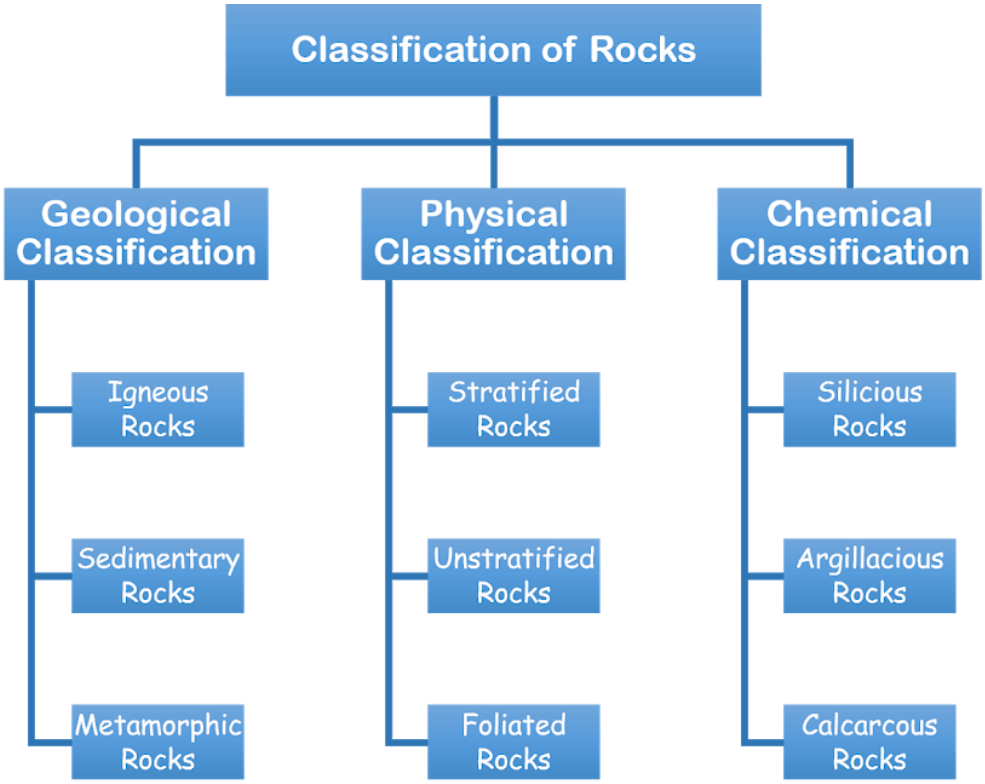
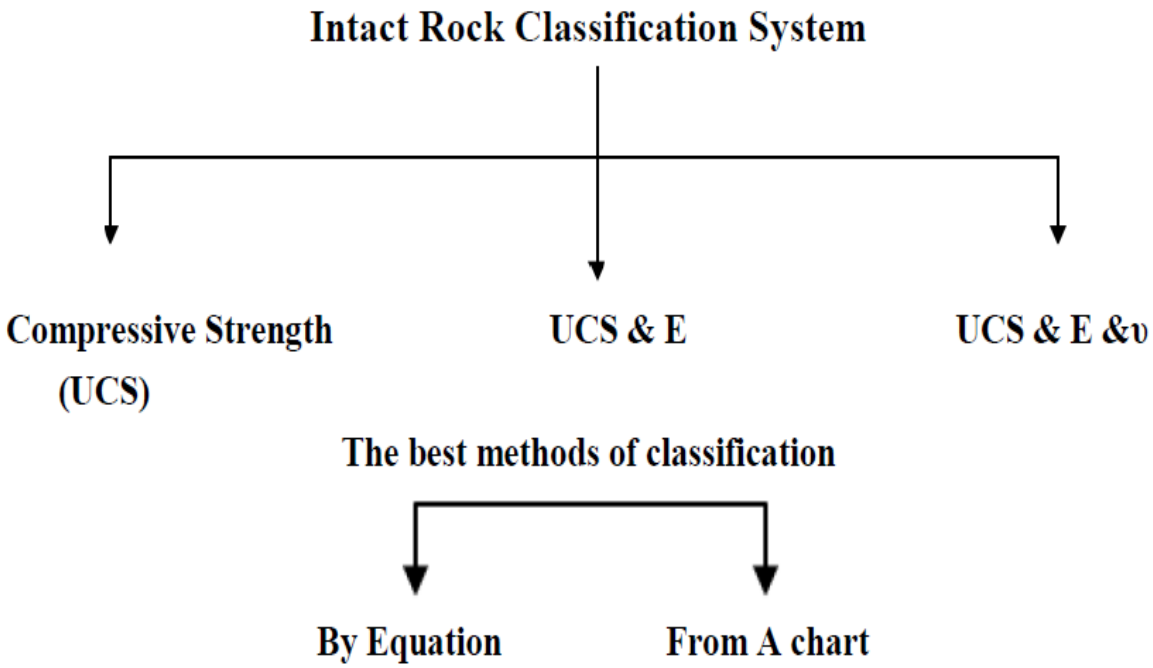
General Classification of Rocks

Rocks are classified based on three major factors as follows :

1. Geological classification
2. Physical classification
3. Chemical classification



Intact Rock Classification



There are three methods for intact rock classification:

1. **Strength System:**

According to **STRENGTH** (**Uniaxial Compressive strength (UCS)**)

2. **Modulus Ratio System** (By Deere and Miller,1966):

According to **STRENGTH** and **MODULUS OF ELASTICITY** (**Modulus Ratio MR**).

3. **Strength – Deformation System** (By Turk and Dearmann,1983):

According to **STRENGHT** and **DEFORMABILITY**

Uniaxial Compressive Strength (UCS), Modulus of Elasticity (E), Possion's Ratio (υ)

1. **Strength System:**

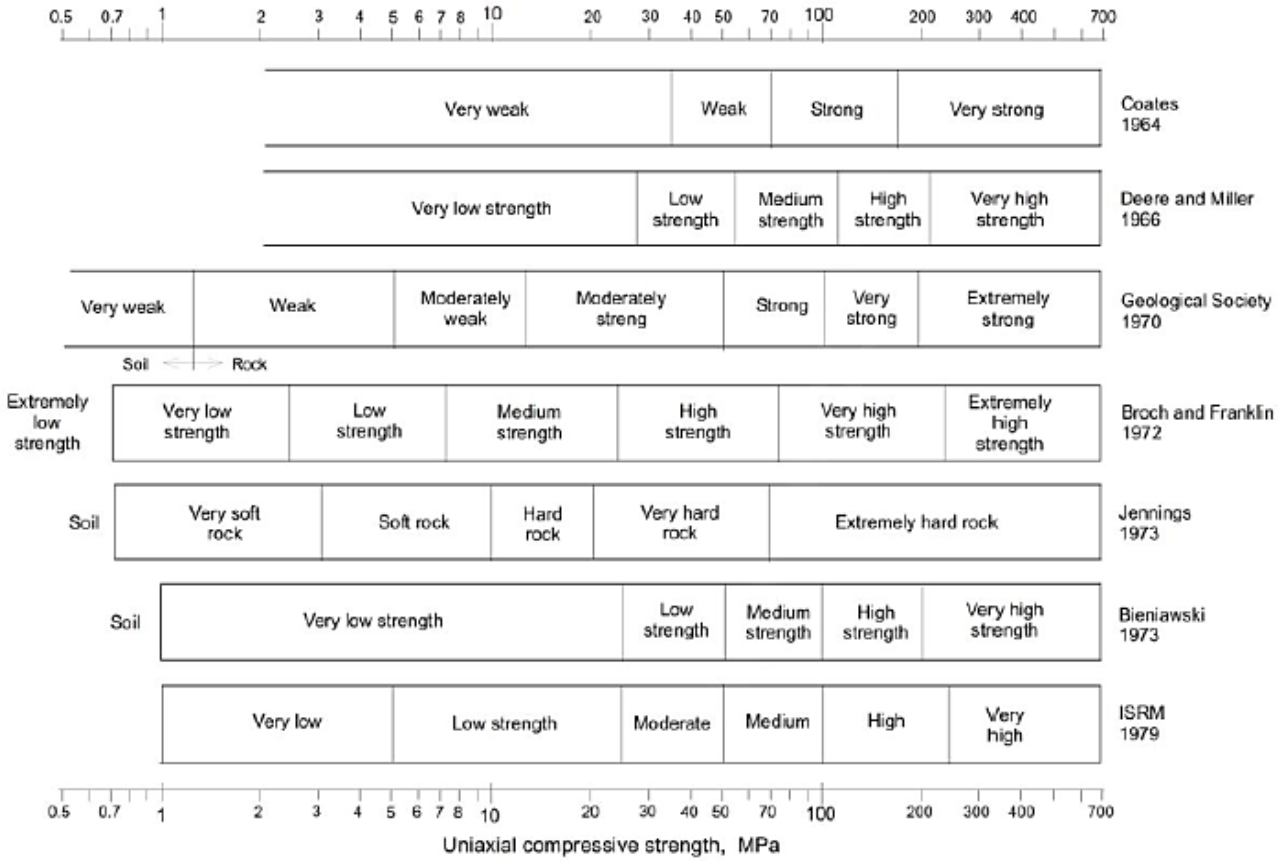
According to Compressive Strength (UCS):

Example: Limestone, UCS = 120 MPa (Coates, 1964)

The intact rock of limestone is classified as a strong rock according to coates Classification (1964).

Example: Basalt, UCS = 210 MPa (Deere & Miller, 1966)

The intact rock of Basalt is classified as high strength to very high strength rock according to Deere & Miller (1966).



Various strength classifications for intact rock (from Bieniawski, 1984)

2. Modulus Ratio System:

According to strength and Modulus of Elasticity (UCS & E Values), By Deere & Miller (1966).

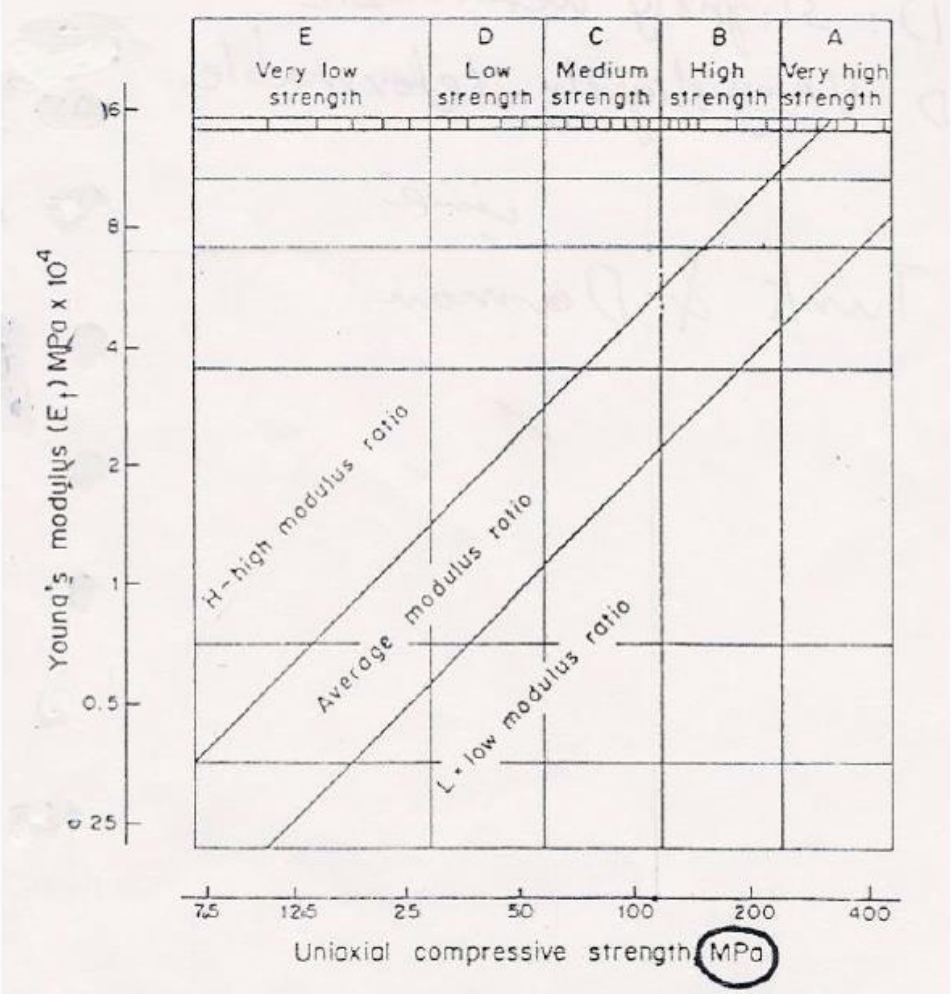
The classification can be made using either of the two methods:

(1) By Equation: $M_R = \frac{E}{ucs}$

Engineering classification of intact rock on base of modulus ratio

Class	Description	Modulus ratio
H	**High modulus ratio**	**Over 500**
M	**Average (medium) ratio**	**200-500**
L	**Low modulus ratio**	**Less than 200**

(2) From Chart:



∴ Engineering classification of intact rock.
(after Deere and Miller, 1966)

Example: (Granite) UCS = 150 MPa, E = 60 GPa

$$M_R = \frac{E\ (Mpa)}{ucs\ (Mpa)} = \frac{60000}{150} = 400$$

∴ MR = 400 (Medium Ratio)

The intact rock of granite has a medium ratio according to Deere and Miller classification (1966).

3- Strength – Deformation System:

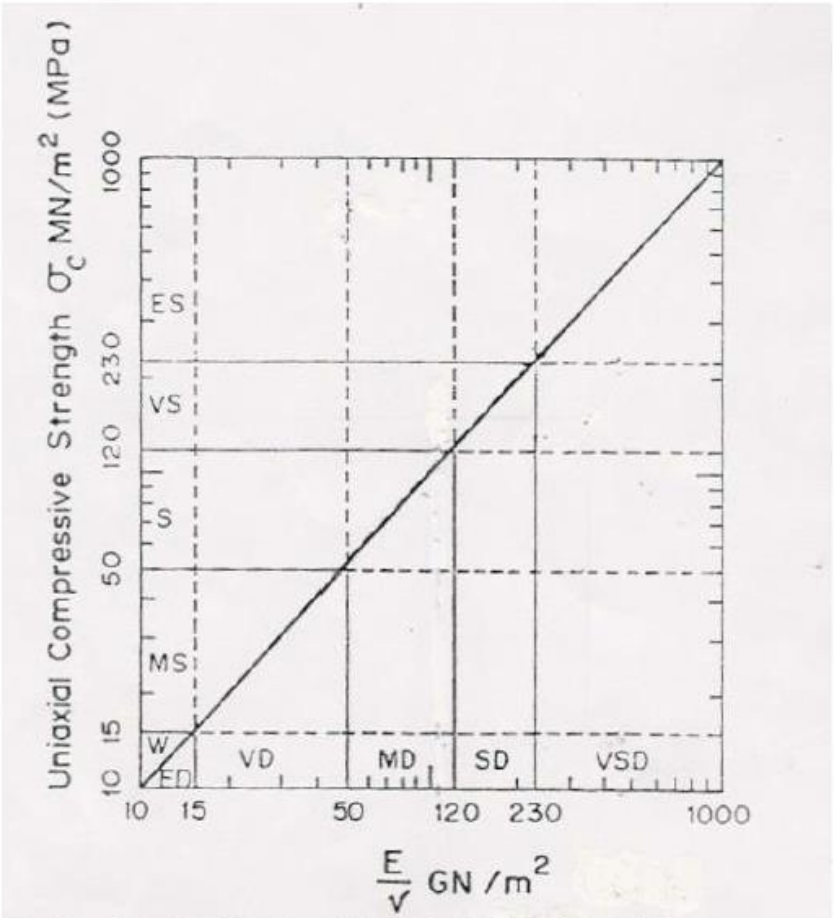
According to Strength, Modulus of Elasticity & Poisson's Ratio (UCS, E &υ values). By Turk and Dearman (1983). It is of the best and appropriate classification methods, since it is including the three engineering parameters.

Example: Diorite, UCS = 180 MPa, E = 60000 MPa, υ = 0.2

$$\frac{E}{\upsilon} = \frac{60000\ MPa}{0.2} = 300000\ MPa = 300\ GPa$$

From the attached chart:

The intact rock of Diorite is classified as a very strong (VS) and very slightly deformable (VSD) rock according to Turk and Dearmann classification (1983).



Engineering classification of intact rock (Turk and Dearman, 1983) (W: weak; MS: moderately strong; S: strong; VS: very strong; ES: extremely strong; ED: extremely deformable; VD: very deformable; MD: moderately deformable; SD: slightly deformable; VSD: very slightly deformable.