

interior of North-East California and the adjacent parts of Oregon, being covered in the interval by Tertiary volcanic products. The plain is cut on to the Chico series and older rocks, and there rest on it the Ione formation, probably equivalent to the auriferous gravels, the Tuscan tuff, and the Red Bluff Pleistocene beds. It is noteworthy that the plant remains in the oldest of these rocks are of low altitude and not mountain types. There was evidently much movement in post-Chico time, then came erosion during the Eocene, and finally new movement with some warping and deformation. As the Eocene base-level was perfected erosion became much slacker, and was chiefly effected by solution, so that there was left much insoluble and dense material, including quartz and gold, ready to be deposited in the auriferous gravel when the next movement supervened, making the slopes steeper and giving the streams fresh impetus.

Returning now to the east, we have a lengthy account, by Mr. W. J. McGee, of the Lafayette Formation.¹ This writer has shown a remarkable adaptability in suiting his style to his subject, as he expresses it in the following sentence: "The history of development of the eastern land is recorded in nature in characters so grand that but a small part of a single one may be seen at once, so that the direct reading is difficult." The Coastal Plain of the United States is based on Cretaceous rocks, which are covered by the following rocks in order, the first having an uncomformable base: the Lignitic beds, the Claiborne and Meridian deposits, the Vicksburg-Jackson or White Limestone, the Grand Gulf beds, the Lafayette formation, and the Columbia beds. From this succession the author makes out the chief oscillations and changes in physical geography undergone by the Atlantic slope and the Mississippi embayment. The age of the formation we are left to judge from the following enigmatical sentence. "If the Cenozoic be not made to include the Pleistocene, and if the age be then divided into equal portions called Eocene and Neocene, and if then the Neocene be divided into ten equal parts, the Lafayette period may be supposed to correspond with the eighth or, perhaps, with the seventh or the ninth of these parts." The work closes with an account of the material resources of the formation, soils, siliceous clays, gravel, and iron, followed by the history of events recorded in the rocks. Mr. McGee illustrates his paper with some excellent maps, and also contributes to the fourteenth Annual Report a geological map of the whole of the United States at present surveyed.

W. W. W.

THE GAME FIELDS OF THE EASTERN TRANSVAAL.²

IN proceeding into the interior of Africa from almost any point on the eastern coast, the traveller passes over a low coastal plain to the foot of the scarp of a high plateau. This plateau is succeeded to the west by a still higher one, which is gained either by a second steep ascent or by a gradual slope. The existing river valleys and former earth-movements have in places interrupted this arrangement; but, notwithstanding a few such exceptions, it persists with remarkable uniformity from Abyssinia to Natal, where the dominant meridional geographical lines bend round into the east and west series that rules in Cape Colony. In the eastern Transvaal, this zonal arrangement of the country is well developed. Inland from Delagoa Bay is a tract of undulating lowland, ending at the foot of the Libombo Mountains,

¹ Twelfth Annual Report of the Geological Survey of the United States, 1890-91. (1891.)

² "In Haunts of Wild Game. A Hunter-Naturalist's Wanderings from Kahlamba to Libombo." By Frederick Vaughan Kirby, F.Z.S. 8vo. Pp. xvi + 367. With map, portrait, 16 full-page and 24 smaller illustrations. (Edinburgh and London: Wm. Blackwood and Sons, 1896.)

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which separate Swaziland and the Transvaal from Portuguese East Africa. Seventy miles further to the west is the parallel range of the Drakensberg or Kahlamba (to adopt the author's spelling of the name, which is usually written Quahlamba). Between these mountain ranges is a belt of bush-covered veldt. The Crocodile River (a tributary of the Komati) and the Olifants River flow from west to east across this belt, at a distance of about 100 miles from one another. These, with the mountains, enclose a roughly quadrangular area, some 7000 square miles in extent, which is the favourite hunting-ground of Mr. F. V. Kirby. Small though this area is, it includes very varied types of country. To the west are the densely wooded eastern slopes of the Drakensberg, and part of the turf-clad plateaus or terraces beyond; to the east lies low country with sub-tropical vegetation, intervening between the Libombo Mountains and the Limpopo River.



FIG. 1.—A Head of the Great Kudu.

Most of the area consists of barren, scrub-covered plains known in this part of Africa as Bush-veldt, and near the equator as the Nyika. Most of this area was once rich in game. In the Bush-veldt lived the rhinoceros and buffalo, the sable and roan antelopes, the gnu, waterbuck, zebra and mpalla. The wooded foothills of the Drakensberg, or the "Kloof Country," was the home of the koodoo, the hill-leopard, the bush-buck, and the reed-buck. On the western plateau, or the "Krantz Country," in addition to some of the animals mentioned, lived the oribi and the mountain reed-buck.

This book relates the experience of nearly twenty years of hunting in this rich game country. The author tells his story in much better English than we are used to in books of sporting adventure. He is obviously not only a skilled sportsman, but a man with a keen eye for fine scenery, of literary tastes, and a careful and patient

observer. His book is somewhat lengthy, and consists in the main of descriptions of successful stalks, night-watches, and exciting encounters in the chase of the various classes of game. Every page will be of interest to sportsmen; while the notes on the habits of the game, and the descriptions of variations from the normal forms, render it of importance to naturalists.

The book is divided into two parts. The first describes shooting in the "Krantz" and the "Kloof" countries; the second, that of the Bush-veldt. As the district is settled, and the natives friendly, and as the railway to Pretoria passes along the southern border of the country, the conditions of life are very comfortable. The author shot with dogs, generally on horseback, and in the case of smaller game, had the help of large parties of beaters. But the sport was not always by any means of the battue type. Five chapters out of the thirteen in the first part of the book are devoted to leopard hunting, which is

day-time," is not supported by recent accounts from Equatorial Africa. Some lions there recently, in broad daylight, attacked and routed a hundred men belonging to a Uganda caravan. The last chapter in the book is a discussion of the respective merit of rifles, in which the author takes the side of heavy weapons. He declares the '303 to be a very over-rated gun, and most of his arguments seem to me quite sound, at least as far as concerns the professional sportsman. The author, however, perhaps does not sufficiently consider the case of those with whom sport is only secondary to other work. He says that the advantages claimed for the '303, owing to its lightness and absence of recoil, are fictitious; for sportsmen must be so strong, that the few extra pounds make no difference, and that they do not feel the recoil of a '577. This is no doubt true, if potting game is a man's sole occupation; but if in addition to a rifle he has to carry a butterfly-net and a satchel of collecting-

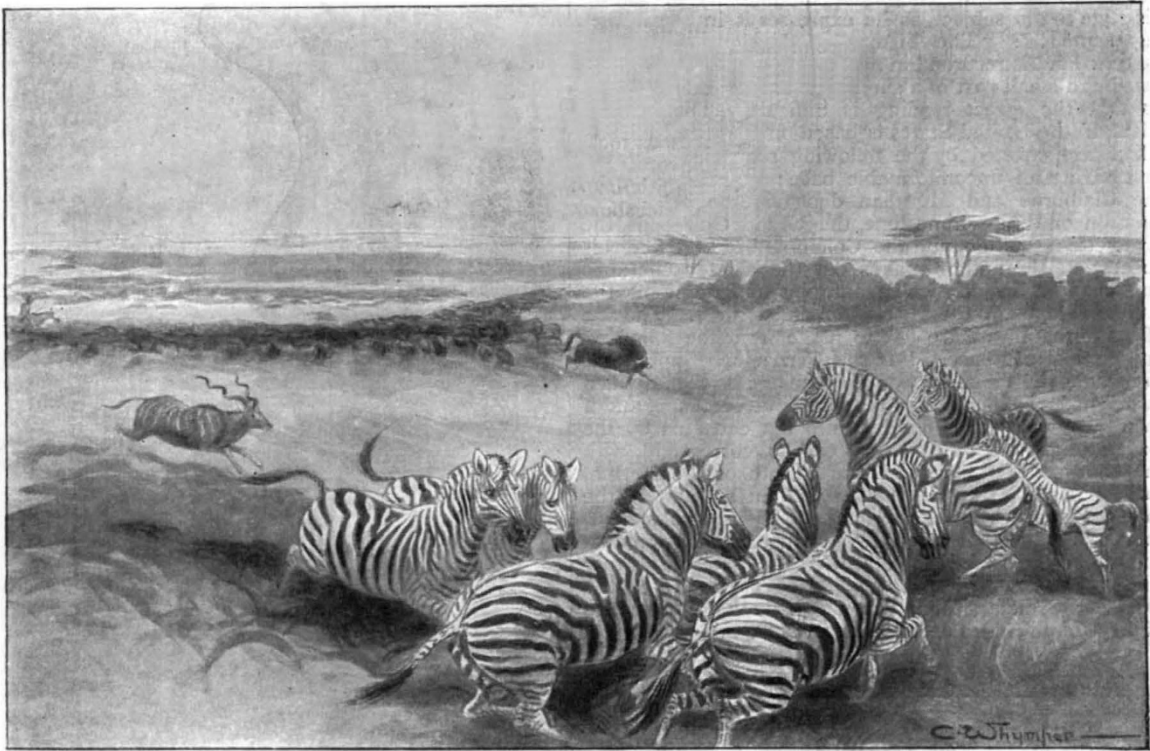


FIG. 2.—A Scene on the Game Fields.

always arduous, and one to buffalo hunting, which is generally dangerous. The author has great respect for the leopard, and protests against its being described, as he says it generally is, as "a contemptible sneak" and "utter coward." He describes it, on the contrary, as "an incredibly daring brute," and says it "will usually show fight where a far larger and more powerful animal would try to back out of it." But we thought that this estimate of the courage of the leopard was generally accepted, although the author describes the other as that which is invariably held. The five chapters on lions and lion-hunting, in the second part, will probably be the most generally attractive in the work. The author scorns the idea that the lion is not the king of beasts, and his experiences certainly show that its courage is sometimes superb. His remark, however, that in the case of lions, "if not interfered with or actually in a starving state, there is absolutely nothing to fear from them if met in the

bottles, every pound saved is of great importance. It is no doubt true, that during the excitement of the chase, a sportsman does not feel any inconvenience from half-a-dozen blows from a '577; but if, during the next few hours, the traveller tries to take an altitude, or read a round of angles with a theodolite, he will find that he has felt the recoil, and has to pay for his sport by less accurate observations than he might otherwise have taken.

The interest of the book is greatly enhanced by Mr. Charles Whymper's illustrations, which are a valuable addition to that artist's series of studies of wild animal life. By the courtesy of the publishers two are here reproduced as examples. In the picture of the game-fields, the artist has well illustrated the inquisitive zebras' stupid habit of swinging round occasionally to satisfy their curiosity as to danger, from which they might otherwise escape.

The most regrettable feature in the book is the author's habit of using native or local names for animals without giving the zoological name. Comparatively few of his readers are likely to recognise the *hyrax* or coney in the "dassie," especially as this term is not mentioned as a synonym in the notes on the fauna in the last chapter. The author's interesting remarks on some snakes lose much of their value, owing to the uncertainty of knowing which species he is describing.

The author's account of life on the game-fields shows that these are not Edens. His realistic account of a fight between a lion and a sable antelope, which resulted in the death of both combatants, and of a zebra which he shot, only to find that it had been so wounded by lions, that much of its flesh was putrid, and that it was full of maggots, help one to realise the tragedy of the struggle for existence. The author blames the Boer Government for allowing the destruction of the game; but the case of South America shows how a fauna, much richer than that of Africa, has become extinct in comparatively recent times, and without human intervention. The extermination of some species in regions of Africa where the game has not been seriously hunted, shows that natural agencies help in that destruction of the game, for which man generally bears the whole of the blame.

J. W. G.

GENERAL J. T. WALKER, R.E., C.B., F.R.S.

BY the death of General James T. Walker, on February 16, the Indian Army, all scientific bodies, and geographical societies, at home and abroad, have to deplore the loss of a gallant and accomplished officer. It is a loss which will be felt most by past and present members of the Indian Survey Department who survive him, who are better cognisant of and can appreciate the many years of service he rendered that Department from first to last, and the talents he devoted to its accurate execution.

Following in the footsteps of previous Superintendents of the Trigonometrical Survey, Colonel Lambton, Sir George Everest, and Sir Andrew Waugh, his principal aim, in guiding the trigonometrical work they had performed, was to carry it to a successful issue, and with the greatest accuracy, more modern instruments, and all that mathematical and geodetical knowledge could achieve. These operations could not have fallen into more zealous, able hands, for it may be said, for the information of those who hear and read little of such work (often insufficiently rewarded), that as a survey of a very large area of the earth's surface, no other area has been so laboriously measured, the observed angles so rigorously computed, and dealt with, and with so little resultant error. Many accomplished brave officers, assistants, and men have also fallen victims to the climate in which the operations were carried on, ranging as it did from the plains of India to the often deadly Terai up to the highest peaks of the Himalayas. In achieving this result, to General Walker, and the officers he directed, is due the greatest measure of praise for its perfectness. All that it entailed from the very commencement in 1800, is to be found in the "Account of the Operations of the Great Trigonometrical Survey of India," twenty volumes, the first nine of which were compiled by General Walker. My first knowledge of his name and work was as far back as 1855, when serving with my regiment at Peshawur I drew for the Quarter-Master General's Department, under the direction of Dr. P. Lumsden, the first map of the Kooram Valley, on which were laid down the peaks on the Sufaidkoh Range, of which Walker had been the first to fix the position. Lieut. Walker's name was well known then in the Panjab, for up to 1853 he had been working single-handed with his usual zeal at the military survey of the

Trans-Indus territory. This was dangerous service in those days on that disturbed wild frontier of the north-west of India, which the East India Company had very lately acquired, where the tribesmen might be seen following their bullocks at the plough, *jezail* slung on back. On this survey it may be said Walker carried his life in his hand, he and his party often being the target for these same *jezails*. The ascent of Turturrah Peak in the Khyber Hills is only one instance of a very hazardous piece of work, but the dash and rapidity with which his plans were made and the distance done, surmounted the difficulties, and brought him safe out of the expedition with the coveted angles secured. Similar risky exploration was effected by him on the borders of Eusofzai and along the base of the hills, near where our troops have been lately employed at the Malakand Pass, and in the neighbourhood of Umbeyla. In fact, all we knew of that border topography for many years, and up to very recently, was the outcome of the young engineer's reconnaissance. Very little was said about this work at the time. In those days it was not the fashion to write up, and make so much of such travel, as is now the case. It took place far off in time and distance from home and headquarters, and only those in the district—his immediate superiors and his brother officers—knew the value of it, and the pluck and endurance it demanded. Moreover, by his tact with some of the chiefs, he managed to penetrate even beyond the frontier; but on returning to Peshawur, and reporting his success in this way, and making certain of praise, he received a severe reprimand. It was perhaps feared that in risking his own life, and the men of his party, he also risked embroiling his Government. It was not until 1865, when I had been in the Survey Department some years, and knew more of his work, that I became personally associated with him and under his immediate orders. He was then engaged on the compilation of his first map of Central Asia. I shall never forget the great pleasure of meeting him daily, and how much I learned from him, discussing portions of that country, looking up books of travel, and the latest work of the Russian Survey, and getting that map completed with the Himalayan Range as far east as longitude 81°. It was the first large map turned out in India by the process of photozincography, then but lately introduced into the office at Deyrah Dhoon, and it went through many subsequent editions. It was when engaged on such researches that Walker's knowledge and his intense love for geographical study showed itself. There was at that period much new topography coming in. The work of the Kashmir Survey, under Captain T. G. Montgomerie, R.E., had filled up an immense blank in the northern frontier of India, from the confines of Gilgit and Hunza Nagar to the Chang Chingmo. Mr. W. H. Johnson had just returned from his trip over the Karakoram range to Ilchi in Khotan; his route survey and observations had to be brought into place, and affected the position of other places in that part of Asia.

It was never my good fortune to serve under General Walker in the field; but I can look back on a short spell of camplife with him, on the mountains north of Mussoorie, with those feelings of desire that the time might come over again. Walker had been working hard for months at his computations, and was overworked; I suggested his joining me in a collecting trip I had planned into the hills, and he fell in with the idea. How he enjoyed the complete rest, and entered with zest into my pursuits; how much there was to talk over that was interesting to both; how we revelled in the lovely scenery of the oak-crowned ranges, with the snows of Jumnutri in the distance, and enjoyed the splendid air of October in the Himalayas, which sent him back to duty again quite set-up. In those few days, however, I got to know Walker, and all the good traits in his character, better than per-