

Breakthrough: Nuclear Emulsion!!

Enhanced photo-films, "early 20th century technology"
Survived at Nagoya University
(with lots of unique applications)

First Measurement in 2024

Developed films
Granite samples from GSJ

WIKIPEDIA
The Free Encyclopedia

Nuclear emulsion

Article Talk

From Wikipedia, the free encyclopedia

A **nuclear emulsion** plate is a type of particle detector first used in nuclear and particle physics experiments in the early decades of the 20th century.^{[1][2][3]} It is a modified form of photographic plate that can be used to record and investigate fast charged particles like alpha-particles, nucleons, leptons or mesons. After exposing and developing the emulsion, single particle tracks can be observed and measured using a microscope.

Description [edit]

Schematic edge-view cross section of nuclear emulsion, not to scale. The nuclear emulsion plate is a modified form of photographic plate, coated with a thicker photographic emulsion of gelatine

Aligned Alpha Tracks Pictured!!!

alpha tracks (thick straight lines)
typ. ~ 10 μm long

Thanks to Sanshiro's talk

Experiment: Rocks

The nuclear emulsion and rock sample were vacuum-sealed in a lightproof bag and stored for about 100 days.

10

Rock samples

Sample-A
Sample-B 6cm
Thin sample-B
Thin sample-B

4.5cm

lightproof bag

Rock
Emulsion
Emulsion

α (From Emulsion)
α (From Rock)

- Since tens of thousands of α tracks were observed under the microscope, machine learning was used for rapid processing.

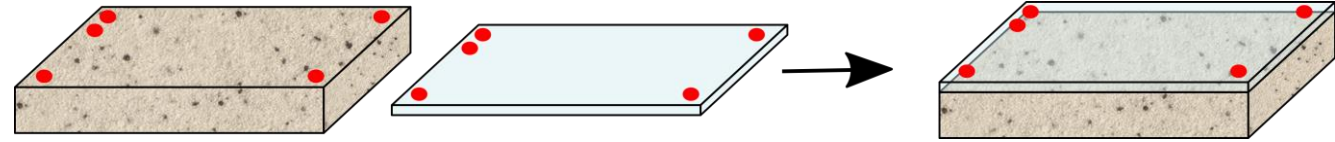
Thanks to Nishikiori's talk

... my two cents
on autoradiographic mapping...

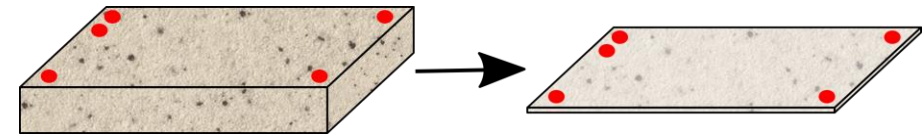


Methodology

Starting from a small granite block, we georeferenced a thin polycarbonate (CR-39) **film sensitive to α emissions**.



From the same block, a **thin section** (30 μm thickness) was prepared, allowing the main minerals to be observed under polarized light using a microscope.



The goal is to identify a spatial correspondence between **macroscopic features, minerals** observed under the microscope, and **alpha decay** events.

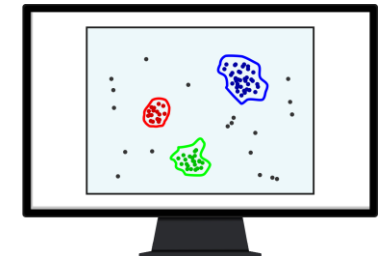
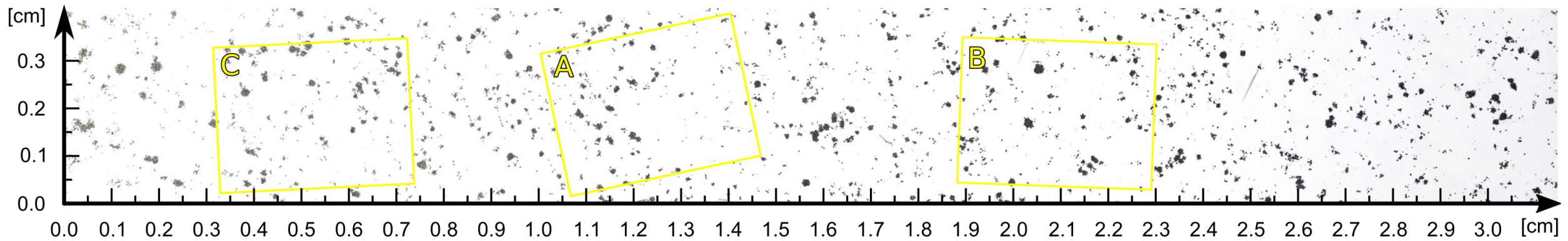
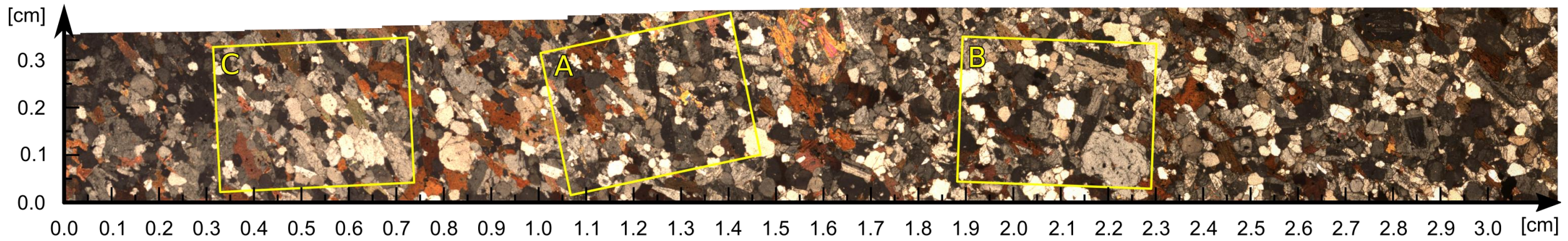
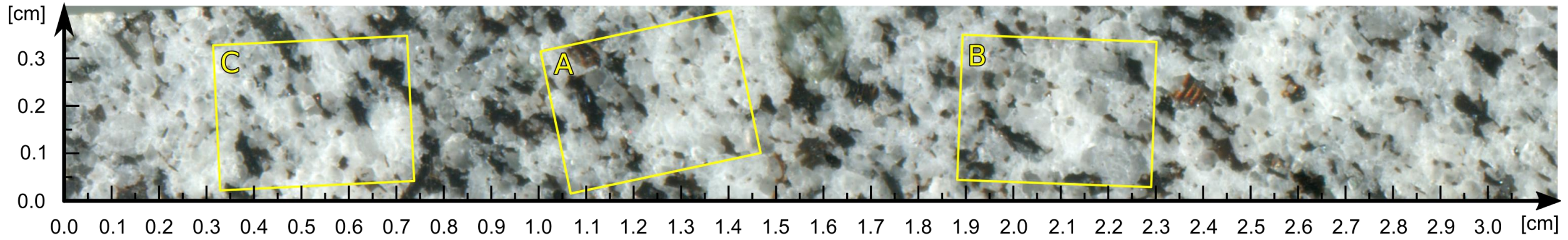
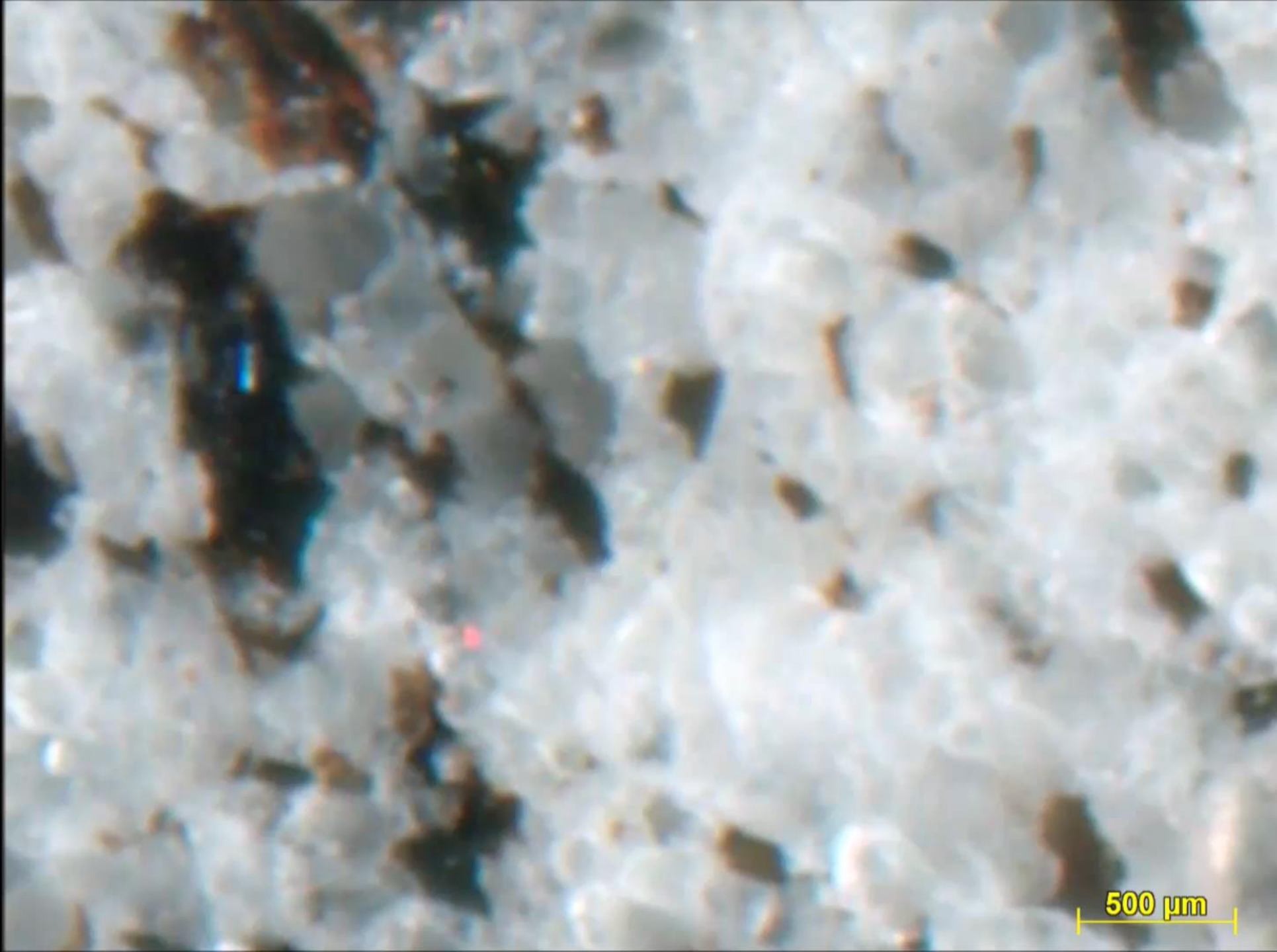


Image mosaic





Distribution of alpha decays in different minerals

Mosaico	Facies	A_{tot} [mm ²]	$A_{\text{trac}}/N_{\text{trac}}$	N_{trac}	$N_{\text{trac}}/A_{\text{tot}}$ [μm^{-2}]
Campione 2	A	129.4	577	5982	$4.62 \cdot 10^{-5}$
Campione 7	B	182.5	610	9211	$5.05 \cdot 10^{-5}$
Campione 6	C	142.3	591	8281	$5.82 \cdot 10^{-5}$

