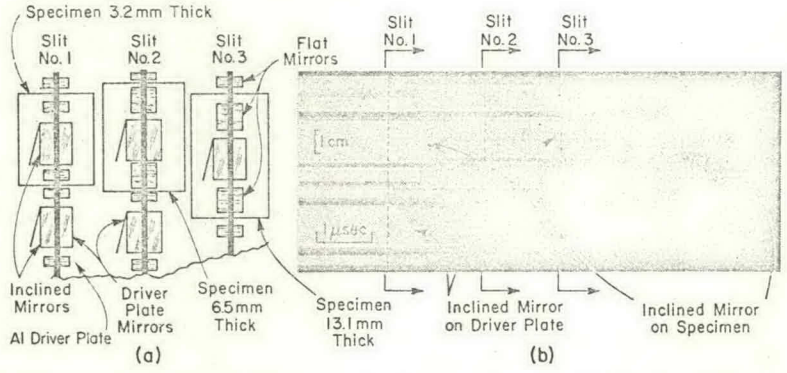


Fig. 1. Plane wave inclined-mirror streak photograph, shot 10,448. (*a*) Arkansas novaculite specimen layout. (*b*) Resulting streak camera record showing elastic and deformational shock wave arrivals. For slit 3, times indicated by t_0, t_1, and t_2 correspond to incident shock arriving at driver-plate free surface, elastic shock arriving at specimen free surface, and deformational shock arriving at specimen free surface. Inclined-mirror cutoff angles γ_1 and γ_2 are used to determine the specimen free-surface velocities imparted by elastic and deformational shocks, respectively.

amplitude with increasing shock propagation distance are observed indirectly in Hugoniot determinations in nonporous rocks and minerals [*Ahrens and Gregson,* 1964]. Strong indications of this phenomenon have been observed in other brittle mediums—single-crystal quartz [*Wackerle,* 1962; *Fowles,* 1961], magnesium oxide [*Ahrens,* 1966], barium titanate [*Doran,* 1962], and single-crystal germanium [*Duvall,* 1963]. It has also been observed in body-centered-cubic metals such as Armco iron [*Taylor and Rice,* 1963].

Experiments

Arkansas novaculite and Sioux and Eureka quartzites were chosen for studying the variation in Hugoniot elastic limit because previous experimentation, some of which was performed before recognition of the stress-relaxation phenomenon, indicated that their elastic limits varied from 50 to 100 kb. Also, the grain size (0.01 mm in Arkansas novaculite, 0.1 mm in Sioux quartzite) is small compared with the shock propagation path lengths.

The variation of the elastic shock amplitude can be observed by (1) varying the amplitude of the final shock state or (2) varying the specimen thickness (shock propagation path length) while holding the final shock state constant. We used approach (2) because the experiments are simpler and data can easily be obtained and compared by observing plane wave propagation with both inclined mir and wedges. The techniques, which are scribed briefly here, are explained in detail *Ahrens and Gregson* [1964].

By using either the inclined-mirror or wedge method we can measure the shock particle velocities associated with the el shock state, U_1 and u_1, and those associated the deformational shock state, U_2 and u_2. Rankine-Hugoniot conservation equations

$$\rho_a(U_b - u_a) = \rho_b(U_b - u_b)$$

$$p_b - p_a = \rho_a(U_b - u_a)(u_b - u_a)$$

relate shock stress p (normal to shock fr density ρ, shock velocity U, and particle locity u across the shock front when the dium is brought from state a to state b. stitution of subscripts 0, 1, and 2 in t equations will refer to the initial zero pre state, the elastic shock state, and the defor tional shock state, respectively.

In the inclined-mirror experiments (Fi 1), specimens having thicknesses varying 3 to 13 mm were mounted on 19-mm-thick aluminum driver plates. Plane shock w nearly flat-topped in pressure profile, were duced in the driver plates by a plane w generator initiating a detonation in a com tion of high-explosive pads consisting of 13 of composition B-3 followed by 51 mm of tol. Flat and inclined mirrors mounted on