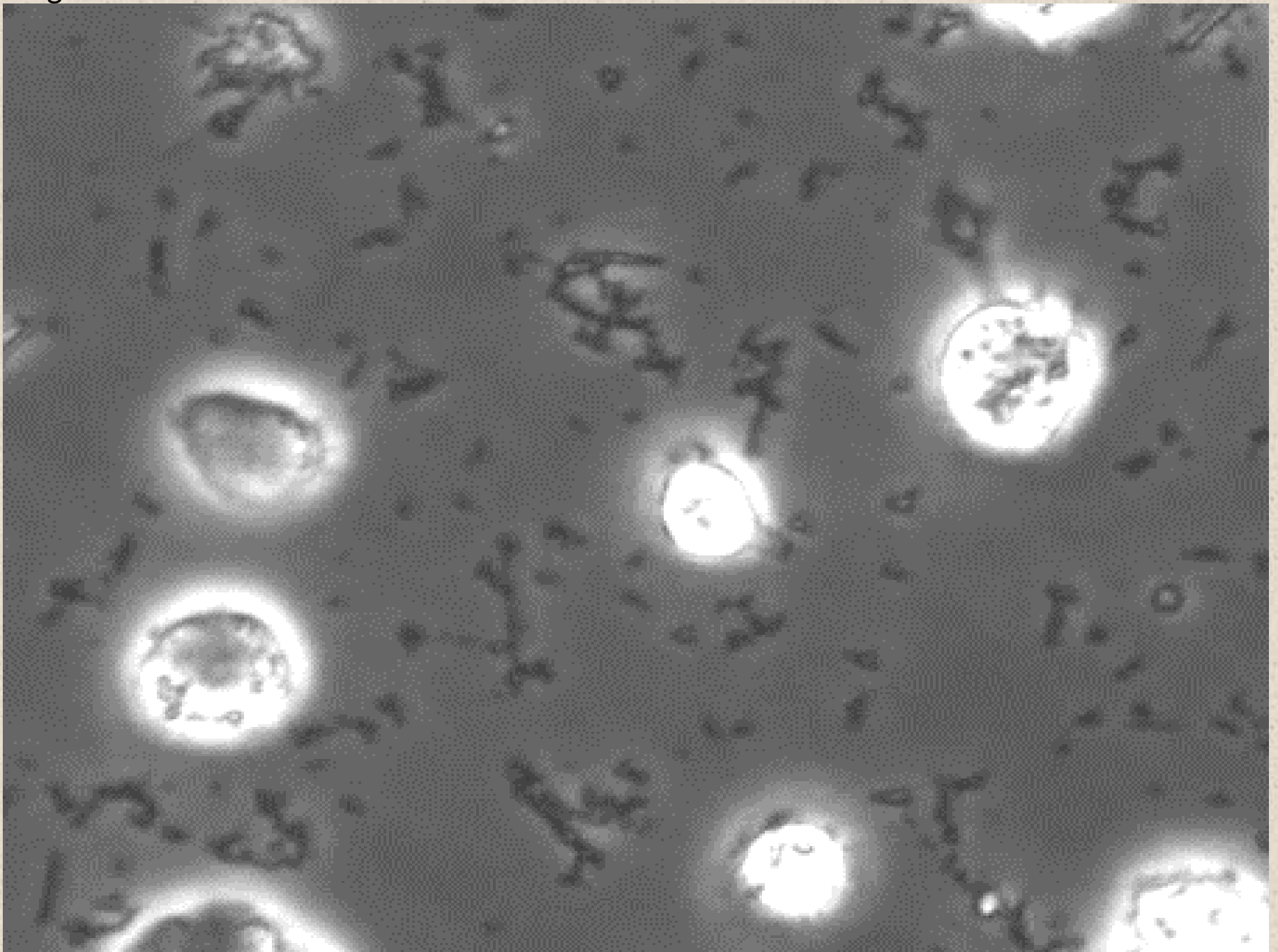
Macrofagi (THP-1)



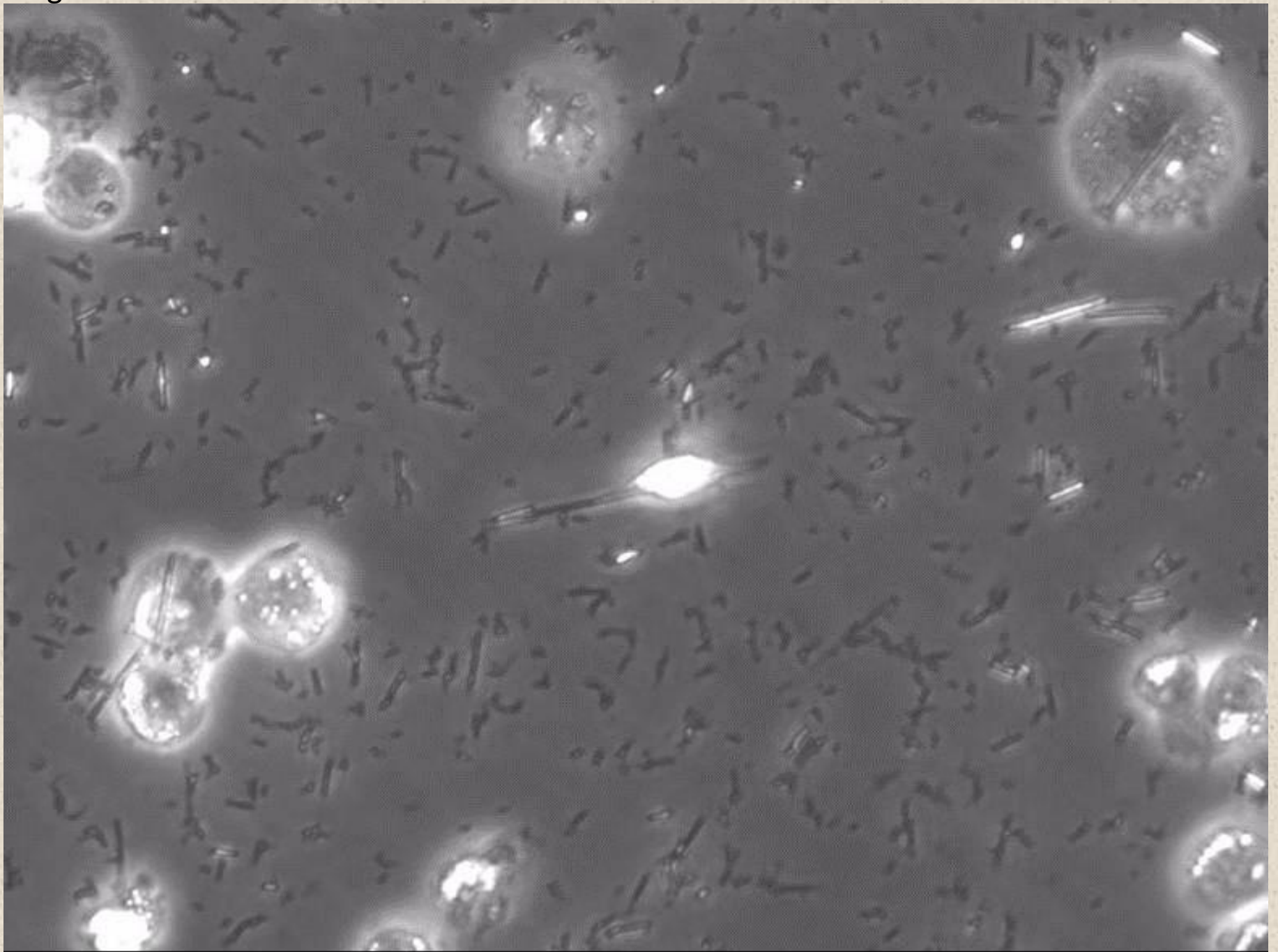
Time-lapse video microscopy



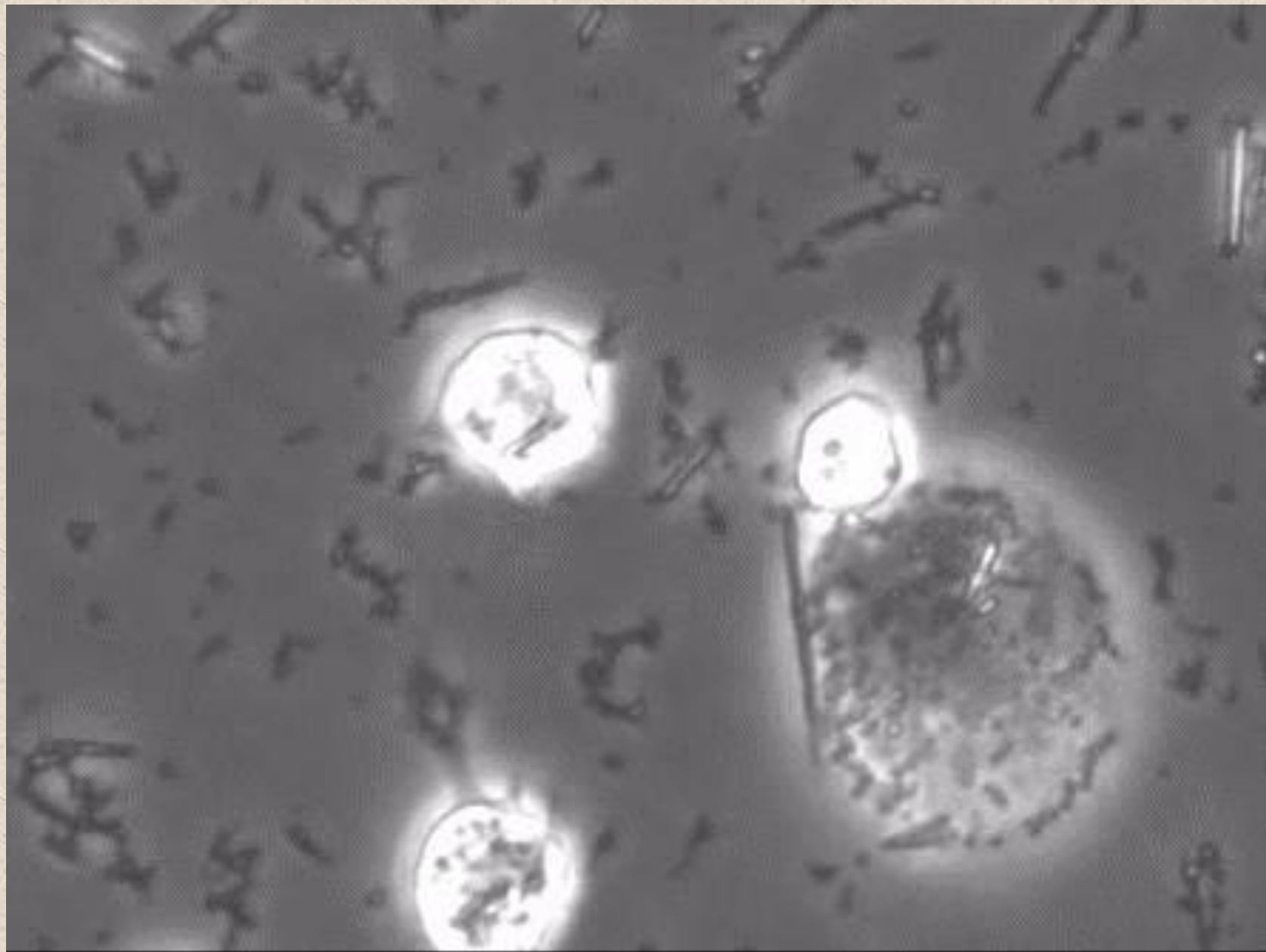
Fagocitosi riuscita

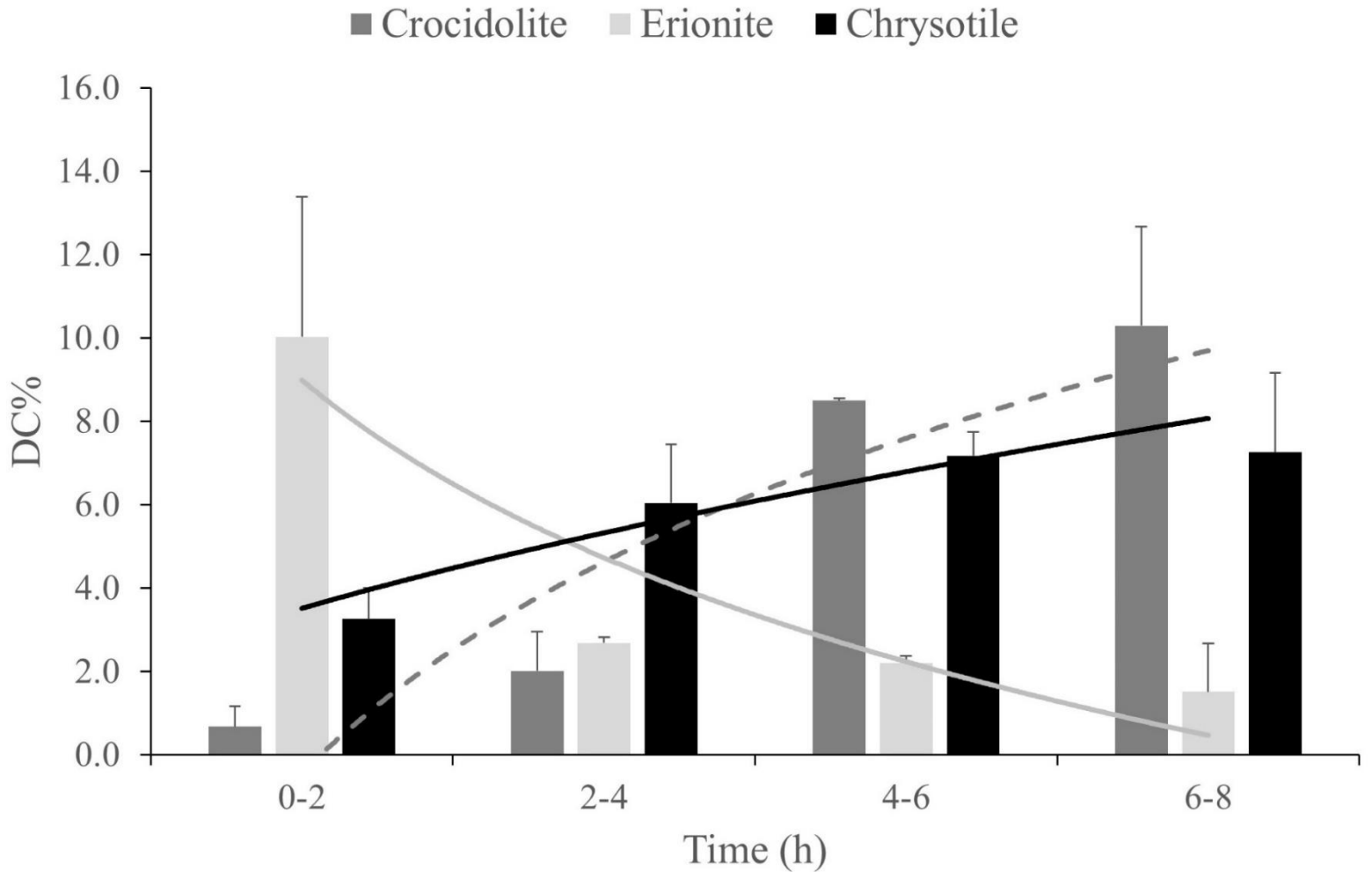


Fagocitosi fallita



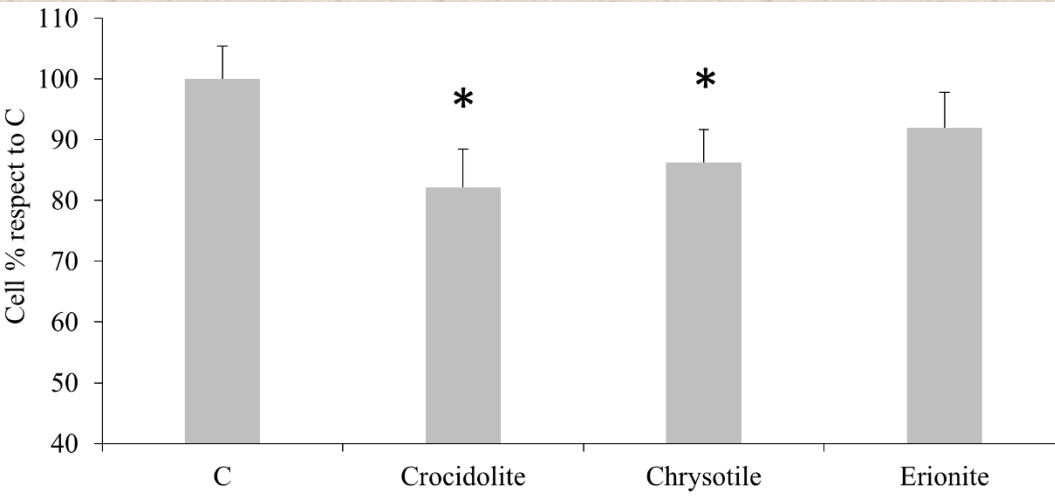
Morte cellulare



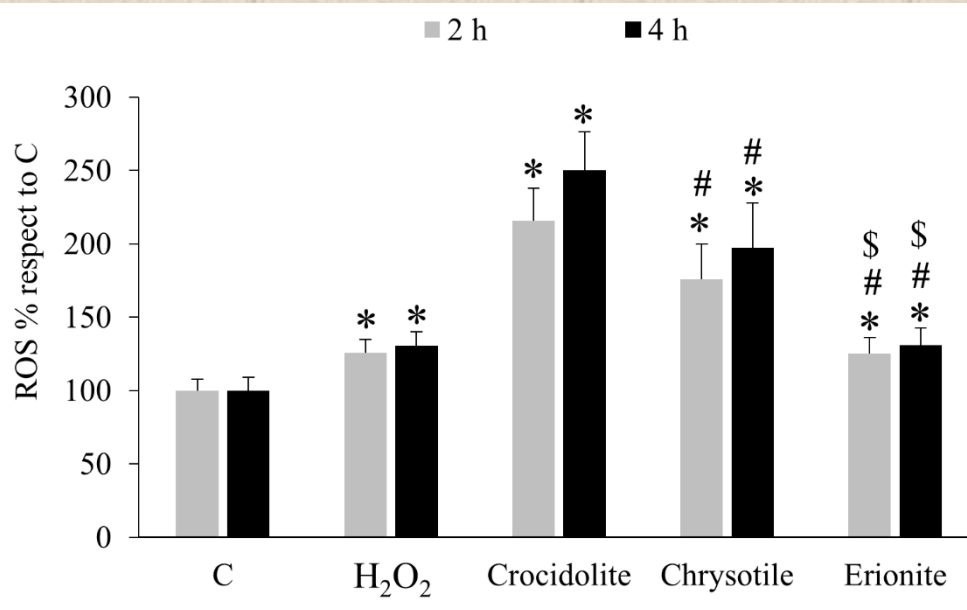
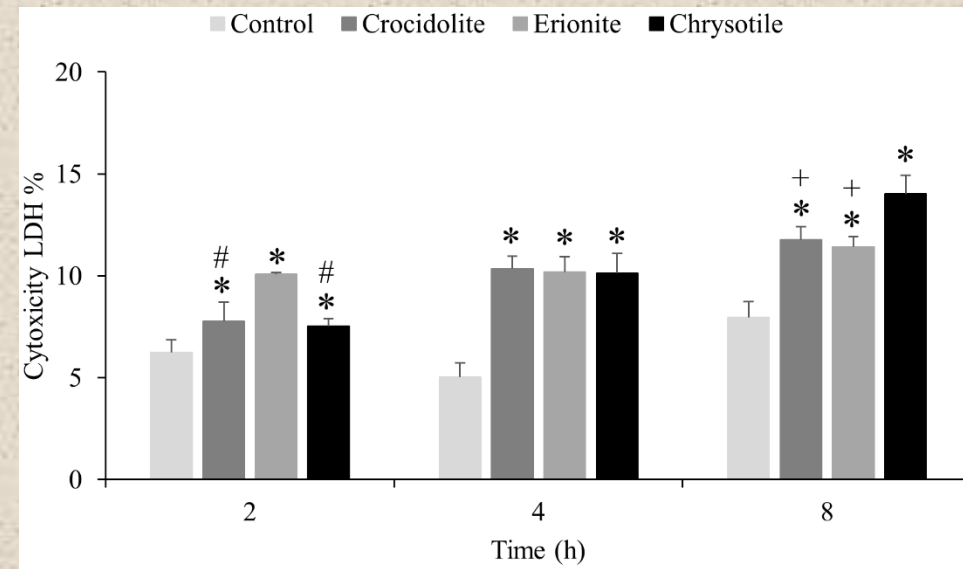


| | Crocidolite | Crisotilo | Erionite | |
|----------------|-------------|-----------|----------|-----|
| Lunghezza (µm) | 2.52 | 4.02 | 3.23 | Min |

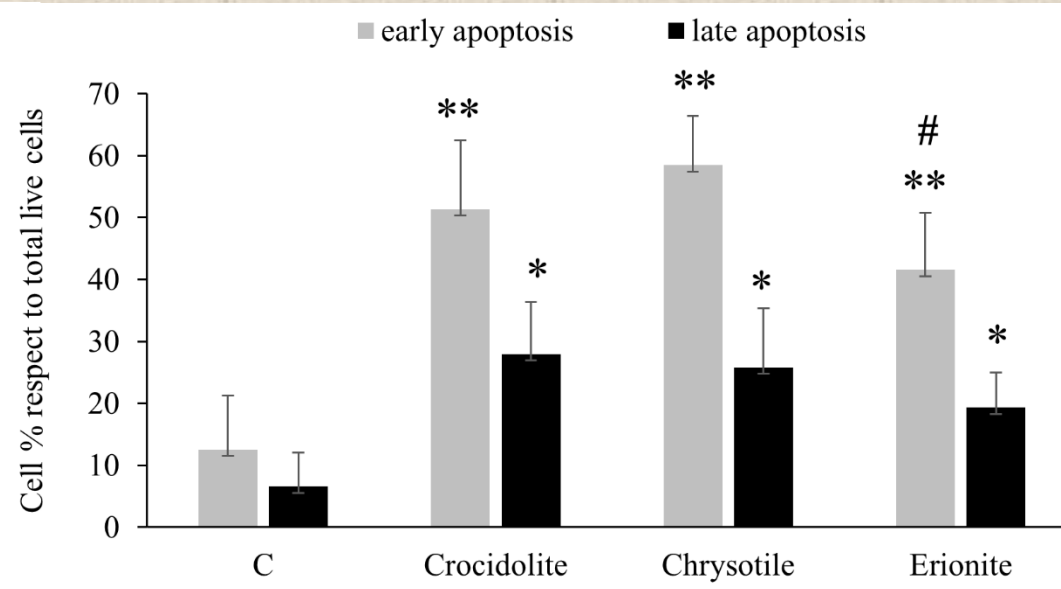
Test vitalità cellulare tramite saggio MTT dopo 8h



Valutazione della morte cellulare per NECROSI con dosaggio del rilascio di LDH

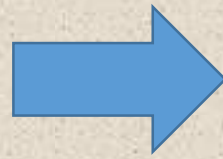
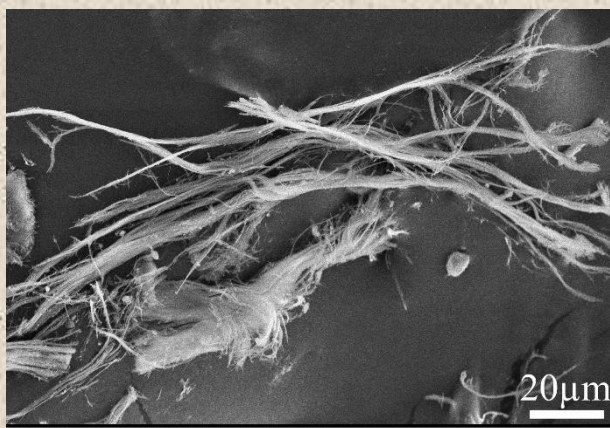


Valutazione della produzione intracellulare di ROS tramite la sonda DCF

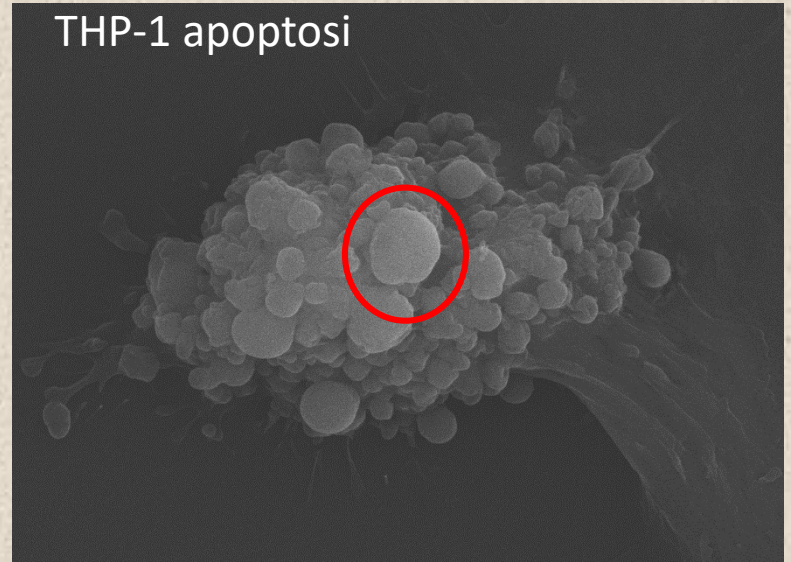


Valutazione della morte cellulare per APOPTOSI tramite marcatura con Annexina dopo 8h

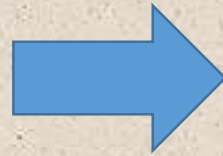
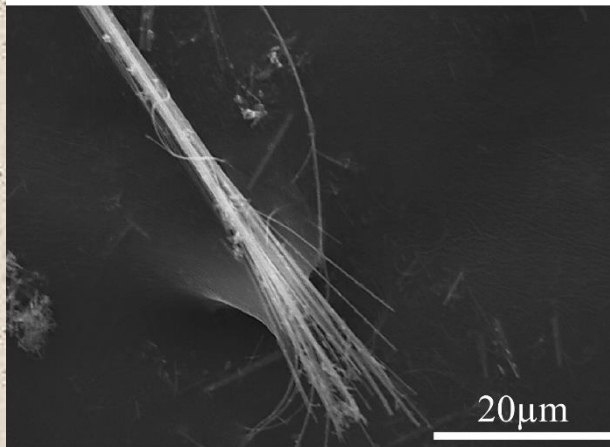
Crisotilo



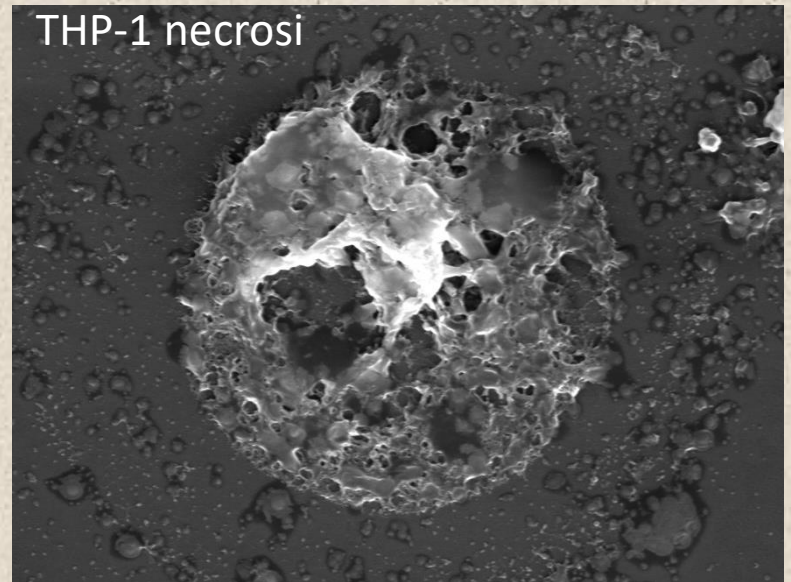
THP-1 apoptosi



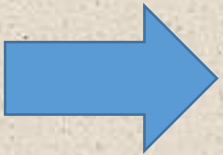
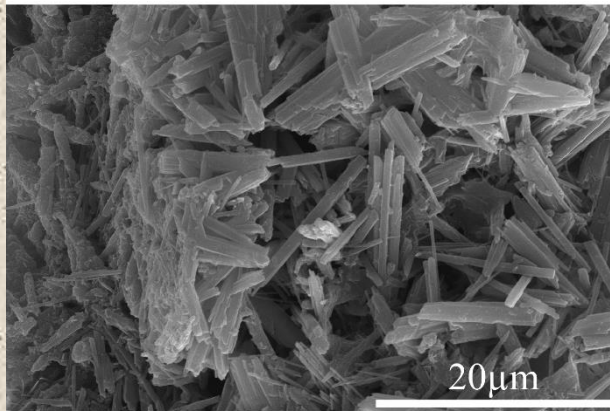
Crocidolite



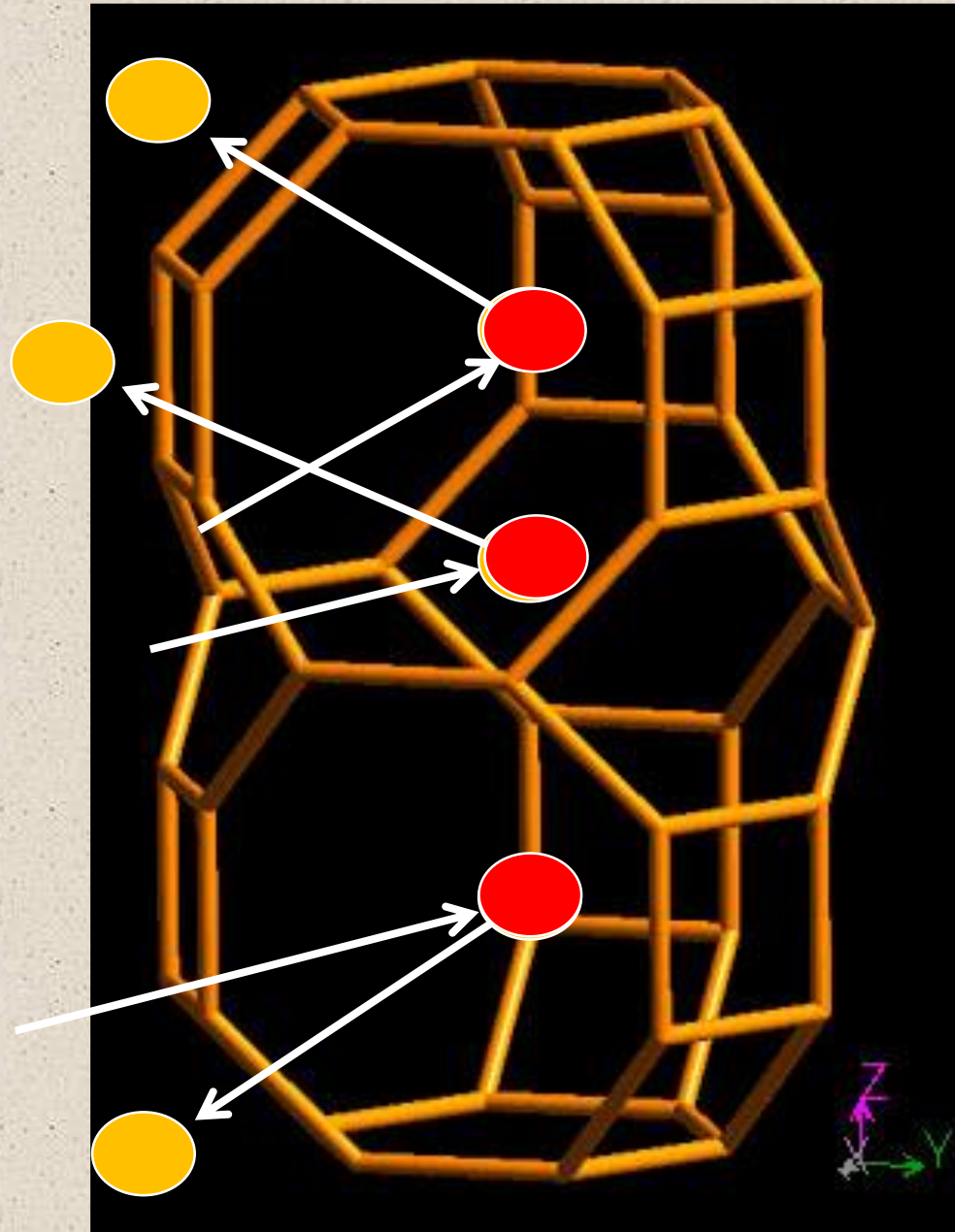
THP-1 necrosi



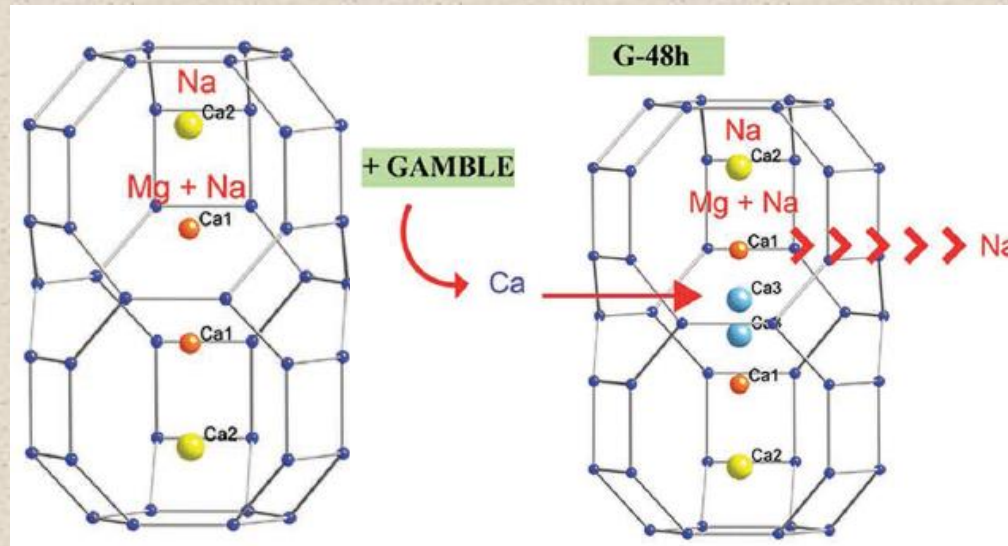
Erionite



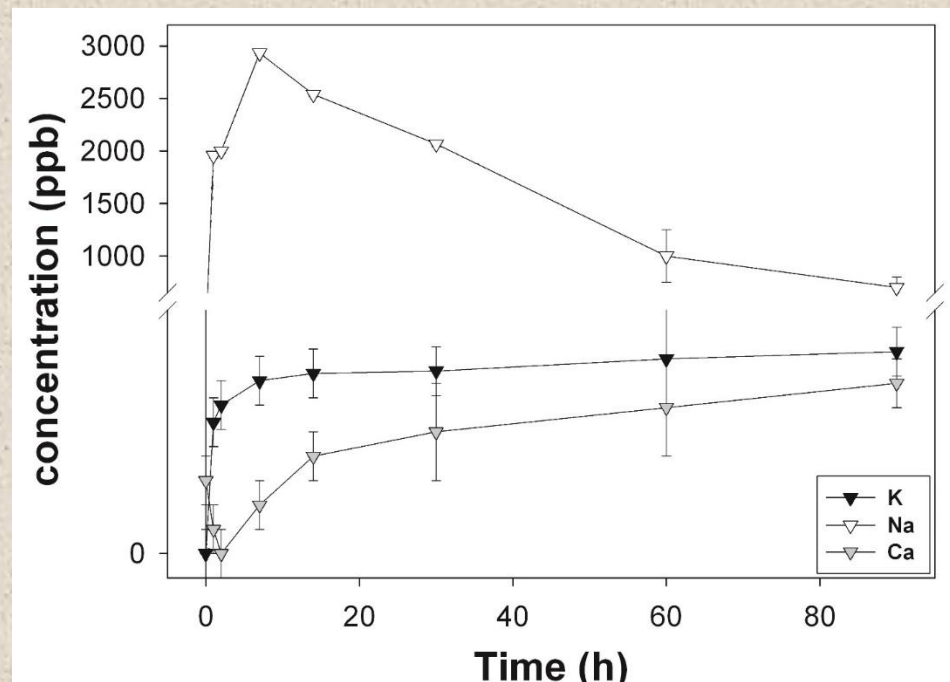
Capacità di scambio cationico



Cations exchange during leaching of erionite-Na with Gamble's solutions



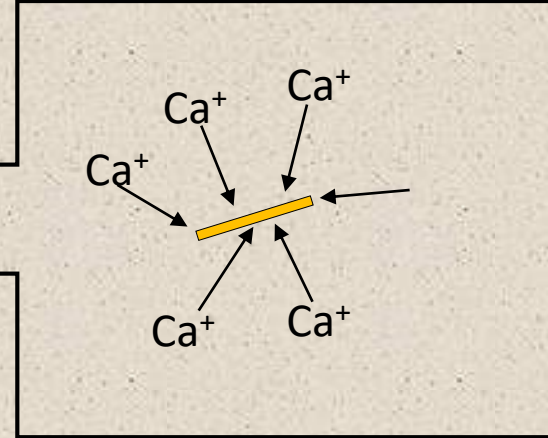
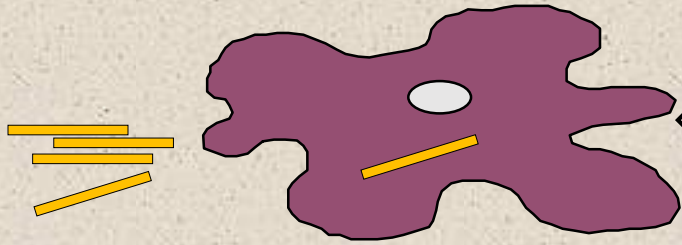
(Ballirano & Cametti, 2015)



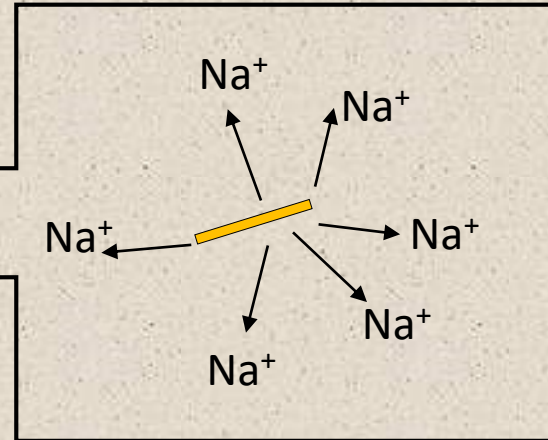
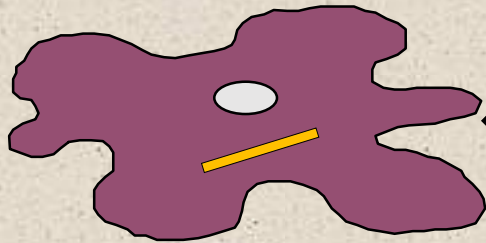
(Gualtieri et al. 2019)

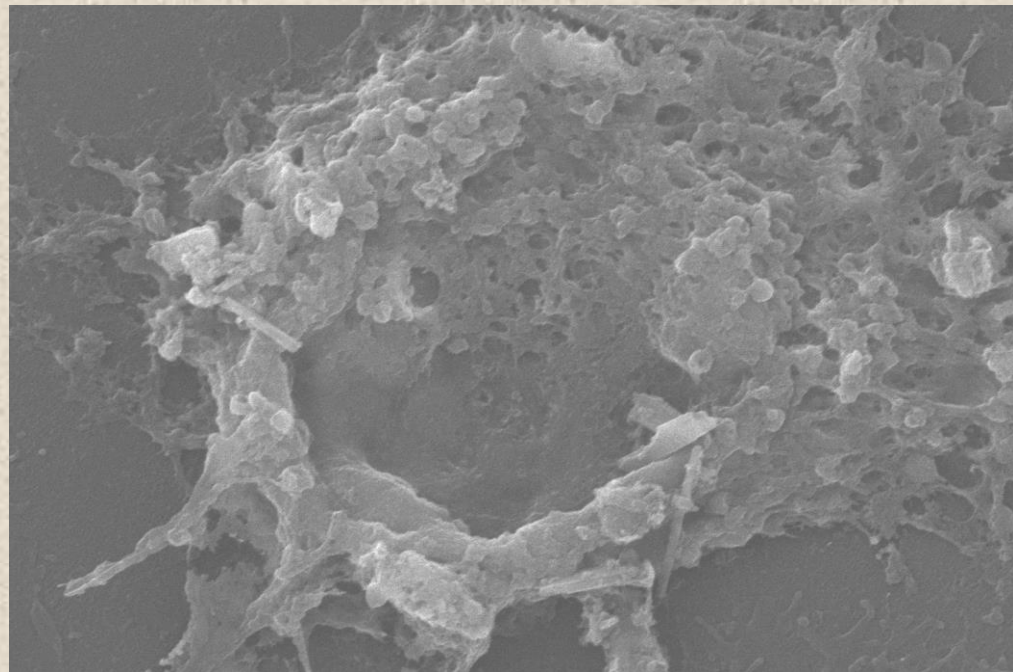
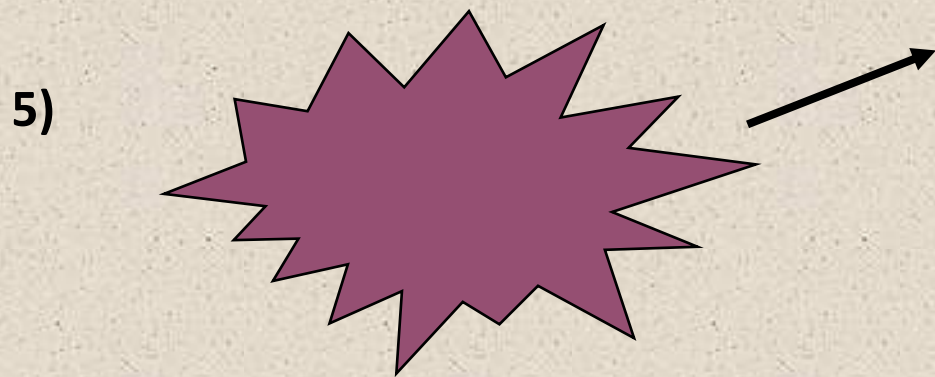
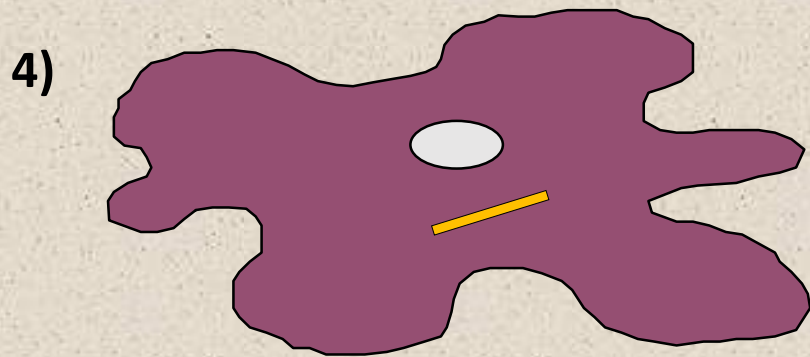
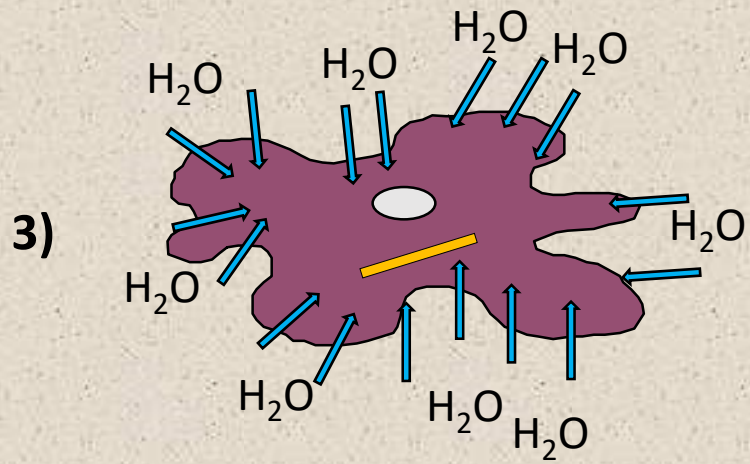
Erionite fibrosa

1)



2)





Papers del 2021

Publicati

- Scognamiglio V., Di Giuseppe D., Lassinantti Gualtieri M., Tomassetti L.; Gualtieri A.F. (2021) **A Systematic Study of the Cryogenic Milling of Chrysotile Asbestos**. Applied Sciences, 11, 4826
- Di Giuseppe D., (..) Ballirano P., Malferrari D., Raneri S.,(..) Gualtieri A.F., (2021) **Characterization and assessment of the potential toxicity/pathogenicity of Russian commercial chrysotile**. American Mineralogist, in press.
- Gualtieri A.F., Zoboli, A.; (...) Scarfi S.; Mirata S., (..) Di Giuseppe D. (2021) **In vitro toxicity of fibrous glaucophane**. Toxicology, 454, 152743.
- Di Giuseppe D., Perchiazzi N., (..) Della Ventura G., (..) Gualtieri A.F., (2021) **Occurrence and characterization of tremolite asbestos from the Mid Atlantic Ridge**. Scientific Reports, 11, 6285.
- Giacobbe C., Di Giuseppe D., (..) Gualtieri A.F., (2021) **Crystal structure determination of a lifelong biopersistent asbestos fibre using single-crystal synchrotron X-ray micro-diffraction**. Journal of the International Union of Crystallography (IUCrJ), 8, 76–86.
- Malferrari D., Di Giuseppe D., Scognamiglio V.; Gualtieri A.F. (2021) **Commercial brucite, a worldwide used raw material deemed safe, can be contaminated by asbestos**. Periodico di mineralogia, in press.
- Gualtieri A.F., Leoncini M., Rinaldi L., Zoboli A., Di Giuseppe D.; (2021) **WebFPTI: A tool to predict the toxicity/pathogenicity of mineral fibres including asbestos**. Earth Science Informatics, in press.

Sottomessi

- Di Giuseppe D., Scarfi S.; (..) Bassi A.M., Mirata S., Almonti V., (..) Gualtieri A.F. (2021) **Acute cytotoxicity of mineral fibres observed by time-lapse video microscopy**. Toxicology.

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Università degli Studi di Modena e Reggio Emilia
dott.ssa Valentina Scognamiglio*

Progetto PRIN «FIBRES A MULTIDISCIPLINARY MINERALOGICAL, CRYSTAL-CHEMICAL AND BIOLOGICAL PROJECT TO AMEND THE PARADIGM OF TOXICITY AND CANCEROGENICITY OF MINERAL FIBRES»



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and applied topics on Environment, Archaeometry and Cultural Heritage*

SAPIENZA
UNIVERSITÀ DI ROMA

Commercial brucite, a worldwide used raw material deemed safe, can be contaminated by asbestos

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Alessandro F. Gualtieri ¹

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Brucite commerciale: è sicura?

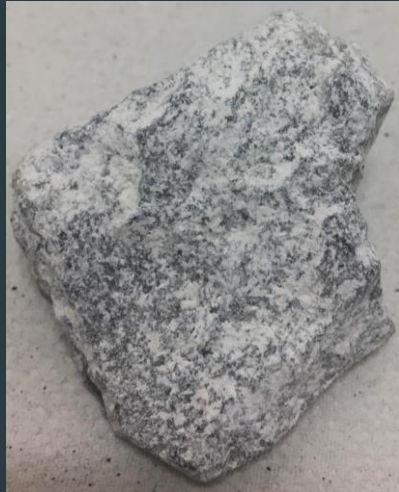
Caratterizzazione morfologica, mineralogica, chimica e termica

- Metodologie analitiche impiegate:*
- **XRPD**
 - **XRF**
 - **TGA e DTA**
 - **SEM-EDS**

- Scopo*
- Informare la comunità scientifica internazionale
 - Suggestire la necessità di un protocollo multi analitico



BRUCITE: GENESI ED USI COMMERCIALI



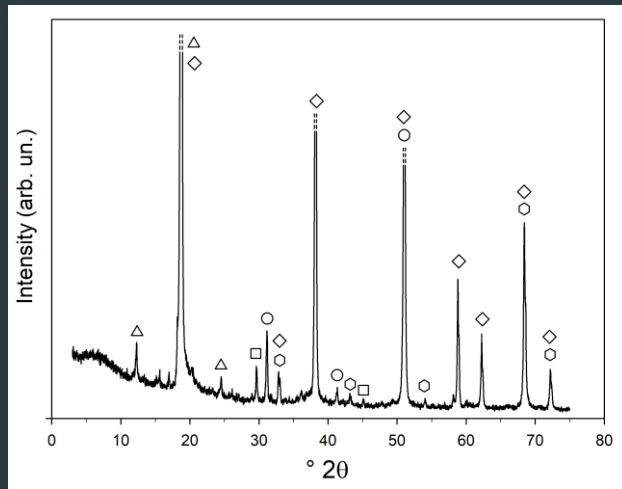
Genesi

- Depositi ultramafici per alterazione di duniti e peridotiti (serpentinizzazione)
- Depositi carbonatici ricchi in Mg - metamorfismo alta T, bassa P

Impieghi

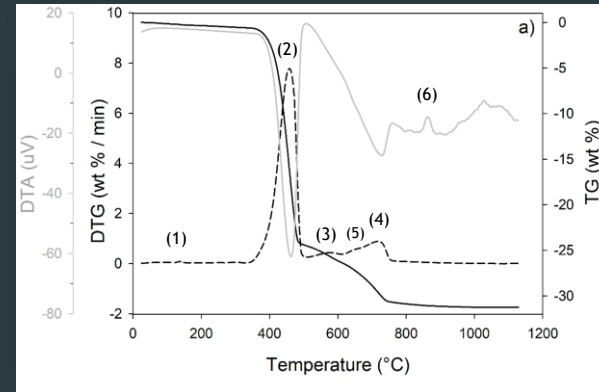
- Gres porcellanato
- Vetri (ritardante di fiamma)
- Isolanti e rivestimento

XRPD



- △ Serpentino
- ◇ Brucite
- Calcite
- Dolomite
- ⬡ Magnesite

TG (DTG)



- TG
- DTA
- DTG

- 6 eventi termici:
- (1) 122-158 °C, 0.096wt%
 - (2) 329-511 °C 23.95wt%
 - (3) 512-613 °C 1.84wt%
 - (4) 614-801 °C 4.5wt%
 - (5) 656 °C
 - (6) 870 °C

XRF

| | SiO ₂ | TiO ₂ | Al ₂ O ₃ | Fe ₂ O ₃ | MnO | MgO | CaO | Na ₂ O | K ₂ O | P ₂ O ₅ | LOI |
|---------|------------------|------------------|--------------------------------|--------------------------------|---------|--------|--------|-------------------|------------------|-------------------------------|--------|
| Brucite | 2.04 | 0.014 | 0.24 | 0.31 | 0.032 | 64.33 | 1.91 | 0.031 | 0.093 | 0.040 | 30.96 |
| | (0.11) | (0.005) | (0.04) | (0.06) | (0.007) | (0.91) | (0.11) | (0.009) | (0.007) | (0.010) | (1.01) |

SEM-EDS

Preparazione del campione
secondo Decreto legge 06/09/94

Concentrazione di crisotilo:

$$C = \frac{A \cdot (w_a)}{n \cdot a \cdot W} \cdot 10^6$$

169mg/Kg
(0,02 wt%)

A: superficie del filtro (mm²)
W_a: peso tot delle fibre contate (mg)
n: numero di analisi
a: area di misura (mm²)
W: peso del campione nel filtro (mg)

