painted on the blackboard, and, to show territorial changes, filled in with colored crayons. This method has the great advantage of growing before the class, changing with the history. But it is wanting in cleanness and accuracy, requires much disagreeable labor, and involves destroying the boundaries of the one period before putting on those of the next; so that the eye cannot compare the two stages.

Accompanying this device, I have used that for the pupils which you suggest; i.e., small uncolored outline-maps, to be filled in for successive epochs by the student himself. My class in medieval history last year was required to make eighteen of these. To get the outline-maps, we have copies made by the hektograph process. Tracing-paper can be used to get the first copy, thus bringing this scheme within the reach of every teacher.

We also use your scheme involving a series of wall-maps for successive epochs. With other teachers I have often felt the need of cheap printed outline-maps, to be filled up in the course of the work. In lieu of such outline-maps, we have gotten along pretty well by the use of white holland, which is sufficiently translucent to be used like tracing-cloth; so that the labor of carefully drawing the map has to be performed but once. This material we buy in quantities, so that it costs but twelve cents and a half per yard. To secure the requisite width, two or more pieces can be sewed together. Being strong to resist wear and tear, for maps it is about the most satisfactory material with which I am acquainted.

But the best device, by all odds, which we have yet hit upon, is a system of ground-maps with superposable fractional maps. The original map we mount on a soft pine back, and indicate every change by overlaying it with fractional maps corresponding in natural features to the original, but colored in such manner as to show the altered political relations. Thus, having a map of Italy divided and colored to show its political condition before 1859, — with Sardinia and Piedmont red, Austrian territory yellow, Parma orange, Modena gray, Papal States brown, Tuscany olive, and Naples purple, — we tell the story of Magenta and Solferina; then lay over yellow Lombardy a red Lombardy, to show its acquisition by Sardinia; and a green Savoy and Nice over the red Savoy and Nice, to show how France exacted them as the price of her assistance. Then, on Victor Emanuel's acceptance of the offered sovereignty of Parma, Modena, Bologna, and Tuscany, a red patch is tacked over these districts. So a red Sicily and a red Naples are laid on when Garibaldi's work is done. A red Ancona and Umbria finish the work for 1860. In 1866 Venetia is covered with red; and in 1870, the remainder of papal territory.

During the year we have worked out sets for the territorial history of France from 1550 to 1870, of Prussia from 1400 to 1866, of the Ottoman empire from 1680 to 1886, of western Europe from 395 to 888, etc. From no other plan have we obtained results at all comparable with those of this year.

The advantages of this device are apparent. It is superior to the series of maps, because, 1°, it changes with history; 2°, a more definite concept of the changed territory is obtained when it can be taken off and handled as a piece of cloth; 3°, the student can be set to work out the changes for himself, — to build up or take to pieces the map; and, 4°, it is less expensive, involving but one or two full-sized maps. It is superior to the blackboard scheme, because, 1°, it is clearer; 2°, it is more accurate; 3°, it is easier to reproduce, and so not too difficult for the student and the overworked teacher; and, 4°, it preserves both the original condition of things and the changed order, each of which can be reproduced in turn, and thus the exact nature and extent of the change can be clearly and definitely seen.

Incidentally, the use of a soft-wood back has suggested several little devices which we find quite helpful. For battles we use a bright red spear-head of stiff cloth fastened with sealing-wax to the head of a needle. These, being removable, are placed on the map just where events call for them; can be made large enough to show across any room without permanently disfiguring the map; do not crowd regions like the Netherlands, where many battles have been fought, till the confusion is hopeless; and, finally, furnish, in putting them on, a useful exercise for the student. Similarly, we use a yellow star on a black circle for treaties of peace, and lines of colored braid to follow expeditions, such as Alexander's or the crusades. Doubtless other expedients of the same nature will suggest themselves.

F. M. TAYLOR.

Albion, Mich., May 28.

Some Ojibwa and Dakota practices.

Science (vol. iii. No. 57) records on p. 298 the discovery of human bones suggesting cannibalism in a cave near the village of Holzon Brunswick, reported to the Berlin anthropological society by Professor Nehring. "It is the first evidence discovered," says the author, "that a race of anthropophagi ever existed in Germany. The bones were not fully calcined, and had evidently been chopped to obtain the marrow. As a still greater proof of cannibalism, it was shown that the bones were thrown in a heap, as if cleared after a meal. . . . In the subsequent discussion Professor Virchow raised some objections to the cannibal theory."

A case like the one in question might sometimes, probably, be referable to exceptional cannibalism; that is, to an act of cannibalism committed under extraordinary conditions, by a race not commonly addicted to the vice, and even in general, perhaps, abhorring it. In solving problems of this sort, it becomes a pertinent inquiry, how savage man of the historic period actually 'takes his meals,' if such they may be called, and whether or not he practises disposing of the residuum of his food in the orderly manner indicated above.

An instance of man-eating, with its attendant circumstances, occurring among the wild Ojibwas of Lake Pokegema, Minnesota, is cited below. It is put on record in this place for the purpose of illustrating exceptional cannibalism in non-cannibal tribes, and of showing how, half a century ago, Algonkins and Dakotas still inhabiting the northwest were accustomed to hew in pieces, distribute, and leave to be gnawed by animals, the slaughtered bodies of their enemies. The given facts, furthermore, emphasize the possible co-existence, in the same aboriginal community, of two widely differing grades of civilization, particularly in the case of savages just emerging from barbarism in virtue of their association with enlightened races.

It should be stated that this paper has been prepared from verbal and written material kindly

furnished the writer by Mrs. Elizabeth Taylor Ayer, a missionary lady who was a keenly interested participant in most of the events reported. Among the early writers of Minnesota, fragments of the same narrative occur, presenting, however, different phases of this history, and altogether lacking the element of continuity.

The Ojibwa band of aborigines settled about Lake Pokegema, in what is now Pine county, Minn., included in 1841 two Ojibwa braves, — one named We-*zhai*-ma; the other called by the missionaries stationed at that point Julius Caesar, both on account of his distinguished bearing, and his prowess in battle.

Some time in May, 1841, these two Indians were despatched down the St. Croix valley to St. Croix Falls for needful supplies. Upon reaching their destination, they learned that their hereditary enemies, the Sioux or Dakotas, were about to attack the Pokegema Ojibwas, when, leaving their supplies behind them, they hastened homeward to give warning of the impending danger.

During the return journey, they encountered the war-party in question, under circumstances which rendered advance and retreat alike dangerous. Without a moment's hesitation, the young Ojibwas fired upon the hostile party, Julius Caesar killing one of the leaders of the expedition: the two then parted from each other, and, in accordance with Indian tactics, fled in opposite directions.

The foe pressed hotly upon Julius. He threw his gun lightly over one shoulder, and, with a backward half-aim, shot dead a second Sioux warrior, who proved to be a brother of the first. These two Sioux braves were sons of Little Crow, senior, a prominent and influential chief of the Kapota band of Dakotas, at that time settled within a few miles of the present site of the city of St. Paul.

Julius himself immediately fell. His body was dismembered. His limbs were literally hewed in pieces and scattered to the four winds. His head was scalped, detached from the trunk, placed in a kettle with fragments of his person, adjusted with the face turned toward the bodies of his victims seated near, and left dangling from the bough of a convenient tree. A friendly party eventually discovered and identified the mutilated remains, and conveyed intelligence of the disaster to the families of the young men at Lake Pokegema. No traces of We-*zhai*-ma's body could be found, but, as he had completely disappeared, it was believed that he likewise had perished at the hand of the enemy.

The Pokegema Indians apprehended further hostilities in the immediate future. The better to guard against surprise, such of them as were dwelling upon the mainland abandoned their places, and took refuge with friends upon a small island near the centre of the lake. The sole approach to this spot being by water, the Pokegemas withdrew their canoes at night from the outer shore, and secured them against capture upon the island. The women had at the proper season planted potatoes, maize, and other vegetables upon the mainland in large open fields which they called gardens. These they cultivated during the day, returning to their island lodges by boat at nightfall.

Three runners were soon despatched from Lake Pokegema to acquaint friends at Mille Lacs with the fate and supposed fate of Julius and We-*zhai*-ma. Early upon the morning chosen for their departure, they were set across the lake to the west, in canoes, by two young girls of the band, who accompanied them for the purpose of returning the boats used to their owners at the island. A hostile force of Sioux warriors had meanwhile succeeded in penetrating secretly to Pokegema, and these were now ambushed in two bodies upon the eastern and the western edges of the lake. The larger division, of one hundred fighting men, was posted upon the eastern shore, in the rear of the gardens, and was expected to make the main attack upon the Ojibwas. The western party, of thirty, comprising men and some women and boys, was so stationed as to prevent the Ojibwas from retreating across the lake during battle. The latter force had been strictly charged to make no sign until firing should be heard from the eastern shore.

One or two of the Sioux hotheads, however, could not withstand the temptation to fire upon the canoes as they reached the beach. The Ojibwa runners promptly returned the fire, and made for the shore. They finally escaped their opponents by plunging into the forest, though all were more or less wounded.

The two Indian maidens were small creatures of only about twelve years, being pupils at the mission-school. These girls sprang out of the canoes, and in their terror waded from the shore into the shallow waters of the lake. They were pursued and captured by the Sioux party. The men, dragging them to land, butchered them upon the spot, their dying shrieks ringing in the ears of the distracted parents at the island. They were scalped, their heads were cut off, a hatchet was sunk in the brain of each, their bodies were mutilated, and the heads were set up in mockery in the sands of the shore.

In brief, the Sioux party lost two men killed outright, and one mortally wounded. So assured of success in this expedition were they, that they had brought with them a certain number of boys and women to aid in carrying away their anticipated spoils. In finally quitting the field, they possessed themselves of a boat owned by the missionaries, and, depositing their slain within it, moved two or three miles up Snake River, where they landed. Here they arrayed the dead in the best they could procure, and left them seated in an upright position against the trunks of trees.

Two days after the fight, certain of the wild Pokegemas ascended the river in search of the dead bodies of the enemy, which they found arranged as described, and which they proceeded to hew in pieces, and convey to the island for distribution among the members of their band. All those who had lost a relative at the hand of a Sioux were to be supplied with a portion of a Sioux body, those recently bereaved being the first to be served.

The mother of one of the slaughtered girls was a pagan. She received as her allotment the head of a Sioux warrior. The mother and the wife of Julius, who were no longer wild Indians, had appropriated to them an arm each. The savage mother, frantic with grief and rage, repeatedly dashed the head vengefully among the stones, and tossed and spurned it with her foot along the sands until weary, eventually leaving it to be eaten by the dogs, and to moulder away among the refuse of the village. On the other hand, the mother and wife of Julius accepted in silence the customary mementos of victory, and withdrew with them to their lodge. Here the two bereaved women took the dissevered limbs upon their

laps, swathed them carefully in wrappings of cloth selected by the mother from her most valued treasures, repeated above them a short prayer, and, stealing out unobserved, dug a suitable pit and buried them in it.

The night after the return of the Pokegemas with the Sioux bodies, they treated themselves to a great feast at the island, which culminated in the usual hideous orgies. From this banquet the better class of the band absented themselves. Sioux flesh was at this time boiled and eaten with wild rice. Mrs. Ayer, testifying absolutely to this latter point, adds, that the given instance of cannibalism is the only one coming to her personal knowledge during the whole period of her connection with the wild Ojibwas, something more than twenty years.

We-*zhai*-ma, who had been mourned as a victim of the Sioux, re appeared after the attack on Lake Pokegema. He had managed to elude pursuit while the enemy were busied with their captive, and had finally succeeded in effecting escape. When he eventually resumed his return, it was by a circuitous route which materially delayed his arrival at home.

The events here detailed sealed the fate of the Pokegemas as an independent band. Constant dread of Sioux incursions caused these people to abandon their hunting and fishing grounds at the lake, and betake themselves to regions less accessible to the foe. They melted away from Pokegema as if by magic, withdrawing singly and in groups, and retiring for the most part to the north and north-west; many of them fleeing to Mille Lacs and Lake Superior. Within a very short time they were wholly absorbed in cognate branches of the great Ojibwa tribe, presenting a case of the complete disintegration of an aboriginal community without corresponding loss.

FRANC E. BABBITT.

Coldwater, Mich., June 4.

The agricultural experiment-station of New Jersey.

For a state so peculiarly located with reference to market facilities as New Jersey, and containing, withal, such large areas of unproductive soil, it would seem most appropriate that the study of artificial sources of soil-fertility should constitute, as it does in that state, the primary work of the state agricultural experiment-station.

There are certain features of the work of this New Jersey station, as detailed in its recent reports, to which I wish briefly to direct attention. One of these is, that, with but trifling exceptions, the entire resources of the station are directed to the solution of the chosen problem, and that no attempt is made to skim over the limitless field of agricultural research.

Another notable feature is that the field and feeding experiments, all of which bear directly or indirectly upon the central problem under investigation, are conducted upon the parallel lines of laboratory analysis accompanied by field or stable tests; the fact having apparently been recognized that the chemist's analysis alone is not a sufficient criterion upon which to base an estimate of the agricultural value of a fertilizer or feeding-stuff, although an essential factor in forming that estimate.

A third conspicuous feature of the work of this station is the absence of that class of experiments which can justly be styled 'empirical.' The field-experiments especially are co-ordinated upon a thoroughly scientific plan, and constitute a form of research which requires for its successful prosecution as high a degree of scientific ability as is ever called for in the chemist's or physiologist's laboratory.

The institution of duplicate experiments on farms in various parts of the state is another commendable feature of this station's work, in that it not only brings under observation the effects of differences in soil and climate, but is educating a number of farmers in the methods of accurate experimentation.

No doubt there are many citizens of New Jersey who feel that their special interests are being neglected by the state experiment station; but I believe that the station is doing wisely in confining its work to such questions of primary importance as may be thoroughly handled. To do a definite work well is far better than to skim over a larger field, especially in science, where half-truths are so liable to be whole errors; and I believe that its present course will the sooner bring to this station the means for enlarging its field of useful work.

C. E. THORNE.

Penetrating-power of arrows.

Some time since, I noticed a letter in *Science* asking for information in regard to the penetrating-force of the arrow.

I have in my possession the sixth dorsal vertebra of a buffalo, the spine of which contains an iron arrow-point. The arrow struck the spine about two inches above the centre of the spinal canal, and penetrated the bone .82 of an inch. The bone at the point struck is .55 of an inch thick, and the point of the arrow protrudes beyond the bone .27 of an inch. The arrow was shot from the right side of the animal, and the plane of the point was horizontal. The animal was mature, and the bones well ossified. Though the vertebra has been much weathered, the epiphyses adhere closely. The animal was not as large as some individuals. The whole vertical length of the vertebra is thirteen inches.

The arrow must have penetrated several inches of flesh before striking the bone. OLIVER MARCY.

North-western university,
Evanston, Ill., May 31.

Spectrum of comet c. 1886.

Comet c. 1886 presents to telescopic vision a rather bright oval of light, with an ill-defined nucleus in the north preceding quadrant. Although a faint object, it was so temptingly situated for observation, that, rather out of curiosity, the telescope, already employed in faint spectroscopic work, was directed upon it. The method of observation, while adapted to use very faint light, is yet supplied with checks against optical illusion. Observations were obtained on May 26, 28, and June 4. They afford five loci of light, agreeing fairly in position with the five series of lines in the low-temperature spectrum of carbo-hydrogen, and afford a strong suspicion of other loci, two of which lie near strong lines in the low-temperature spectrum of oxygen, and others to the low-temperature spectrum of carbo-oxygen. The spectra given in micrometric gaseous spectra by Piazzi Smyth have in each case been used as reference.

O. T. S.

New Haven, Conn., June 8.