Reason to study

- The engineering mechanics problem posed by underground mining:
  the prediction of the displacement field generated in the orebody and surrounding rock by any excavation and ore extraction processes.

  The rock in which excavation occurs-

  stressed by gravitational, tectonic and other forces, and methods exist for determining the ambient stresses at a mine site

- Since the areal extent of any underground mine opening is always small relative to the Earth's surface area, it is possible to disregard the sphericity of the Earth.

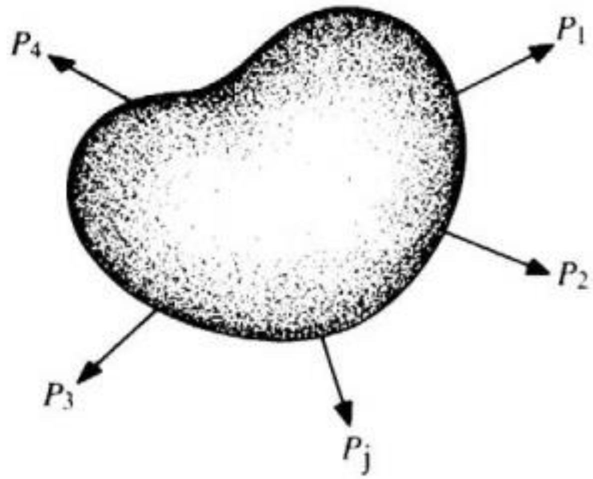
- Mining can then be considered to take place in an infinite or semi-infinite space, which is subject to a definable initial state of stress.

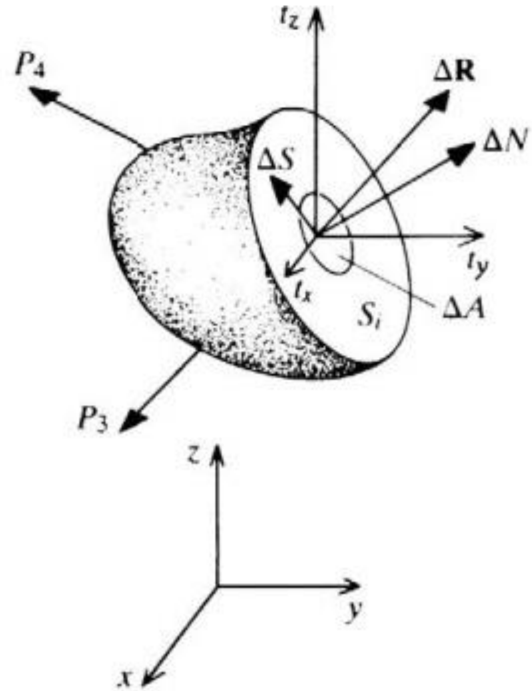
- THEREFORE,

  An understanding of the notions of force, stress and strain is fundamental to a proper and coherent appreciation of the response of a rock mass to mining activity.
- Prediction of rock mass response to mining therefore requires a working understanding of the concepts of force, traction and stress, and displacement and strain

Force and Stress

- The concept of stress is used to describe the intensity of internal forces set up in a body under the influence of a set of applied surface forces.
- State of stress at a point in a body where forces acting on the planes which are orthogonally oriented with respect to a coordinate system (*for example, a cartesian set of reference axes, x,y,z*)





- Any interior surface Si, subjected to applied surface load, needs to be in equilibrium state
- Suppose, over an element of surface Δ*A surrounding a point* O, the required resultant force to maintain equilibrium is Δ**R**

- The magnitude of the **resultant stress σr at O, or the stress vector, is then** defined by,

$$\sigma_r = \lim_{\Delta A \to 0} \frac{\Delta R}{\Delta A}$$

- IF, one vector component of ΔR acting normally to ΔA is ΔN

  and

  another vector component acting tangentially to ΔA is ΔS
- THEN, at point O, normal stress component, σn and shear stress component, τ

can be defined as,

$$\sigma_n = \lim_{\Delta A \to 0} \frac{\Delta N}{\Delta A}, \quad \tau = \lim_{\Delta A \to 0} \frac{\Delta S}{\Delta A}$$