grammar school geography by more than fifty pages, and the necessary limits to the size of such a book are evident. Such matter might, of course, be supplied by the use of supplementary geographical reading, or by the teacher; but, unfortunately, few schools have the access to good libraries which will make the former possible; and few teachers have a sufficient fund of general information to enable them to supply this need.

To use this book, with all its excellent features, as it should be used to reap the full benefit of its contents, calls for a degree of skill and ability on the part of our teachers beyond that of the average instructor; and school superintendents in places which have adopted it will find it no easy task to educate their teachers to this end. But as the book sets before us a higher standard and ideal of geographical teaching than our schools have ever known before, and as it tends to bring them into closer relations with the best scientific work of the day, it deserves a hearty welcome.

T. W. HARRIS,
KEENE, N. H. *Supt. of Schools.*

The Religions of India. By EDWARD W. HOPKINS. Boston, Ginn & Co. 1895. 1 vol., 8vo., pp. 612.

The Teaching of the Vedas; what light does it throw on the Origin and Development of Religion? By MAURICE PHILLIPS. London, 1895. 1 vol. 8vo.

Of these two books, apearing almost simultaneously, the first mentioned is much the more important in scope and scholarship. It is volume I. of the 'Handbooks on the History of Religions,' edited by Dr. Morris Jastrow, Jr., of the University of Pennsylvania, and its author is Professor of Sanscrit in Yale College.

The plan of his work may be briefly stated. He begins with an examination of the date of the oldest Vedas, reaching the conclusion that the bulk of the Rig Veda was composed about a thousand years before the Christian Era. This is a late date to assign it, and we are inclined to believe that the author has been too much influenced by a certain French school who have set themselves to modernize everything ancient by one-sided arguments. A chapter follows devoted to the ethnography of India, illustrated by a map. The leading questions are touched lightly, dates of monuments are not attempted, and the main points averred are the close relationship of the Vedic Aryans to the Iranians, the entrance of the early hordes through the open pass of Herat, and the existence of castes among them before their settlement in India.

Four chapters are assigned to an exposition of the pantheon of the Rig Veda, and one to the religion of the Atharva Veda, which are followed by a careful and clear comparison (Chap. VIII.) of the early Hindu divinities with those of other Aryan and some non-Aryan peoples. From the Vedic epoch the Indian religions rapidly assumed varied forms. Earliest of these was Brahmanism, which is described in three chapters, followed by Jainism, Buddhism, and the numerous early and late sects of Hinduism, with the worship of Vishnu, Siva and the wild polytheism of later centuries. These are depicted in their chief traits and their historic connections pointed out with learning and clearness. The chapter on the religious traits of the present wild tribes is less satisfactory. Their faiths do not seem to be so familiar to the author, or he has less sympathy and less patience with them. The volume closes with a discussion of the probable influence which Indian religion and philosophy exerted on the analogous mental products of the early Semites and Aryans. It is natural that the author, steeped in the lore of Indian thought, should discover traces of it in the teachings of Jew and Greek; but it is likely that many will think he goes too far in deriving so much of the latter from the former.

It is a question of great moment to the historian of religions whether this long period of continued growth—at least three thousand years—developed in India higher conceptions of divinity and duty, a finer spirituality in the votary, a nobler sentiment toward his fellow man.

On this Prof. Hopkins speaks with clear conviction. He believes that tracing back the numerous branches of Hindu sectarianism to the Vedic period, one finds that throughout the long intervening time the direction has been true, and the higher aim 'steadily kept in view.' "Nor can one judge otherwise even when he

stands before so humiliating an exhibition of groundling bigotry as is presented by some of the religious sects of the present day" (p. 472).

In striking contrast to this is the conclusion reached by Mr. Phillips in his volume. In fact, the whole of it seems to be written for the purpose of proving the opposite opinion. He asserts that the farther back we go in the Vedic age, the purer and higher do we find the conceptions of divinity, man, duty, worship, a future state, sacrifice, etc. Hence he avers: "The development of religious thought in India has been uniformly downward—not upward—deterioration and not evolution." He explains this by the theory of a 'primitive divine revelation' granted to the Aryan forefathers, darkened and lost in their descendants. He shows a good reading knowledge of the Vedas in his discussions, but a total ignorance of the methods which now obtain among real scholars in treating the historical growth of religious phenomena. The need of such a work as that of Prof. Hopkins and of the series which it commences, is amply indicated by the appearance of such an essay as that of Mr. Phillips.

D. G. Brinton.

SCIENTIFIC JOURNALS.

THE AMERICAN JOURNAL OF SCIENCE.

The February number of the American Journal of Science opens with an article by A. M. Mayer, giving the results of an extended series of experiments upon the modulus of elasticity of bars of various metals and its variation with change of temperature. This modulus was obtained by transverse vibrations of bars of known dimensions and density. Rods of steel, aluminum, brass, glass and American white pine were employed. These were vibrated longitudinally, held between the thumb and forefinger, and the vibration-frequencies determined by the help of the standard forks of Dr. Koenig's tonometer in Paris. The application of Poisson's formula (shown to hold closely true by special experiments) gave the velocity of sound, and the modulus of elasticity was then calculated from the usual mathematical relation connecting these quantities. Special experiments were employed to give the coefficients of expansion, the densities, etc. The results are contained in an extended table and further represented graphically in a series of plates. These show that the decrease of the modulus of elasticity of glass, aluminum and brass is proportional to the increase of temperature; straight lines referred to coördinates giving the results of experiments on these substances. The five steels, silver and zinc give curves, convex upwards, showing that the modulus decreases more rapidly than the increment of temperature; while bell metal alone gives a curve which is concave upwards; its modulus decreasing less than the increment of temperature. Bell metal was found to be an alloy peculiarly well suited for bells, as the intensity and duration of its vibration were the same at 50° as at 0°; all other substances showing a marked diminution of intensity and duration of sound at 50°.

In a special discussion as to the acoustical properties of aluminum, it is shown that this metal is not peculiarly *sonorous* as ordinarily believed. On the contrary, if a bar of aluminum and a bar of brass having the same length and breadth and giving the same note are struck transversely so that the bars have the same amplitude of vibration, the bars give equal intensity of sounds; but the bar of aluminum from its low density and because of its internal friction will vibrate less than one-third as long as the bar of brass. The peculiarity of aluminum consists in this fact, that its unusually low density (2·7), combined with a modulus of elasticity of only 712×10^6, renders this metal easy to set in vibration; a transverse blow given to a bar of this metal causes it to vibrate with an amplitude of vibration greater than that which the same energy of blow would have given to a similar bar of steel or of brass.

It is true, however, that since aluminum gives, from a comparatively slight blow, a great initial vibration, and since its vibrations last for a short time, this metal is peculiarly well suited for the construction of those musical instruments formed of bars which are sounded by percussion and the duration of whose sounds is not desirable.

On the other hand, there is one serious objection to the use of aluminum in the construction of musical and acoustical instruments, and that