the weather, etc., are treated pleasantly in various chapters; but the chief results of the International Circum-polar Stations are hardly alluded to. In the chapter on theories respecting the origin of the aurora no mention can be found of Lockyer's ingenious meteoric theory. The data given respecting the height of the aurora are likewise far from complete; and in the table on page 71, giving wave-lengths of lines found in the auroral spectrum, only 14 lines are given, which doubtless was the full number in 1882, but which now contrasts strangely with Gyllenskiold's detailed description of 32 lines.

Lemstrom's experiments upon the artificial reproduction of the aurora do not seem to our author to be all that has been claimed for them; and, after noticing Tromholt's unsuccessful attempt with similar apparatus, he gives the experience of M. Vaussenat at the Pic du Midi, who, at an elevation of 2,877 metres, with a network of wire covering an area of 640 square metres, obtained nothing in the way of an artificial aurora. So, like many another explanation of the aurora, this may be laid away for the present as unproven. The true relation of the aurora to magnetic perturbations still remains to be determined. Angot repeats a suggestion which has been made elsewhere, viz.: that many of the difficulties which now present themselves in connection with auroras and magnetic perturbations will disappear if it be understood that, under the one name of aurora, we are now classifying phenomena which may be of very different natures. Let us make one class of auroras embrace those widely extended magnificent displays which are accompanied with magnetic disturbances, and another class those displays which are local in character and more in the nature of manifestations of atmospheric electricity.

There remains little to be said about the relation of sun-spots and auroras, other than that the agreements thus far made out are, it is to be feared, more apparent than real. We seem, indeed, to be but little removed from the military authorities who, at Copenhagen in 1709, during a very brilliant aurora, ordered that the troops be paraded, the drums beaten and arms presented. We are able to do as little. A. M.

Geological Survey of Michigan. L. L. Hubbard, State Geologist. Vol. v., 1881–1893. Part I. Upper Peninsula, 1881–1884. Iron and Copper Regions, by Carl Rominger, pp. 179, 3 plates and a map. Part II. Geology of Lower Michigan, with reference to deep borings. C. E. Wright and A. C. Lane, with an introduction by L. L. Hubbard, pp. 100, plates LXXIII. and a map. Lansing, 1895.

The Geological Survey of Michigan is to be congratulated on finally possessing, as we learn from this report, a house of its own, where its collections can be permanently stored and kept together for reference. There is so much complexity in the geology of the Upper Peninsula, and so much importance attaches to the determination of obscure species of rocks, that a permanent home is indispensable, and the sole regret is that it was not earlier attained. The volume before us resumes, in the same style, the series of Michigan reports that temporarily ceased with the issue of Vol. IV., in 1882. Part I. consists of a manuscript of Dr. Carl Rominger, formerly State Geologist, that was prepared about 1882, and has remained unpublished to date. To properly appreciate Dr. Rominger's paper on the iron districts one must place one's point of view back in 1883 and efface from mind as far as possible the work of Irving, Van Hise and G. H. Williams, the reports of Wadsworth, the reviews of Alex. Winchell and many other minor papers on the petrography and stratigraphy of this difficult

region that have appeared since. The Gogebic district, that has proved the key to the structure of the other ranges, had not yet developed a mine when seen by Dr. Rominger, and in the older ranges the 'soft ores,' now the chief source of supply, were looked upon, when known, with more or less contempt. The paper is a further amplification of the author's previous report and is to be considered in this connection. Its chief value to-day is in its historical bearings and in the fact that it does its author the justice of finally issuing his work. Otherwise, lacking, as it is, in sections, geological maps and illustrations, it forms for a general reader a rather disjointed series of observations.

The chapter on the Keweenaw group of copper-bearing rocks stands much better by itself. The geology of the country is much simpler than in the iron regions, and not much important additional work has been done in the last ten years. The report is brought down to date, also, by recently acquired data. Accurately plotted cross-sections afforded by the deep Tamarack shafts, and by long prospecting drifts in the Calumet and Hecla mine, illustrate admirably the astonishing succession of basaltic eruptions that go to make up the Keweenawan formation. The report furnishes thus an excellent short account of the geology of Keweenaw Point, of the adjacent mainland, and of the copper mines. As such it is to be commended to the general reader. When we read of the extensive prospecting and exploration that have so widely opened up the surface and that have so often been without remuneration, we cannot but regret that we do not better understand the laws of the precipitation and distribution of the copper. Despite Professor Pumpelly's brilliant and suggestive thesis, most observers familiar with the mines feel that the whole story has not yet been told.

Part II. is a very valuable contribution, and more than Part I. brings out that which is new. Dr. Hubbard's introduction is timely. It sets forth the views of Ochsenius on the origin of thick deposits of rock, salt, gypsum and their associates, and places before American readers what is really the only good explanation of their formation. The 'bar theory,' based, as it is, on true chemical principles and necessary geological relations, lays us under obligations to Ochsenius that are no less important in their scientific than in their economic relations. As applied to petroleum, however, there is little in the geology of our serious oil regions, so far as yet opened up, that indicates any notable connection between the 'mother liquors' of an evaporating estuary and these stored up reservoirs of hydrocarbons. The main part of the paper consists of Dr. Lane's revision and elaboration of notes which were mostly accumulated by the late State Geologist, Charles E. Wright, whose untimely death removed a vigorous worker in the midst of his career. The records of the wells sunk for brines or in the search for oil and gas have afforded a vast amount of valuable information about the stratigraphy of the Lower Peninsula. These have been elaborated by Dr. Lane in a very admirable way. After a brief introduction regarding the gaps in the record, and the errors that creep into observations of this character, a review is given of the stratigraphy of this portion of the State, which is to be commended to any reader who desires a brief account of the thickness and arrangement of the formations. The records are then plotted in numerous diagrams, from which sections are assembled that cross the geosyncline in five or six different places. A descriptive text accompanies the sections, arranged by towns in alphabetical order. The report cannot fail to be of equal interest to scientific men and to those who are engaged in the rapidly growing industries

based on brines and gypsum. Whether an oil field lies under the surface is a question which only the explorations of the future can solve. J. F. Kemp.

Veröffentlichungen aus dem Königlichen Museum für Völkerkunde. Berlin. 1895.

The above named publication by the Museum of Ethnography in Berlin appears quarterly in large folio form, and consists of special studies by experts in some of the lines of anthropologic science.

The last number, Band IV., Heft 1., deserves separate mention for the valuable contributions it contains to American archæology. It presents three articles, each of which is a model in its way.

The first is a descriptive catalogue of a collection of idols, fetishes and priestly ceremonial objects from Zuñi, collected and explained by Mr. Frank Hamilton Cushing, and now deposited in the Berlin museum. It is illustrated with 26 drawings inserted in the text, and the purposes of the objects with their mythological associations are accurately set forth.

The second article is by Dr. Carl Sapper, on 'Ancient Indian Settlements in Guatemala and Chiapas.' It is accompanied by a most useful map of Chiapas, Tabasco, Guatemala and part of Honduras, giving the locations of the ancient native towns, caves containing remains, rock-drawings and localities deserving further investigations. To this are appended 20 plans of ancient ruined cities within the area mapped, a number of them entirely new, others more accurately drawn than in previous publications. Among them may be mentioned the famous Iximche, the capital of the Cakchiquels; Sacabajá, a city of the Quiches; Los Cuyes in the department of Huehùetenango; the rock-inscriptions of Zacualpa in Chiapas, and others. This archæological study will be of great use to future investigators.

The third article is an interesting study, by the eminent Americanist, Dr. Carl Seler, of a series of vases and similar objects brought by Dr. Sapper from Guatemala. It is illustrated by 104 drawings inserted in the text, and the subject is elucidated by the thorough acquaintance with the literature of the conquest which the author always has at command. A number of these vases are decorated with hieroglyphs of the form characteristic of the Mayan tribes. Some of these the author identifies with others in the manuscripts and sculptures, and suggests explanations for them. He is inclined to believe that such inscriptions indicate that the vases were manufactured elsewhere than where they were found; an opinion which will not hold, in view of the large number of sherds bearing glyphs obtained from the southern Mayan territory. This essay is a most important contribution to the study of the Mayan hieroglyphs.

D. G. Brinton.

SOCIETIES AND ACADEMIES.

THE ASTRONOMICAL AND PHYSICAL SOCIETY OF TORONTO.

At a meeting on June 11th the following notes on mass and temperature in the solar system were read by Mr. A. Elvins:

I have long thought that a relation exists between the masses of the heavenly bodies and their temperatures, the heat rising as the mass increases. Mercury is too near the Sun to be observed with much chance of success. Venus is somewhat better situated, but its brilliancy is so great that it is a difficult object to observe; its atmosphere, however, often shows dark patches, which I think may be openings through the general mass of clouds which seem to envelope the planet, reflecting light from their outer surface. Like the earth, I think it has polar caps of snow; I have seen a bright spot at the north pole on several occasions during the past fortnight, and similar observations have been previously