Compression data

The results of the present investigation are based primarily on the Hugoniot data from single-crystal α-quartz by Wackerle (1962), covering a range of 0·4–0·7 Mbar, and Al'tshuler *et al.* (1965), from 0·6–2·0 Mbar, and the Hugoniot data for single-crystal α-quartz and pore-free quartzite by Trunin *et al.* (1971), covering a range of 0·4–2·0 Mbar. The Hugoniot data by these investigators as represented in the pressure-density field, are indicated in Fig. 1. In addition, the value for the 'Anderson–Grüneisen' parameter was determined by a least-square fit to experimental values of the Grüneisen ratio as a function of the volume; these data were calculated by Ahrens *et al.* (1970) from porous quartz and fused quartz Hugoniot measurements provided by Jones *et al.* (1968), Shipman (1969) and McQueen (1968). These data are indicated in Fig. 2. The shock-wave compression data considered represents a pressure range of 0·4–2·0 Mbar. A necessary criterion for a satisfactory 'fit' of the selected equation of state is that it provide an adequate representation of the compression of stishovite in the zero to 0·4 Mbar range. Therefore, consistency of the calculated results with

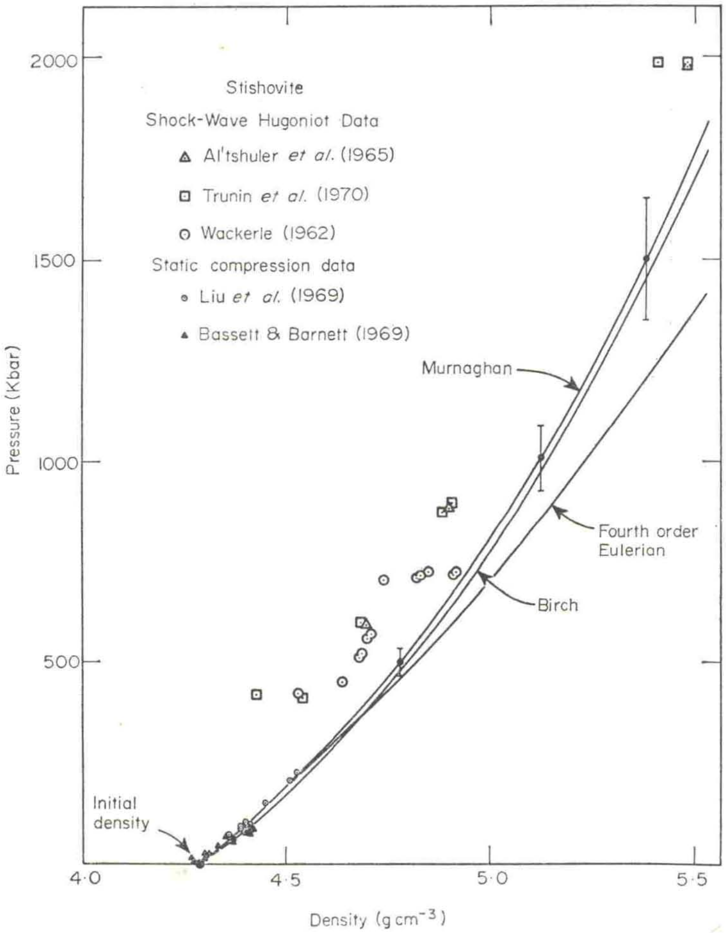

FIG. 1. Pressure-density Hugoniot data for α-quartz and quartzite in the stishovite regime. The calculated isentropes, centred at ambient conditions, are indicated for the present study (Murnaghan), Ahrens *et al.* (1970) (Birch), and Davies (1972) (Fourth-Order Eulerian).

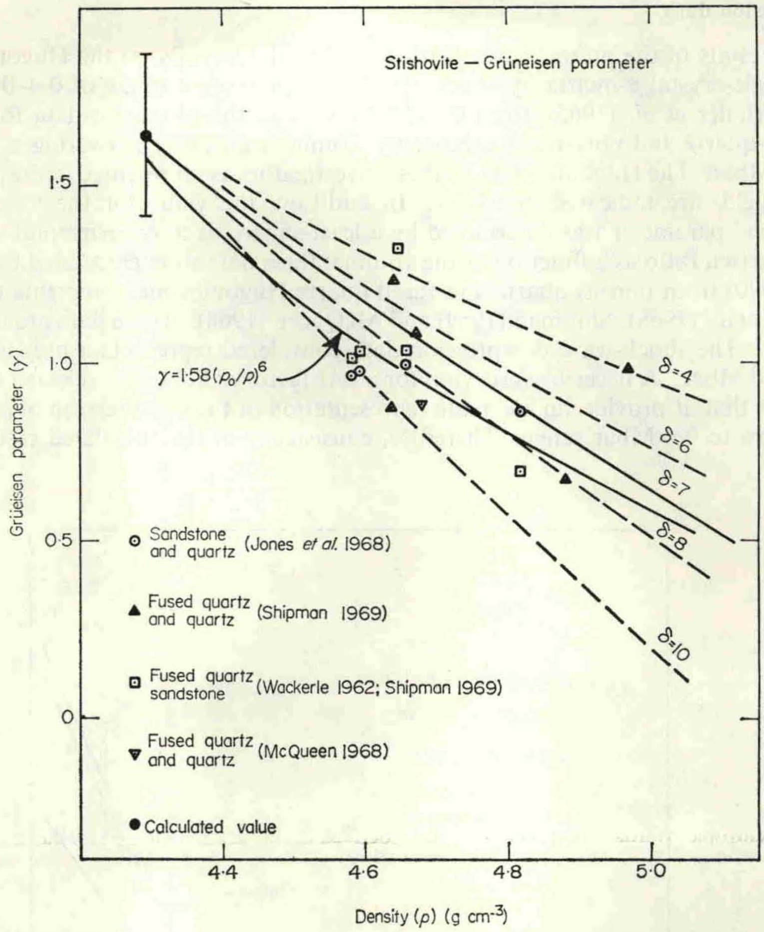

FIG. 2. Grüneisen parameter as a function of density for sandstone, fused-quartz, and α-quartz in the stishovite regime (after Ahrens *et al.* 1970).

the respective elastic properties determined independently from static-compression and ultrasonic measurements provides a means of evaluating the suitability of the equation of state used in the shock-wave analyses.

Isothermal compression measurements for stishovite using X-ray diffraction techniques provide data in the zero to 250 Kbar range. Ida, Syono & Akimoto (1967) measured the effect of pressure to 130 Kbar on the *a* and *c* lattice parameters of stishovite using a tetrahedral-anvil type of apparatus and an NaCl pressure standard. The bulk modulus derived from the data using a quadratic Bridgman equation of state is $7{\cdot}1 \pm 2{\cdot}0$ Mbar. However, it has been pointed out by Bassett & Barnett (1970), that this surprisingly high value and the anomalous behaviour of an increasing *c* axis with pressure observed by Ida *et al.* (1967), could possibly have resulted from an erroneous interpretation of the shift in the (111) reflection. The measurements of Bassett & Barnett (1970) also were carried out in a tetrahedral-anvil press on a synthetic stishovite powder with NaCl as a pressure standard. A fit of the resulting pressure-volume data in the range zero to 85 Kbar yielded a value of $3{\cdot}0 \pm 0{\cdot}3$ Mbar for the bulk modulus. The effect of pressure on the volume of stishovite to almost 250 Kbar has been measured by Liu, Takahashi & Bassett (1969) by means of a diamond anvil high-pressure cell and an NaCl marker. These data have been fit by this