TABLE 1. Final Shock Hugoniot Data for Almandine Garnet

Shot No.	Initial Density, g/cm^3	Thickness, mm	Projectile Velocity, km/sec	Projectile Composition*	Shock Velocity, km/sec	Particle Velocity, km/sec	Pressure, kb	Final Density, g/cm^3	Inferred Phase
A1-1	4.186	4.696	0.90 ±0.01	wp	6.82 ±0.02	0.65 ±0.02	205 ±5	4.586 ±0.029	Garnet(?)
A1-2	4.185	4.694	1.11 ±0.01	wp	7.02 ±0.04	0.81 ±0.01	250 ±6	4.706 ±0.044	Transitional
A1-3	4.180	4.694	1.16 ±0.02	fs	7.13 ±0.04	0.84 ±0.01	262 ±4	4.708 ±0.043	Transitional
A1-5	4.182	4.938	1.11 ±0.01	fs	7.03 ±0.03	0.75 ±0.01	231 ±5	4.662 ±0.032	Transitional
A1-7	4.175	4.831	2.24 ±0.02	wp	8.56 ±0.05	1.61 ±0.02	576 ±10	5.142 ±0.016	Garnet hpp
A1-8	4.184	5.006	1.46 ±0.01	wp	7.37 ±0.04	1.06 ±0.01	337 ±5	4.865 ±0.048	Garnet hpp
A1-9	4.158	4.976	1.32 ±0.01	fs	7.20 ±0.05	0.90 ±0.01	283 ±3	4.725 ±0.043	Transitional
A1-10	4.182	4.702	1.57 ±0.01	wp	7.46 ±0.02	1.14 ±0.01	366 ±7	4.916 ±0.025	Garnet hpp
A1-11	4.181	4.719	1.79 ±0.01	wp	7.74 ±0.04	1.29 ±0.01	435 ±10	4.985 ±0.041	Garnet hpp
A1-14	4.185	4.722	2.03 ±0.01	wp	8.36 ±0.03	1.46 ±0.02	512 ±3	5.071 ±0.015	Garnet hpp
A1-15	4.176	4.628	0.87 ±0.01	al	6.09 ±0.03	0.32 ±0.01	98 ±4	4.371 ±0.029	Garnet
A1-16	4.180	4.862	0.82 ±0.01	al	4.56 ±0.01	0.29 ±0.01	93 ±3	4.350 ±0.019	Garnet
A1-17	4.184	4.834	2.32 ±0.01	wp	8.64 ±0.02	1.67 ±0.01	600 ±5	5.183 ±0.025	Garnet hpp
A1-18	4.186	4.890	2.48 ±0.04	wp	8.86 ±0.03	1.78 ±0.03	663 ±10	5.238 ±0.041	Garnet hpp
A1-19	4.179	4.577	2.50 ±0.02	wp	8.74 ±0.05	1.80 ±0.02	657 ±5	5.263 ±0.017	Garnet hpp
A1-20	4.184	4.552	1.22 ±0.01	al	6.49 ±0.03	0.45 ±0.01	141 ±5	4.466 ±0.031	Garnet
A1-23	4.186	4.655	2.35 ±0.01	wp	8.70 ±0.03	1.69 ±0.02	615 ±7	5.195 ±0.018	Garnet hpp
A1-24	4.186	5.090	2.48 ±0.05	wp	8.81 ±0.04	1.79 ±0.05	656 ±10	5.253 ±0.039	Garnet hpp

*Flyer plate and driver plate composition: wp, polycrystalline tungsten; fs, fansteel [*Ahrens et al.*, 1971]; al, 2024 aluminum.

TABLE 2. Elastic Precursor Data

Shot No.	Initial Density, g/cm^3	Precursor Velocity, km/sec	Particle Velocity,* km/sec	Amplitude, kb	Precursor Density, g/cm^3
A1-1	4.186	8.27	0.33	114	4.360
		±0.02	±0.02	±7	±0.011
A1-2	4.185	8.38	0.22	77	4.298
		±0.04	±0.02	±7	±0.011
A1-3	4.180	8.44	0.28	99	4.323
		±0.03	±0.01	±4	±0.005
A1-5	4.182	8.20	0.20	69	4.287
		±0.03	±0.01	±3	±0.005
A1-8	4.184	8.23	0.31	107	4.348
		±0.02	±0.01	±10	±0.016
A1-9	4.158	8.30	0.29	100	4.308
		±0.04	±0.02	±3	±0.006
A1-10	4.182	8.75	0.19	70	4.274
		±0.03	±0.02	±7	±0.010
A1-11	4.181	8.82	0.38	140	4.369
		±0.03	±0.03	±11	±0.015
A1-15	4.176	9.07	0.15	57	4.246
		±0.04	±0.01	±4	±0.005
A1-16	4.180	8.58	0.24	86	4.300
		±0.01	±0.01	±4	±0.005
A1-20	4.184	8.48	0.18	64	4.275
		±0.03	±0.01	±3	±0.005

*Assumed to be one-half the measured free surface velocities.

EXPERIMENTAL RESULTS

The data for the final Hugoniot high-pressure states are indicated in Table 1 and Figure 4. The total range of data represents about a 25% compression of the initial almandine-garnet over a range 0–650 kb. It is apparent from Figure 4 that three separate regimes of compression characterize the data. These regimes have been interpreted to represent an initial range of compression involving the almandine-garnet phase, a transition range characterized by partial transformation into a high-pressure phase (hpp), and, finally, the intrinsic compression of the shock-induced high-pressure phase (garnet hpp).

Compression of the garnet initial phase occurs along the Hugoniot to approximately 200 kb. Within this regime the shock wave compression states are consistent with the ultrasonic data of *Soga* [1967] obtained on an almandine-garnet of similar composition. The indicated (adiabatic) compression of Soga's sample was calculated by using the Murnaghan and third-order Birch-Murnaghan equations of state. The pertinent parameters for Soga's specimen, $\rho_0 = 4.160$ g/cm^3, $K^s = 1770$ kb, and $(\partial K^s/\partial P)_T = 5.43$, are considered appropriate for comparison with the present data. In addition to the acoustic work, isothermal static compression data were obtained for the garnet measured by Soga by *Takahashi and Liu* [1970] by using a diamond anvil X ray apparatus with a NaCl pressure standard. These data are also consistent with the present results; deviations above 200 kb are considered related to reaction kinetics. Above 200 kb the shock Hugoniot data indicate an abnormally high compression in relation to extrapolations