

Luminescence Dating

Sands of Time

Hi! I am Sand
You must have seen me
in the beaches, you can
also see me in the deserts &
in rivers

I am formed as a result
of Physical weathering of
rocks



I am usually
made up of 3 type of
particles

Quartz

Feldspar

Lithic Fragments

Two of us
are mostly used
for luminescence dating



Feldspar



Quartz

Hey!
How are you two able
to estimate time and
not me

Yes! So....

Do you remember,
we were formed from
rocks??

There are radioactive elements
inside these rocks which get
weathered, travels and get
deposited with us

Unlike others Quartz and Feldspars have the ability to
record the amount of radiation they were exposed to

So we can
act as **Dosimeters**
& can be used to estimate
time

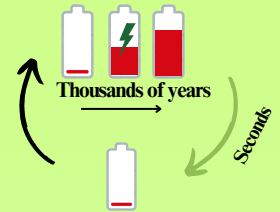
Oh!!!
So it is possible to
estimate the time of
your formation

No!
Luminescence Dating do not
estimate the time of formation of
Quartz or Feldspar Grains

It estimates when the
energy in the grains
were zeroed the last time

I will explain
it easily

When sediments are deposited the
radioactive elements around them radiate
energy and this energy gradually builds up
within the mineral grains, like charging a
battery

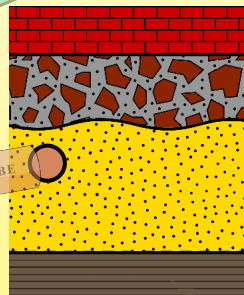


Exposure to sunlight releases this
trapped energy.
The battery becomes drained

Luminescence Dating therefore measures when the
sediment was last exposed to sunlight.

Cool!!!!
How can the scientists
collect Quartz and Feldspar
specifically from the field

In the field they collect sand
not just Quartz & Feldspar.
These are then isolated in
the labs



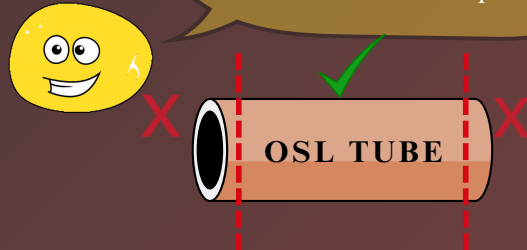
Samples are taken by hammering
tubes in to the sand sequences or
by coring

Samples must not be exposed to any light during sampling
or transportation so they are collected in dark tubes and is
wrapped to prevent exposure

Luminescence Lab

As the samples cannot be exposed to normal light Luminescence labs operate in Red or orange lights

Quartz is used in most commonly for Luminescence, so I will explain how pure quartz is obtained from the collected sand samples



While opening the OSL tube, only the sample in the middle portion of the tube is taken for analysis so as to avoid any exposed samples

Samples are sieved to get particles of size <90->250µm

Step 1



2

First with 37% HCl to remove Carbonates

30% H₂O₂ with 37% to remove organics

3



Samples are sieved again to get particles of size 180-250µm

4



5

Quartz & Feldspar are then separated by using heavy liquid method using SPT (Sodium Polytungstate)

6

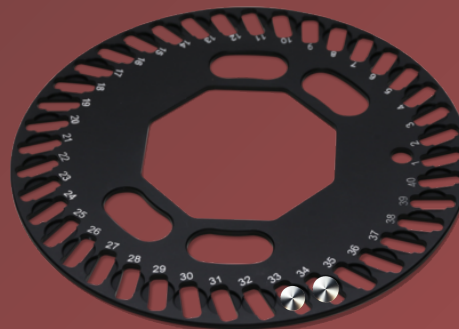
Separated Quartz grains are treated with HF(Hydrofluoric acid) to remove the outer rim of quartz grains



This, isolated pure Quartz is used for Luminescence measurements



Quartz grains are mounted on small metal disc for inserting them to the Luminescence reader



Luminescence carousel with grain mounded metal discs

Age Determination



We can understand this concept by considering a charging battery. If the battery is being charged at a constant rate. And if we know the total charge in the battery. By dividing total charge with charging rate we will get the time from when the battery has been charging.

$$\text{Time} = \frac{\text{Total Charge}}{\text{Charging Rate}}$$

$$\begin{aligned} \text{Total Charge} &= \text{Energy Stored in the mineral} \\ \text{Charging Rate} &= \text{Dose Rate} \end{aligned}$$

$$\text{Age} = \frac{\text{Equivalent Dose}}{\text{Dose Rate}}$$

The luminescence machine emits light of particular wavelength and stimulates the quartz grains. It can also measure the radiation emitted by these grains. This can give the value of total accumulated dose in the quartz grain.

Dose rate is the measure of how the quartz grain was charged by its surrounding matrix. It can be determined by measuring the concentrations of radioactive elements in the samples.



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