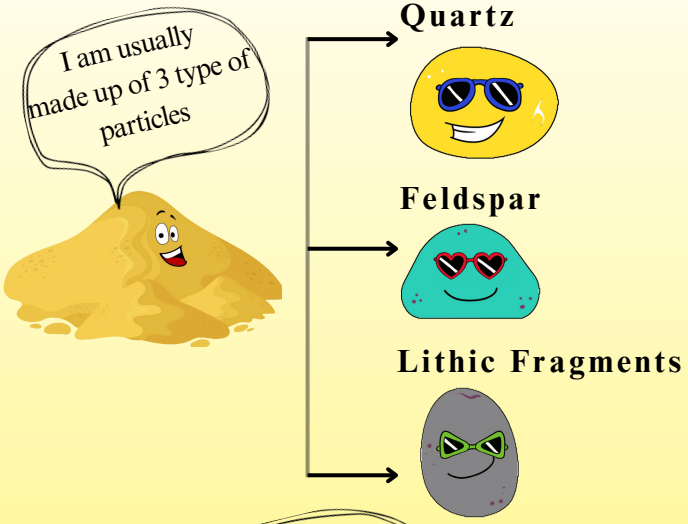
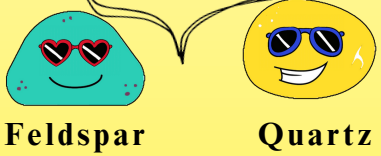
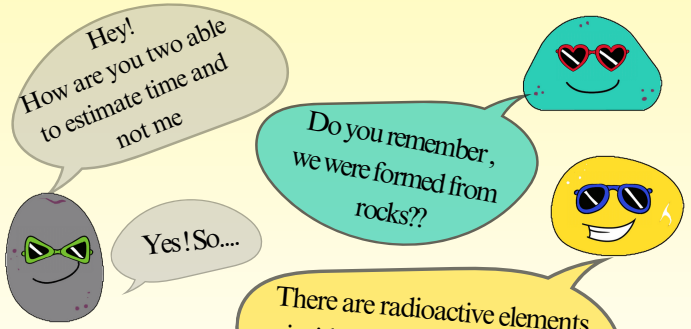
Luminescence Dating

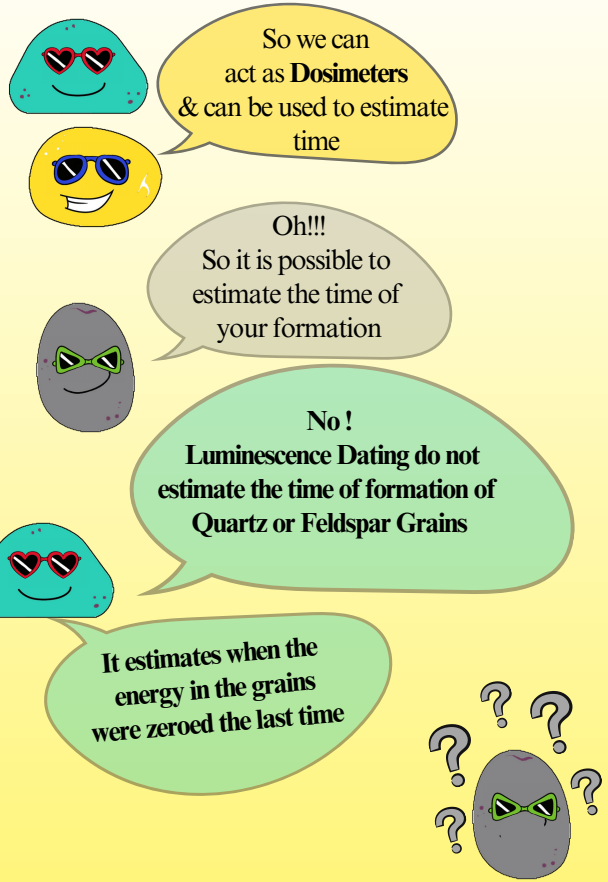
Sands of Time

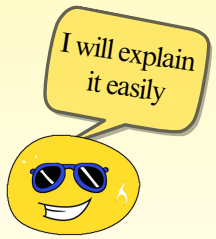




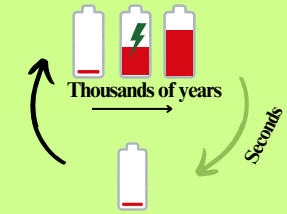


Unlike others Quartz and Feldspars have the ability to record the amount of radiation ,they were exposed to



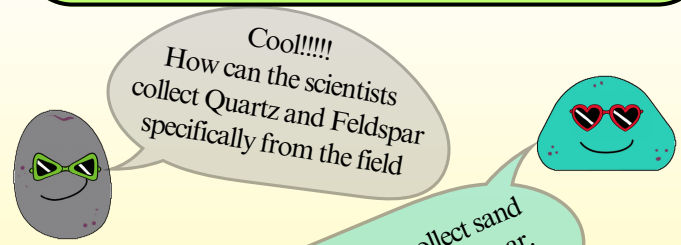


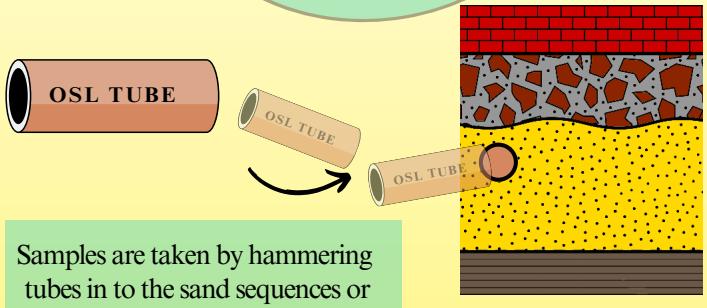
When sediments are deposited the radioactive elements around them radiate energy and this energy gradually builds up within the mineral grains, like charging a battery



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

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





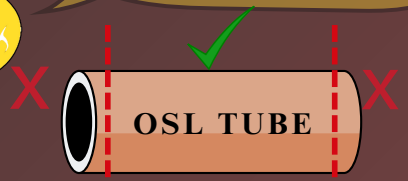
Samples are taken by hammering tubes in to the sand sequences or by coring

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

Now it is a series of cleaning

2

First with 37% HCl to remove Carbonates

↓

30% H_2O_2 with 37% to remove organics

3

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

4

5

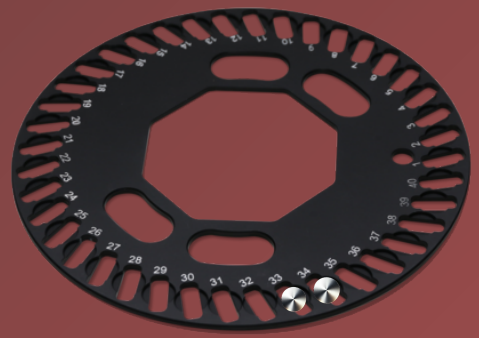
Quartz & Feldspar are then separated by using heavy liquid method using SPT (Sodium Polytungstate)

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.

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

Total Charge = Energy Stored in the mineral
Charging Rate = Dose Rate

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

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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