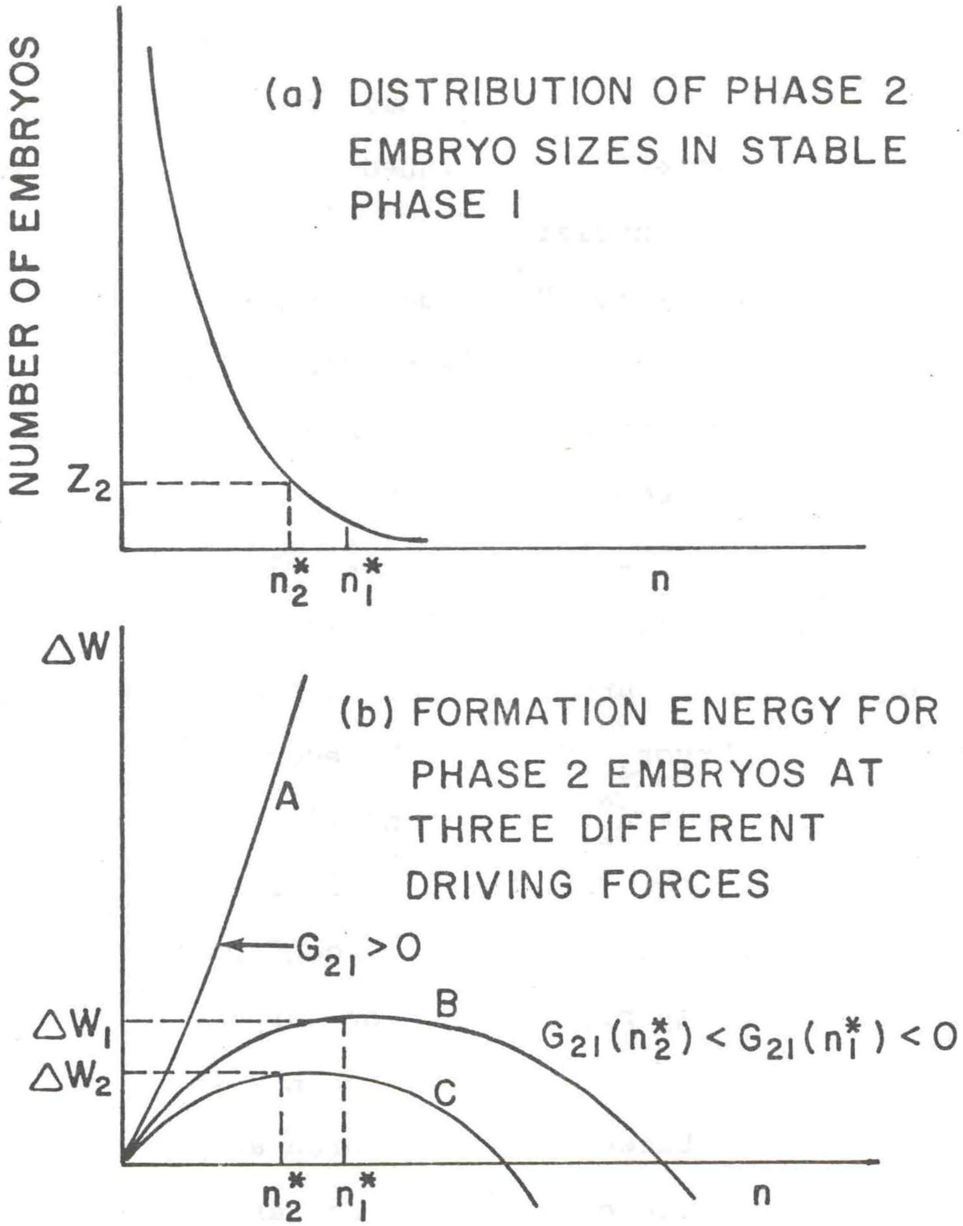

Fig. 5.6.--Spherical embryos in stable phase 1. Curve A is for the stable phase 1 field with $G_2-G_1 = G_{21} > 0$. Curve B is for low pressure sufficient to make the phase 2 field stable with $G_{21}(n_1^*) < 0$. Curve C is for higher pressure, P_2, for which $G_{21}(n_2^*) < G_{21}(n_1^*) < 0$.

sufficient stress, P_1, is applied to make the field for phase 2 stable, G_{21} changes sign and curve B of Fig. 5.6(b) results. For this case, an embryo for which $n < n_1^*$ requires energy to grow; those with $n_1 > n_1^*$ will continue to grow because energy of the system is diminished by growth. Embryos of size $n \gtrless n^*$ are called nuclei.

Increasing stress to P_2 produces energy curve C in Fig. 5.6(b). In this case, the driving force $G_{21}(P_2)$ is more negative than $G_{21}(P_1)$, so energy required to form a stable nuclei of phase 2 is reduced from ΔW_1 to ΔW_2. For curve C a stable nuclei of phase 2 contains n_2^* atoms: $n_2^* < n_1^*$.

If the distribution of embryo sizes given in Fig. 5.6(a) does not change when pressure is increased from zero to P_2, then the number of embryos, N_2, which become stable includes all nuclei for which $n > n_2^*$. This condition applies if the time required to apply the driving force is less than the time required to redistribute embryo sizes to conform to the new state. This should certainly be true for large embryos in a solid where reformation times are large when a shock wave passes.

A relationship between driving force and number of nucleation sites based on these concepts can be derived using nucleation theory. Assume the generally accepted conditions of nucleation, namely, that a number of small clusters of atoms, called embryos, exist; embryos are internally uniform and have the same structure and properties as the final phase in bulk form. These assumptions about embryos leave shape and size as the only variable parameters. A geometrical shape is adopted by