

at the Hugoniot state, most likely provides further evidence for a partially completed phase transformation.

This kind of time dependence has been observed by *Kormer et al.* [1965] in studies on alkali halides, notably with sodium chloride. In these experiments they found anomalies in their shock velocity-particle velocity data, which they suggested were caused by a change in coordination number with a relaxation time approximately equal to the wave transit time across the specimen.

More recently, *Horie and Duvall* [1968] and *Duvall* [1971] have described numerical calculations which predict the wave propagation characteristics of a solid undergoing a rate-dependent phase transformation. Their results indicate that for a constant stress driving force, a propagation time of at least several times the transition time must pass before relaxation effects subside and conditions approximating a steady state two-wave structure occur. *Hayes* [1972] has shown that stress relaxation necessarily occurs at the impact interface and behind the shock wave, if one makes the reasonable assumption that the transformation rate is a function of the thermodynamic states of the constituents and that the shock velocity is constant and propagates along a characteristic. In the present work, stress was not measured immediately at the impact interface; however, it is unlikely that the profile measured at the first gage plane (approximately 1-mm propagation distance in several experiments) differs considerably from the impact interface profile.

The stress propagation characteristics of dolomite appear to be consistent with these earlier studies. Of particular interest is the explanation suggested by *Kormer et al.* [1965] of a change in coordination number in the material undergoing shock compression. In the present carbonate material at a pressure favoring higher coordination number, it is legitimate to raise the possibility that carbon may be assuming a CO<sub>4</sub> tetrahedral coordination similar to the SiO<sub>4</sub> groups in silicates [*Verhoogen et al.*, 1970]. This condition, however, has not been produced experimentally, and the present work provides no evidence for such an occurrence other than that a fairly substantial volume change transition must be occurring to produce the observed wave propagation effects.

Unfortunately, considerable detail in the shock compression process of dolomite is not yet understood. We have no indication of a high-pressure phase boundary. Extrapolation of the high-pressure data to zero pressure, as has been done by other authors, would be of little value in this case, since there is no clear indication of which data correspond to the completely transformed high-density phase. No experiments were performed to recover and isolate the high-density phase.

We do not know with precision at what threshold stress the phase transformation initiates on loading. The shock velocity-particle velocity curve suggests that it may start as low as about 90 kbar. The experiments conducted in the neighborhood of 200 kbar certainly show evidence of partial transformation, and the higher-pressure experiments show evidence of crossing the phase boundary on unloading at about 220 kbar.

Stress relaxation at about 420 kbar implies that the phase transition has not yet reached completion. Why stress relaxation is not observed in the experiments below 300 kbar is not clear. Possibly the relaxation time is a function of the overdriving stress.

Further study of the remaining interesting and extremely important details is required. The present results, however, certainly show an unexpected complexity in the high-pressure shock compression properties of dolomite.

*Acknowledgments.* The authors wish to express appreciation to the staff of Poulter Laboratory for many discussions and considerable assistance. We wish to thank D. B. Larsort of Lawrence Livermore Laboratory for his contribution in several discussions. It is our pleasure to thank T. Ahrens of the California Institute of Technology for critically reviewing the manuscript and suggesting several changes. This work was supported by the U.S. Atomic Energy Commission through the University of California, Lawrence Livermore Laboratory.

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(Received January 27, 1975;  
revised September 11, 1975;  
accepted October 1, 1975.)