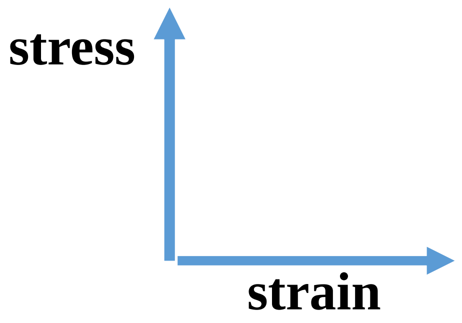
Stress Strain Diagram

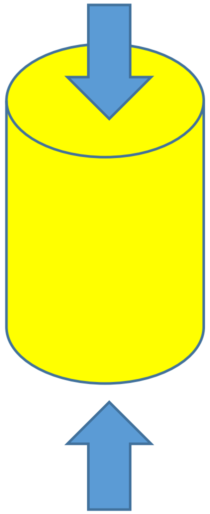
The relation existing between stress and strain is commonly expressed in graphs known as **Stress-Strain diagram.**



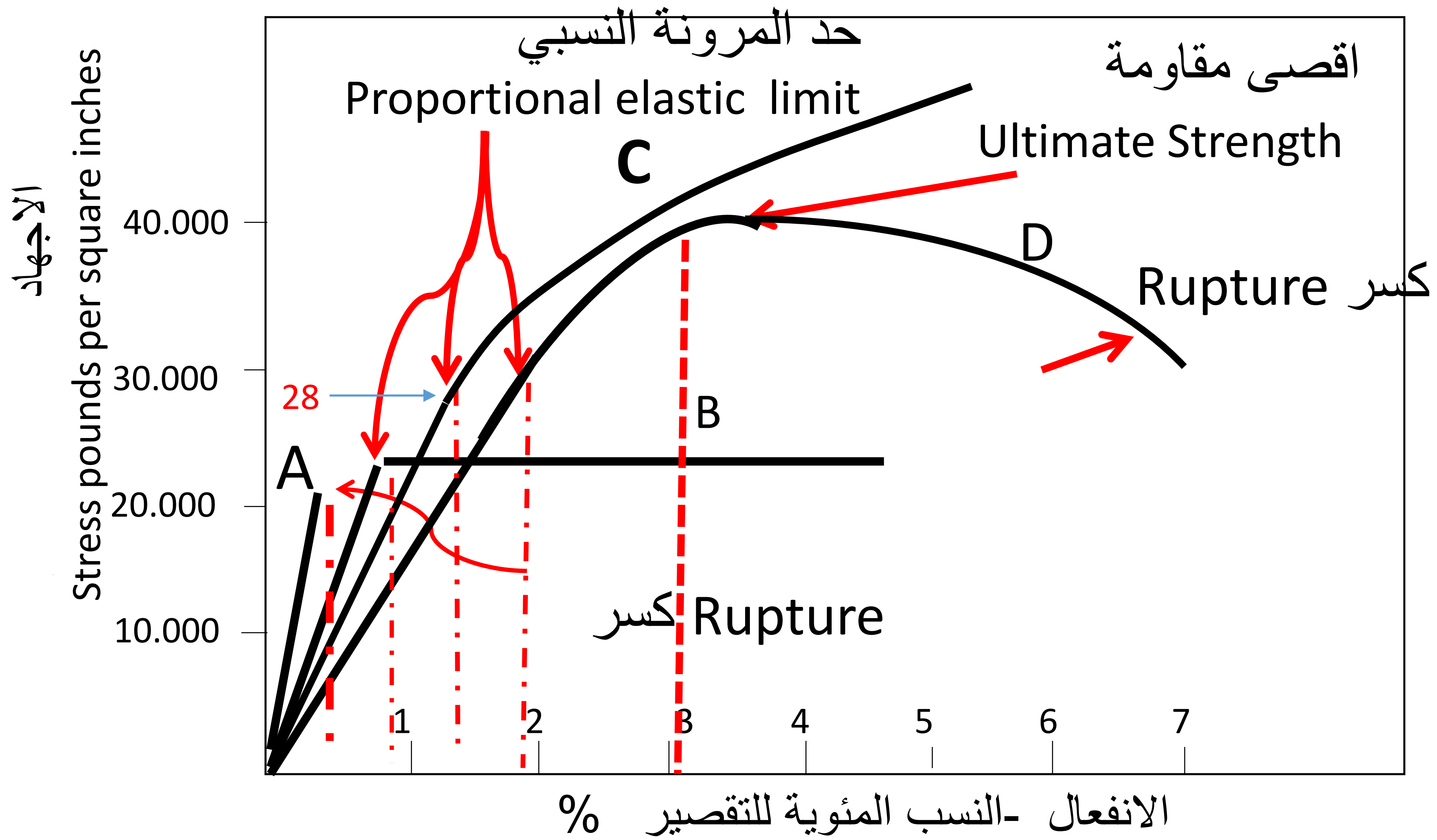
The stress is plotted on the ordinate (vertical axis), whereas the strain is plotted on the abscissa (horizontal axis).

In the figure below, the material is under compression and the compressive stress parallel to the axis of the cylinder in pounds per square inch.

With increasing stress the specimen become shorter and the strain is plotted in terms of the percentage of the shortening of the specimen.



ان العلاقة الموجودة بين الاجهاد والانفعال والتي يعبر عنها بالخطوط البيانية التي تعرف بمنحنيات الاجهاد الانفعال ، تبين وجود اربعة انوع من المواد التي تتصرف بشكل نموذجي تحت الاجهاد الكابس الموازي لمحور النموذج الاسطواني حيث تمثل استجابات مختلفة من التشوه . وكما وموضح بالشكل التالي



حد المرونة النسبي
Proportional elastic limit
اقصى مقاومة
Ultimate Strength
C
D
Rupture كسر
40.000
30.000
20.000
10.000
28
A
B
كسر Rupture
1
2
3
4
5
6
7
الاجهاد
Stress pounds per square inches
الانفعال -النسب المئوية للتقصير %
Strain- shortening in percent

Curve A is the stress –strain diagram of a **brittle substance**. It deforms elastically up to a stress of 20,000 Ib/in .^{2} and has shortened one-half of one percent it then fail by rupture. (have no elastic limit)

Curve B is an ideal plastic substance.it behave elastically at first .At a stress of a bout 24,000 Ib/in.^{2} it reaches the proportional *elastic limit* , which the point at which the curve depart from the straight line . the shortening is slightly less than one percent . thereafter the specimen deforms continuously without added any stress.

(flow without mesoscopic brittle behavior)

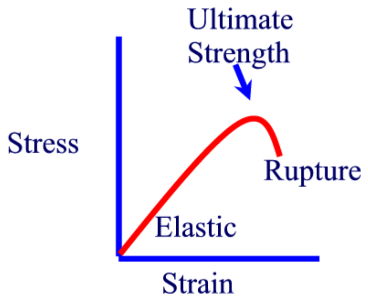
Curve C represent a more normal type of plastic behavior. At a stress of about 28,000 Ib/in.^{2} and a strain of some what over 1 percent, the specimen reach the proportional elastic limit and thereafter deforms plastically. <u>But for every increment of strain , an increase in stress necessary</u>. This is the result of what is called ***work hardening*** ;that is the specimen become progressively more difficult to deform.

Curve D represent a very common type of plastic deformation . The specimen deforms elastically up to a stress of about 28,000 Ib/in. ^{2} and a shortening of somewhat less than 2 %t. A t first an increase in stress is necessary for continued deformation. But when the shortening is somewhat over 3% (highest point) progressively less stress is necessary to continue the deformation .

This high point on the curve is _ ***ultimate strength.***

(maximum stress that a rock can support before failure.)

The stress-strain relation is commonly expressed in graphs known as stress-strain diagrams.



1. Curve A is a brittle substance. (have no elastic limit)

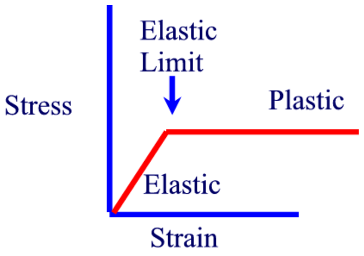
<u>Brittle Rocks behavior-</u> exhibit elastic behavior before rupture

2. Curve B is an ideal plastic substance.

(have elastic limit)

exhibit elastic-plastic behavior

before rupture



3. Curve C more normal type of plastic behavior

(have elastic limit)

4. Curve D another common type of plastic deformation.

(have elastic limit and ultimate strength)

(note:- 2,3,and 4 are <u>Ductile Rocks behavior)</u>

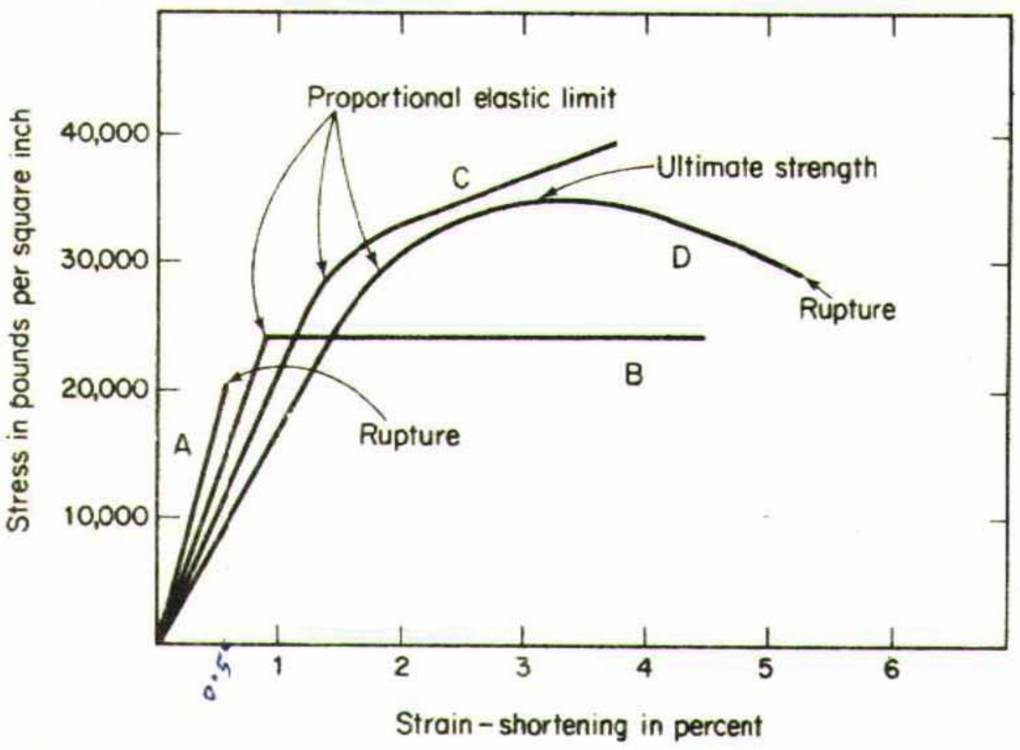


Fig. 2-8. Stress-strain diagrams.

The ultimate strength of a rock is a function of many variable ,
such as confining pressure and temperature.

The term” strength” is rather meaningless term unless all the environment conditions are specified

The shape of the test specimen may control the result,
Moreover, the strength of the same kind of rock may vary greatly, depending on the locality from which it comes . Finally ,the published data usually represent “intact “ rock ,that is small specimens are not marred by flaws.
أخيرًا ، تمثل البيانات المنشورة عادة صخرة "سليمة" ، وهي عينات صغيرة لا تشوبها العيوب.

Large units ,such as those significant to regional tectonics ,are generally characterized by joints and other planes of weakness.