gest that slightly higher temperature or pressure will permit large flow without fracture. Some of our experiments in which the differential stress was released prior to the onset of shearing fracture exhibit only evidence of uniform flow. Doubtless there is some microscopic fracturing of the grains, but no evident loss of cohesion. These experiments are the first known to the writers in which plastic flow has been induced in granite.

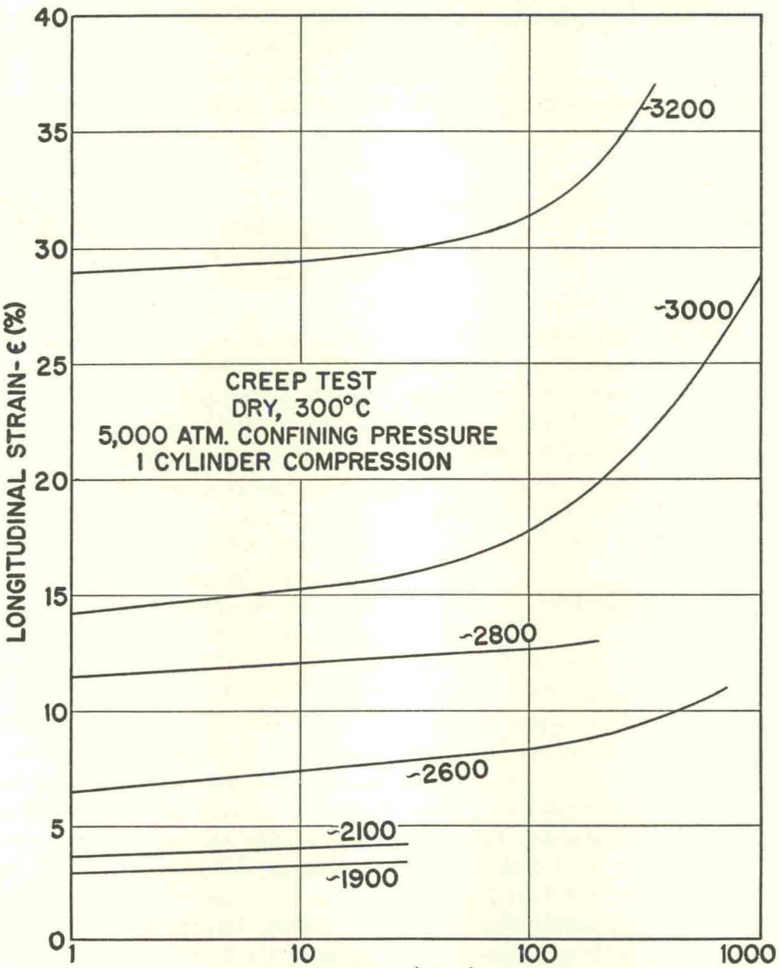

FIGURE 5.—STRAIN VS. LOGARITHM OF TIME—EXPERIMENT 400

Basalt was deformed plastically at 300°C, dry, 5000 atmospheres confining pressure. Under a differential stress of 14,000 kg/cm^2, a specimen was compressed 8 per cent before the removal of the differential stress at the onset of shearing fracture.

A specimen of New Zealand dunite was deformed plastically about 2 per cent at a compressive stress of 9200 kg/cm^2 (300°C, dry, 5000 atmospheres confining pressure). The experiment was terminated by shearing fracture of the dunite. A similar specimen with 3.6 per cent of water broke at 2000 kg/cm^2 compressive stress. It is thought that the water weakened the intergranular bonds so that the specimen gradually disintegrated.

A specimen of Dover Plains dolomite supplied by Dr. E. B. Knopf was deformed plastically

10 per cent under a compressive stress of 7300 kg/cm^2 (300°C, dry, 5000 atmospheres confining pressure). The experiment was terminated by shearing fractures. This result is consistent with the extensive work on dolomite being done by Dr. John Handin at the Shell Laboratories in Houston.

The experiments described in this section were performed by Mr. Hugh Heard and Mr. Norman Coles.

Fabric of Moderately Strained Marble

General Statement

To facilitate comparison with deformed fabrics described in Parts III and IV, our observations have been concentrated on specimens shortened or elongated by about 20 per cent. These are here grouped within the general category "moderately strained marble", as contrasted with the "highly strained" specimen shortened (in creep) by 37 per cent, which is described in a subsequent section.

General Microscopic Character of Fabrics

Even as seen under a hand lens, marble deformed at 300°C has a different appearance from that deformed at lower temperatures: it lacks the chalky appearance of the latter, and the component grains of calcite have a more "glassy" aspect. In fact it begins to resemble some naturally deformed marbles. Under the microscope, cloudiness, internal strain (marked by undulatory extinction and bent lamellae), and marginal fracturing of individual grains are much less conspicuous than in specimens treated at lower temperatures (in Plate 3, *compare* A with C). Consequently even in specimens shortened or elongated by as much as 20 per cent it is possible to determine the orientation of every grain and to identify all visible lamellae and partings on the basis of angular and zonal relationships. Where twinning on $\{01\bar{1}2\}$ is highly developed, the closely spaced lamellae tend to merge locally to give nearly homogeneous, almost completely twinned areas within individual grains; whereas in specimens deformed at lower temperatures grains showing a corresponding degree of twinning are so cloudy, and the twin lamellae so closely packed that it may be impossible to locate optical and crystallographic directions precisely.

As in the specimens deformed at low temperatures, a universal consequence of deformation at 300°C is development of closely spaced visible lamellae in most grains. In this paper we discuss only the preferred orientation of $\{01\bar{1}2\}$ lamellae. Other partings and lamellae are also present in most specimens, notably those parallel to $\{10\bar{1}1\}$ and more rarely to $\{02\bar{2}1\}$ as well as abundantly developed structures irrationally oriented or parallel to high-index planes in the grain lattices. The nature and dynamic significance of all types of lamellae observed in marble deformed over the range 20°C to 300°C are discussed in Part VI (Borg and Turner, 1953).

In all specimens that have been elongated or shortened by 20 per cent or more the pattern of the intergranular surfaces, as shown in any microsection, has been modified by one or some combination of three processes—namely, flattening or elongation of grains, reduction of grain size, and development of subparallel undulating intergranular slip surfaces (*s*-surfaces of the fabric). There is marked correlation between the relative importance of these three effects in a given specimen and the orien-

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Plate 1.—PHOTOMICROGRAPHS OF YULE MARBLE

T sections; polarized light. SS = trace of initial foliation

A. Undeformed marble B. Specimen 295 (*1* cylinder) shortened 19% normal to foliation at 300°C.

Plate 2.—PHOTOMICROGRAPHS OF DEFORMED YULE MARBLE

T sections; polarized light. SS = trace of initial foliation

A. Specimen 365 (*T* cylinder) shortened 20% parallel to foliation, normal to plane of photograph, at 300°C. B. Specimen 358 (*T* cylinder) elongated 20% parallel to foliation, normal to plane of photograph, at 300°C. C. Specimen 272 (*d* cylinder) shortened 19% at 45° to foliation at 300°C. D. Specimen 274 (*d* cylinder) elongated 20% at 45° to foliation at 300°C.