The new second-degree term is smaller by a factor 3.3 than the former one (23 against 75). This is the direction of change which several theoretical physicists have pointed out was probable. I can see no possibility, however, of reconciling with the present experimental data reduction by a factor as large as 10 or even 100, as has been suggested.

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Compressions to 50,000 kg/cm^2

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THE object of this note is to present a compact summary of the numerical results obtained in series of measurements with new apparatus of the volume decrements of about 40 binary cubic compounds together with a few of the more compressible elements up to pressures of 50,000 kg/cm^2. The detailed paper, to be published presently in the *Proceedings of the American Academy of Arts and Sciences*, will contain, in addition to the material to be expected in such a paper, such as a description of the apparatus and discussion of the methods of calculation and the probable errors, a tabulation of the compressions at pressure intervals of 5000 instead of 10,000 kg/cm^2, and at approximately $-80°C$ in addition to room temperature.

The novel feature of the new apparatus is the more effective external support afforded the pressure vessel, there being now two stages of support instead of one as formerly.[1] This materially increases the life of the vessels, permits the attainment of somewhat higher pressures, and decreases the distortion of the vessel and the error from uncertainty in the distortion.

All results are the mean of two or more independent measurements, which usually did not differ by more than 5 percent. One more significant figure is given in Table I than would be justified by the absolute accuracy; the retention of another figure is demanded if the differences are to be smooth. The method is such that the accuracy is less at the ends of the range; the relative values are probably most accurate in the range from 10,000 to 40,000. The probable error varies with the material. The nine compounds of calcium, strontium and barium are probably the least satisfactory. The compressibility of the sulfides of these is probably too high because of presence of a comparatively large amount of amorphous material, and the selenides and tellurides had a tendency to chemical instability.

The figures given in the table are in cm^3 for a specified number of grams, and are ostensibly fractional changes of the volume at atmospheric pressure and room temperature. The volume decrements listed are for room temperature, which may be taken as 23°. The actual measurements were of volume decrements in cm^3 of a known number of grams. To get the fractional volume changes the observed changes must be multiplied by a factor depending on the atmospheric density. The number of grams listed with each substance is the assumed atmospheric density, in most cases the x-ray density as given in Wyckoff. If better densities are later determined, the figures of Table I may be corrected by simple factors.

[1] P. W. Bridgman, Proc. Am. Acad. Sci. **72**, 207 (1938).

A number of new polymorphic transitions were found. Among the compounds, the order of stability seems to be: ZnS structure, NaCl structure, and CsCl structure. That is, a compound of ZnS structure may be forced by pressure into the NaCl structure, and a NaCl structure into the CsCl structure. No polymorphic transitions have been found among the CsCl structures. All of the compounds given above are cubic except HgS, for which the figures refer to the red hexagonal modification. Measurements were attempted on the black cubic modification of HgS, but were found to be impossible over any extended range because the black modification is irreversibly transformed by pressure into the red. The compressibility of red HgS is about twice as great as that of the black in spite of its smaller volume. Measurements not given in the table were also attempted on HgTe. This is formed from the elements with *increase* of volume, and it was found to be unstable under pressure, slowly decomposing to the elements. Although no good measurements could be made of compression because of the decomposition, nevertheless the decomposition was slow enough to permit an approximate measurement of a transition at 12,800 kg/cm² with an 8.4 percent change of volume.

In general, the curves of compression against pressure are strongly concave toward the pressure axis. The fractional decrease of compressibility with pressure is as a rule greater for those substances with an absolutely large compressibility, but this is by no means universal, and there are a number of cases of crossing of the curves. In particular the rapid decrease of compressibility of sulfur and selenium is to be noted. The curve of the compressibility of selenium against pressure has a sharp break in direction near 34,000 kg/cm², that is, a discontinuity in

TABLE I. *Volume decrements of various binary cubic compounds and of a few of the more compressible elements. The numbers are in cm³ for the specified number of grams.*

PRESSURE KG/CM²	NaCl 2.163 G	NaBr 3.205 G	NaI 3.667 G	KCl 1.988 G	KBr 2.750 G	KI 3.123 G	RbCl 2.849 G	RbBr 3.391 G	RbI 3.591 G	CsCl 4.031 G	CsBr 4.478 G
10,000	0.0365	0.0430	0.0553	0.0478	0.0547	0.0648	[d] 0.1882	[e] 0.1879	[f] 0.1918	0.0479	0.0537
20,000	0.0664	0.0771	0.0974	0.0841	[b] 0.1989	[c] 0.1970	0.2184	0.2207	0.2315	0.0850	0.0949
30,000	0.0919	0.1047	0.1294	[a] 0.2225	0.2267	0.2296	0.2422	0.2462	0.2609	0.1146	0.1274
40,000	0.1130	0.1274	0.1538	0.2419	0.2479	0.2532	0.2612	0.2670	0.2831	0.1387	0.1532
50,000	0.1309	0.1464	0.1728	0.2579	0.2650	0.2715	0.2768	0.2848	0.3009	0.1596	0.1748

PRESSURE KG/CM²	CsI 4.547 G	NH₄Cl 1.536 G	NH₄Br 2.548 G	NH₄I* 2.887 G	AgCl 5.589 G	AgBr 6.548 G	AgI 5.709 G	TlCl 7.029 G	TlBr 7.539 G	TlI 7.435 G	CaS 2.617 G
10,000	0.0647	0.0489	0.0487	0.0590	0.0216	0.0215	[g] 0.1896	0.0383	0.0426	0.0510	0.0240
20,000	0.1120	0.0818	0.0880	0.1019	0.0401	0.0404	0.2095	0.0688	0.0763	0.0891	0.0421
30,000	0.1485	0.1070	0.1203	0.1332	0.0562	0.0584	0.2257	0.0936	0.1026	0.1173	0.0555
40,000	0.1781	0.1278	0.1465	0.1570	0.0704	0.0743	0.2396	0.1139	0.1224	0.1387	0.0658
50,000	0.2025	0.1462	0.1676	0.1775	0.0838	0.0890	0.2525	0.1313	0.1377	0.1554	0.0740

[a] Transition at 20,060 kg/cm². Compressions at transition 0.0847 and 0.1980.
[b] Transition at 18,430 kg/cm². Compressions at transition 0.0886 and 0.1938.
[c] Transition at 18,200 kg/cm². Compressions at transition 0.1049 and 0.1899.
[d] Transition at 5000 kg/cm². Compressions at transition 0.0295 and 0.1701.
[e] Transition at 4600 kg/cm². Compressions at transition 0.0330 and 0.1655.
[f] Transition at 4050 kg/cm². Compressions at transition 0.0349 and 0.1614.
[g] Transition at 3020 kg/cm². Volume decrement at transition 0.1630.
* The figures for NH_4I were extrapolated to atmospheric pressure through the large transition that occurs at 500 kg/cm².

TABLE I (*continued*).

PRESSURE KG/CM²	CaSe 3.837 G	CaTe 4.365 G	SrS 3.935 G	SrSe 4.580 G	SrTe 5.256 G	BaS 4.250 G	BaSe 4.956 G	BaTe 5.168 G	PbS 7.472 G	PbSe 8.220 G	PbTe 8.732 G
10,000	0.0190	0.0210	0.0309	0.0213	0.0269	0.0251	0.0251	0.0293	0.0200	0.0289	0.0255
20,000	0.0345	0.0377	0.0516	0.0380	0.0490	0.0450	0.0449	0.0531	0.0383 [b]	0.0523	0.0469
30,000	0.0482	0.0519	0.0658	0.0525	0.0675	0.0612	0.0610	0.0730	0.0752	0.0711	0.0650
40,000	0.0605	0.0650	0.0754	0.0653	0.0833	0.0747	0.0745	0.0898	0.0885	0.0855 [c]	0.0802 [d]
50,000	0.0718	0.0773	0.0830	0.0775	0.0971	0.0861	0.0882	0.1049 [a]	0.0988	0.1183	0.0998

PRESSURE KG/CM²	ZnS 4.100 G	ZnSe 5.322 G	ZnTe 5.736 G	HgS 8.100 G	HgSe 8.312 G	S 2.070 G	Se 4.875 G	Te 6.316 G	In 7.310 G	Sb 6:684 G	Bi 9.80 G
10,000	0.0123	0.0224	0.0226	0.0427	[g] 0.1152	0.0833	0.0893	0.0458	0.0224	0.0249	0.0278
20,000	0.0231	0.0392	0.0413	0.0682	0.1378	0.1316	0.1490	0.0774	0.0425	0.0465	0.0524 [i]
30,000	0.0328	0.0506 [e]	0.0581	0.0854	0.1555	0.1620	0.1865	0.1018	0.0600	0.0659	0.1565
40,000	0.0414	0.0617	0.0740 [f]	0.0980	0.1692	0.1817	0.2 81	0.1225 [h]	0.0749	0.0829	0.1661 [j]
50,000	0.0495	0.0693	0.0931	0.1085	0.1804	0.1961	0.2265	0.1907	0.0870	0.0986	0.1759

[a] Transition at 50,000 kg/cm². Volume decrement at transition 0.0100+.
[b] Transition at 24,680 kg/cm². Compressions at transition 0.0464 and 0.0663.
[c] Transition at 43,320 kg/cm². Compressions at transition 0.0903 and 0.1067.
[d] Transition at 41,200 kg/cm². Compressions at transition 0.0818 and 0.0912.
[e] Transition at 38,470 kg/cm². Compressions at transition 0.0568 and 0.0607.
[f] Transition at 41,270 kg/cm². Compressions at transition 0.0763 and 0.0812.
[g] Transition at 7650 kg/cm². Compressions at transition 0.0130 and 0.1090.
[h] Transition at 40,130 kg/cm². Compressions at transition 0.1227 and 0.1724.
[i] Transition at 27,570 kg/cm². Compressions at transition 0.0692 and 0.1538. (These figures are smoothed figures for direct passage from I to III. There is an intermediate form II, stable over a narrow range.)
[j] Transition at 40,740 kg/cm². Compressions at transition 0.1676 and 0.1700.

$(\partial^2 v/\partial p^2)_\tau$. This is to be described formally as a "transition of the third kind."

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