

isations. The last year's work covered 519 miles of the Red River from its confluence with the Mississippi. Few burial places were found in Louisiana, as these were mainly in the often flooded level ground, and the artificial mounds were erected for places of residence; since most of the finds are obtained from graves the spoil was not very large, and as many of the mounds are now utilised they could not be satisfactorily investigated.

Along the Red River in Arkansas the conditions in the main are different; mounds containing burials, some of them richly endowed with artifacts, are fairly abundant, and further northward the lavish use of pottery with burials has often been described. It seems probable that the Arkansas mound burials were those of people of consequence. The pottery of Arkansas is as a rule tempered with fine gravel or sand, or with small bits of pottery, though kitchen vessels are often shell-tempered. The ware is thin and carefully modelled. There are few unusual shapes, grotesque or life forms were very rarely attempted, though they occur in the region to the north. Many vessels bear a high polish, and nearly all have incised designs filled in with red or white pigment. Circles, often series of concentric circles (probably sun-symbols), form a frequently recurring design. Decoration in polychrome was very exceptional, though common



FIG. 1.

more to the north. A remarkable feature—indeed, it is unique—in connection with some of the mounds is the depth of the grave-pits; one reached 15.5 ft. in depth. Among several interesting pipes, two types have not been met with hitherto. One form, from Haley Place, is of earthenware, the truncate conical bowl of which occurs at some distance from the end, the terminal continuation of the stem being hollow; one is nearly 23 in. long. The other, from Gahagan, is moulded to represent a kneeling man; there is a communication between the bowl and the open mouth of the figure, so that smoke can be made to emerge from it when the pipe is in use (Fig. 1). A number of beautiful useful and ceremonial stone implements were found, and various interesting pendants, some of which have the form of a lizard; one was formerly coated with sheet copper, as were also the large circular ear-plugs of limestone. It is, however, impossible to point out all the items of interest in this memoir.

Dr. Hrdlička adds a notice on the human remains. He says the skeletons from Haley Place and the McClure mounds probably may be safely ascribed to an extension of the Natchez people; the skulls exhibited deformation of the "Flathead" variety.

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MAGNETIC STORMS AND SOLAR PHENOMENA.¹

IN the publication referred to below only the first thesis is printed. It deals with the relations between magnetic storms and solar phenomena. The thesis shows the nimbleness of mind one hopes to see in those who have taken high mathematical degrees at Cambridge, accompanied by a knowledge of terrestrial magnetism most unusual in British seats of learning. There are, it is true, researches bearing on the subjects investigated of which the author seems unaware, but his knowledge of foreign writings, including theoretical work by Kelvin, Larmor, Birkeland, Störmer, and Schuster, and observational work by Walker, Airy, Ellis, Maunder, Hale, and many others, is highly commendable. Also the attitude he adopts towards the work he criticises is generally philosophical. Thus, taking Kelvin's attempted demonstration that solar action cannot be the proximate cause of magnetic storms, Bosler points out that there are possibilities not considered by Kelvin making much smaller demands on the sun's stores of energy, and that in the light of modern knowledge no one can say what is a reasonable limit to solar expenditure. On the other hand, he recognises that Kelvin's work directed attention to a point apt to be overlooked.

Dr. Bosler regards his countryman Marchand (1887) as the first to claim a connection between the occurrence of magnetic storms and the presence of individual sun-spots or faculæ near the sun's central meridian, but he regards Maunder's observations on the recurrence of storms in the solar rotation period as the strongest evidence yet advanced in favour of this view. He seems to be unaware of Broun's early work. He apparently accepts Sabine's deduction of an eleven-year period—corresponding to the solar period—in magnetic disturbances, but while recognising the strength of the evidence adduced—especially that of Maunder—in favour of solar jet theories, he considers Dr. Schuster to have demonstrated the impossibility of swarms of any kind of electrified particles sticking together all the way from the sun to the earth. The view he inclines to is that earth currents are the immediate cause of most, if not all, magnetic disturbances. The evidence he advances in favour of this view is derived from comparisons of records of magnetic storms at Parc St. Maur and Greenwich—especially those known as "sudden commencements"—with corresponding records of earth currents. This from an observational point of view is probably the most important part of the thesis, though only partly novel.

The author thinks earth currents may be produced by movements of electrified matter—associated with protuberances, spots, or faculæ—on the sun. Taking the case of a cable of 0.25 cm.² section, made of copper of resistivity 1600, enclosing a circle 8000 km. in perimeter, he calculates that the current induced in the cable by a magnetic field of amplitude 10γ and period 10 sec., normal to the plane of the circle, would at a distance of one metre from the wire produce an alternating magnetic field of amplitude 1250γ. This is adduced as an illustration of how a small field originating in the sun might be amplified on the earth. The idea may be worth considering, but the problem treated seems somewhat too remote from actuality. The magnetician will find a variety of other interesting matter in the thesis.

C. CHREE.

¹ "Thèses présentées à la Faculté des Sciences de Paris pour obtenir le grade de Docteur en Sciences Mathématiques." By M. J. Bosler. Pp. 96. (Paris : Gauthier-Villars, 1912.)