

VELOCITY OF SOUND IN FREE AIR.

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In the preparation of data for publication in the International Critical Tables the writer spent a great deal of time in the study of the literature on the question of the velocity of sound in free air. Inasmuch as only a few of the results are to be published in the Tables, it is thought worth while to publish all of the data in the Proceedings of the Indiana Academy, as follows:

Velocity	Authority	Method
332.0	Committee, Academy of Science, Paris ¹ , 1738.....	Flash and sound of cannon
331.2	Committee, Bureau of Longitude, Paris ⁵ , 1822.....	Gun flash and sound
332.25	Moll and Von Beek ¹⁷ , 1823.....	Flash and sound of cannon
333.00	Dulong ⁸ , 1829.....	Variable length organ pipe
332.37	Bravais and Martins (Faulhorn) ⁴ , 1844.....	Reciprocal gun firing. Stations at different levels
331.33	Wertheim ²⁷ , 1844.....	Organ pipes
330.66	Le Roux ¹⁴ , 1862.....	Tubes and chronoscope
331.37	Regnault ¹⁸	Reciprocal gun firing, distance 1280 and 2445 m.
330.71	Regnault, Paris, 1864.....	Air in very large tubes
330.6	Regnault ¹⁸ , 1866.....	Gun and electric chronograph
332.40	Stone (Cape Town) ²² , 1871.....	Bosscha's interferential method
331.57	Szathmari ²³ , 1877.....	Kundt's tubes
331.68	Blakley ³ , 1884.....	Fork and short resonance tubes
331.32	Stevens ²¹ , 1898.....	Gun and chronometer, also electric chronograph
330.7	Frot ¹¹ , 1898.....	Water pipes and manometric capsule
331.36	Violle ²⁵ , 1900.....	Average of weighted results of previous investigators
331.78	Rowland ¹⁹ , 1902.....	Water pipes and manometric capsule
331.15	Violle, Vautier ²⁶ , 1905.....	Telephone transmitters and parabolic reflectors
331.29	Hebb ¹³ , 1905.....	Closed resonator
331.41	Hebb, 1919.....	Kundt's tube, Poulson arc, frequencies up to 800,000
331.92	Thiesen ²⁴ , 1908.....	Kundt's tube
331.0	Dieckmann ⁶ , 1908.....	Guns. Electro acoustic detector
331.9	Schweikert ²⁰ , 1915.....	Artillery. Phonodeik detectors
330.96	Eschlangon ⁹ , 1918.....	Gun and microphones
330.86	Miller, D. C. ¹⁶ , 1918-19.....	Air in tube. Electric chronograph
330.80	Angerer and Ladenburg ² , 1921.....	Thiesen method corrected
328.6	Dixon, Campbell and Parker ⁷ , 1921.....	Steam whistle and chronograph
331.57	Grüneisen and Merkel ¹² , 1921.....	Average of the weighted results of Rowland and last ten observers listed above
332.11	McAdie ¹⁵ , 1922.....	
331.45	Foley ¹⁰ , 1925.....	

The above chronologically arranged table indicates a more or less gradual time decrease in the velocity of sound as experimentally determined. The weighted average of 331.78 meters per second obtained by Rowland in 1902, and of 331.45 by the author of this paper in 1926, would seem to be too discordant to be attributed wholly to experimental errors. The decrease is more strongly suggested by comparing data obtained when the experimenters were using the same, or practically the same, methods. For instance, the

Average of Cannon Flash Methods

1738 to 1828	= 331.95
1848 to 1905	= 331.48
1918 and 1919	= 330.87

In a paper on "A Photographic Method of Finding the Instantaneous Velocity of Spark Waves," (10) the writer cites his own work and that of others who have shown that the velocity of a very loud sound wave at points *very near* the source, and therefore where the molecular displacement is relatively large, is much higher than at points farther removed. The results obtained by Miller in 1918 and 1919 were corrected for this abnormal velocity, which doubtless explains a part of the decrease his results seem to show. It would appear, however, that not all the decrease is so explained, for the results obtained by earlier experimenters were generally over such great distances between the sound source and the observing station that the abnormal velocity near the former would have had little effect on the average over the entire range.

A very slight change in the constitution of the atmosphere, either in the ratio of the nitrogen and oxygen content, or in the CO₂ or other "impurities" present, would explain the decrease.

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