

# The Probability

Suppose that an event **E** happens in **h** ways out of a total of **n** possible likely ways. Then,

$$p = \Pr(E) = P(E) = \frac{h}{n}$$

This is called **Probability of Occurrence** of the event (or **Success**)

Therefore the **Probability of Nonoccurrence (Failure)** is

$$q = P(\text{not}E) = 1 - P(E)$$

**Probability** of an event is always between **0 and 1**

# The Probability

## Example:

Let E be an event of having the number 3 in a single toss of a die. What is the probability of having  $E=3$ ?

## Solution:

$n=6$  → faces of the die

$h=1$  → face of the event  $E=3$

$P(3) = 1/6 = 0.17$  → means that this event might happen one time in every six tosses.

$P(\text{not } 3) = 5/6 = 0.83$

# The Probability

Now, consider the following **geological examples**:

1- What is the probability that a carbonate rock sample has porosity of 0.3 or greater if we have 100 samples out of which 6 samples have porosity of 0.3 or greater?

$$P(\text{sample}) = \frac{n}{N}$$

Therefore,  $P(\text{sample}) = 6/100 = \mathbf{0.06 \text{ or } 6\%}$

This is called the *Classical Interpretation Approach*.

# The Probability

Now, consider the following **geological examples**:

2- What is the probability of having a sandy lens in a clay bed if the volume of the lens is 10 cu.m. and the volume of the bed in that locality is 75 cu. m.?

$$P(event) = \frac{\textit{size\_of\_smaller\_event}}{\textit{Size\_of\_larger\_event}}$$

Therefore,  $P(\text{sandy lens}) = 10/85 = \mathbf{0.12} = \mathbf{12\%}$

This is called *Geometrical Interpretation Approach*.

# The Probability

Now, consider the following **geological examples**:

3- What is the probability that gold concentration is between 480 ppm and 600 ppm at mine?

Construct a **relative frequency histogram** and interpret the probability value from it.

This is called the *Relative Frequency Interpretation Approach*.

**The applications related to Relative Frequency Interpretation Approach will be used in this course.**

# What is Probability?

- **Probability** is a measure of how likely (probable) specific observations of a variable may or may not occur.

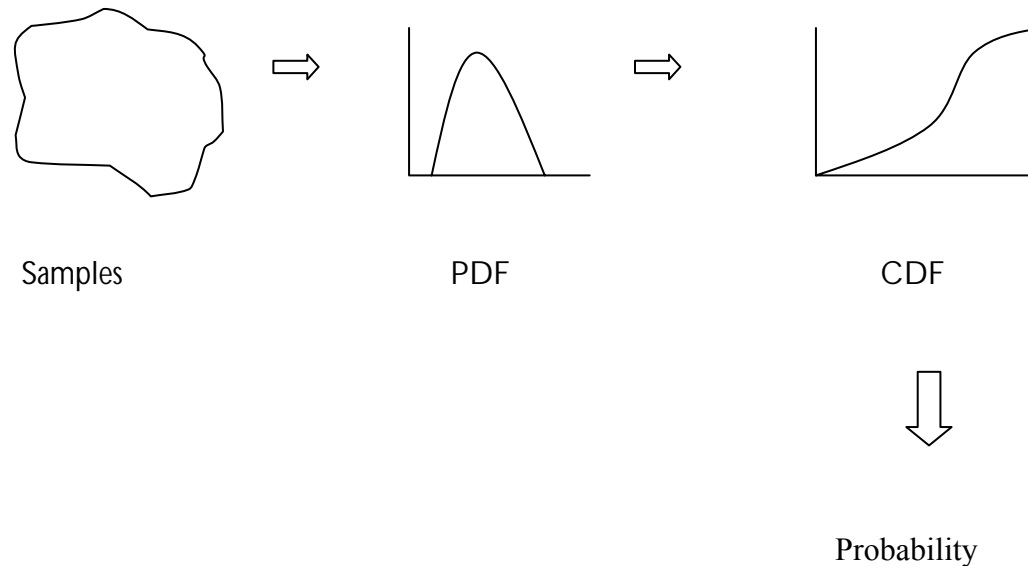
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## **Example:**

- »  $P(\text{porosity} \leq 0.15) = 10\% \text{ or } 0.10$
- »  $P(\text{porosity} \geq 0.23) = 82\% \text{ or } 0.82$

# How to Represent Probability?

**1- Frequency distributions** (e.g. relative frequency dist.  
And cumulative frequency dist.)



# How to Represent Probability?

## 2- Expectations

If  $P(\text{iron}) = 0.2 = 20\%$  and the available ore deposit = 250 ton, what is the expected iron in that deposit?

Expected tonnage of iron =  $250 * 0.2 = 50$  ton → **Q:**

Is it feasible to mine it or not?