pieces separate from the specimen, and the experiment is terminated. Only one experiment in extension was successful, and, since the jacket ruptured after 13 per cent deformation in this case, the amount of water present could not be determined.

Experiments with interstitial water in compression present no new problems.

During these experiments, a cylinder packing failed, and further experiments had to be restricted to 5000 atmospheres confining pressure. Several comparison runs were made at 5000 atmospheres confining pressure to determine the effect of this single environmental variable at room temperature, 150°C, dry, and with water.

With the exception of the single long-time test, all experiments were performed at the same rate of strain as those in Part I. All Yule marble specimens were cut from the same block as those of Part I.

Results

Figure 1, B shows the average stress-strain curves for Yule marble, dry, at 150°C and 10,000 atmospheres confining pressure. These are to be compared with the similar room-temperature curves (Fig. 1, A) reproduced from Part I. Two things are immediately apparent: (1) the specimens are all considerably weaker at 150°C; (2) the relative strengths in the four orientations are different at 150°C.

These differences suggested that the mechanism of deformation inferred from room-temperature data (Parts I, II, III) might no longer apply. To check this, the method used in Part I, based on analytical data from part II, was tested for its ability to correlate the relative strengths at a given average shear strain (0.1). The results are shown in Table 1. (*See* Part I, p. 860–861, for explanation of method.)

The standard deviation of the calculated from the observed values is 6.1 per cent. The standard deviation of the observed values from their mean is 12.5 per cent. Thus, the degree of correlation obtained is not nearly so good as that at room temperature (Part I, p. 861), and the deviation is considered to be greater than the experimental error. However, the degree of correlation obtained indicates strongly that the mechanism of deformation is basically similar to that at room temperature.

The values of the derived parameters as compared to those at room temperature are:

	Room Temperature	*150°C*
τ_a	840 kg/cm²	575 kg/cm²
τ_b	1470 kg/cm²	810 kg/cm²
$\alpha = \tau_b/\tau_a$	1.75	1.41

where τ_a is the hypothetical average resolved shear stress on those $\{01\bar{1}2\}$ planes with maximum resolved shear stress, in the twinning sense, and τ_b that in the translation sense, as explained in Part I. It is worthy of emphasis that, under the assumptions employed, these are not real shear stresses since resistance to deformation occurs not only on the $\{01\bar{1}2\}$ planes employed in this analysis, but also on others. Nevertheless, it is felt that the differences in these values at room temperature and at 150°C are qualitatively related to the actual difference in the response of the individual crystal grains of the aggregate. This would imply that the shear stress necessary to produce twinning is only slightly reduced by the increased temperature, while the shear stress required to produce translation is reduced much more.

The behavior of single crystals substantiates this deduction. Figure 2 shows preliminary stress-strain curves of calcite single crystals at room temperature and at 150°C in two orientations in each case. Those compressed parallel to the *c* axis are oriented so that twinning on $\{01\bar{1}2\}$ is impossible, and translation is favored. Those compressed normal to the *c* axis are favorably oriented for twinning on one $\{01\bar{1}2\}$ plane, and this is observed to be the predominant mechanism of deformation. The shear stress for twinning is the same at both temperatures within the experimental error at these low stresses. The shear stress in those favorably oriented for translation is reduced three to four times by the increase in temperature. These results are tentative, owing to the difficulty of preparing single crystal specimens without flaws. The heating involved in soldering on the jacket induces some *r* cleavage, due to thermal shock, and the effect of this on the mechanical properties is not known. Experiments to refine these data are planned with jackets which require no heat. This greater

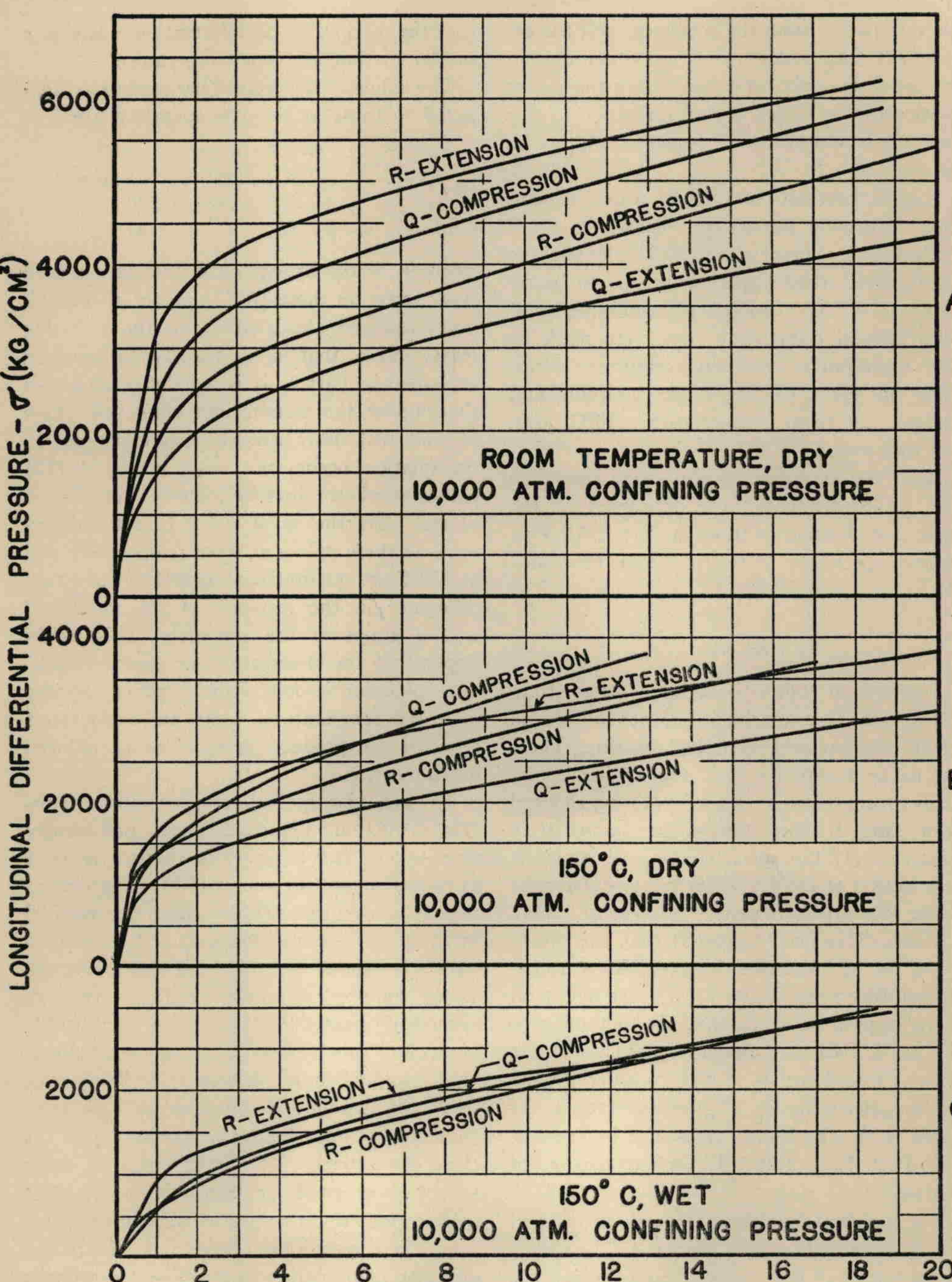

FIGURE 1.—STRESS-STRAIN CURVES OF YULE MARBLE

effect on translation than on twinning is, however, consistent with the interpretation of the marble data.

The effect of water on stress-strain relations is shown in Figure 1, C. The amount of water in the *R* cylinder in extension is unknown, since