If the system is impervious to liquid and the load contact is a "perfect surface" then only the external free face can be in contact with the solution. Actually the system is, in general, never impervious to the liquid and perfect contact surfaces non-existent. Penetration occurs along crystal boundaries, across crystal cleavages and cracks. The stressed surfaces carry the load non-uniformly and contain high points of localized stress. As these high points are dissolved the stress distribution shifts to other high points and the process is repeated.

Thus at the stressed face solubility is increased by a compressive load and lowered by a tensile load. At the free face solubility is increased by either a compression or tension but by a much smaller factor. It should be noted however that the integral expression for (9b) is

$$\frac{\pi^2 - \pi_0^2}{E} = \frac{\rho RT}{M} \ln \left(\frac{a_2}{a_{2_0}} \right), \qquad (10b)$$

which may become large for large π. ρ and E are here mean values for the range of integration. This relation is the *plastic flow factor for tension*.

According to this interpretation it is found that, whereas under compressive load the solute concentration tends to increase at both stressed and free face, diffusion of solute away from these faces would leave the bulk of the solution supersaturated. Consequently deposition of solute should occur at unstressed places. If, however, the solution can supersaturate by an amount in excess of the relatively small increased solubility at the free faces, then crystallization will take place on these free surfaces which, under these conditions, act as nuclei for deposition. Our mechanism can thus be considered as a diffusion process along crystal grain boundaries wherein the solution acts as a transfer medium. This diffusion rate will approach a steady state when a dynamic equilibrium between rate of solution and rate of deposition has been established, and will be governed by the mobility of the solute in the solution, the path length, and the concentration head between the stressed and free faces.

If, by changing the load, we change only the concentration head of the *polycrystalline* substance then the change in the steady creep rate, $\dot\epsilon_s$, should be directly proportional to the change in activity, or

$$\frac{d \ln a_2}{d\pi} = B \frac{d \ln \dot\epsilon_s}{d\pi}, \qquad (11)$$

where B is a constant. From (10a) and (11) we obtain

$$\pi - \pi_0 = K \ln (\dot\epsilon_s / \dot\epsilon_0), \qquad (12)$$

where K is a physical constant. This is the relation obtained empirically[13] for the steady creep rate of compressively loaded alabaster in contact with water.

As compressive load is increased the solubility at the stressed surface eventually becomes larger than the amount by which the solution can supersaturate. Under these conditions the solution will drop the excess solute in any available unstressed space. Consequently, the texture of the substance may thus become so loosened that it crumbles under the load.

The remainder of the discussion parallels that for plastic flow in polycrystalline metals. As before, we divide our system into hypothetical isolated portions and derive expressions for the stressed face and free face. We assume also the coexistence of two phases—the bound atoms of the solid and the free migrating atoms with energies exceeding those necessary to break the cohesive bonds of the crystal lattice. At the melting point this will be equivalent to the heat of melting.

The analogous relations to (9a) and (9b) connecting compressive stress π and "melting" temperature, T_m, in degrees absolute are readily derived as

$$\left(\frac{d \ln T_m}{d\pi} \right)_{\text{SF}} = -\frac{1}{\rho h} \qquad (12a)$$

and

$$\left(\frac{d \ln T_m}{d\pi} \right)_{\text{FF}} = -\frac{\pi}{\rho E h}, \qquad (12b)$$

where h is the heat of "melting" and the other quantities are as before.

The melting point at the stressed face is thus depressed for compression and raised for tension. This may be observed graphically from Fig. 3

[13] The experimental data were obtained by Griggs. To be offered for publication, with Goranson, in a future issue of the *Bulletin of the Geological Society of America*.