Anthropological notes on Bantu natives from Portuguese East Africa / by G.D. Maynard and G.A. Turner.

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As we have had the opportunity of making a comparatively large number of anthropological records on certain Portuguese East African Natives, who had been recruited for work on the Gold, Diamond, and Coal Mines of the Transvaal, we thought it might be of interest to publish them, together with a few brief notes on the tribes concerned. The measurements were made on natives who had died before actually commencing work, as well as on those dying after having worked for periods of varying lengths. Both classes include natives who had come to the mines for the first time and also natives who may have been on the Rand on previous occasions.

With the exception of a few natives from the British Nyassaland Protectorate, all the cases referred to were recruited in Portuguese East Africa.

We are therefore dealing with a mixture of Bantu tribes, scattered over large tropical and sub-tropical areas. The attached map shows the various districts in which recruiting operations for the Transvaal mines have been carried on, and it will be noticed that the tropical and sub-tropical areas are divided by a well defined and substantial "buffer" district, namely, the Moçambique Company's territory. The whole area is bounded;—on the east by the Indian Ocean, on the north by the Rovuma River and German East Africa, on the south by Zululand, and on the west by Lake Nyassa, the British Nyassaland Protectorate, Rhodesia, the Transvaal, and Swaziland.

Owing to the enormous extent covered by recruiting operations, and the varying character of the country, our records include natives

of many tribes with different customs. The physical and climatic differences of their homes are also considerable, so that their diet and mode of living are subject to wide variations. Thus, for instance, this group includes, on the one hand, natives from high altitudes, such as the Lake Nyassa plateau, the Namuli peaks in Quilimane, and Angoniland north of Tete, in which places the altitude varies from three thousand to six thousand feet above sea level; and on the other, natives living in low lying areas, some of which are fertile, others swampy, and others again almost waterless and full of game. From these extremes in the character of the country we naturally find considerable variations in the habits, customs, diets, dwellings, and occupations of the inhabitants. Near the sea the people are, so to speak, amphibious, and live largely on fish; in other parts where water is scarce, they are hunters living on game, while in yet other parts the people are agriculturists and stock breeders. It must always be remembered, however, that owing to tribal wars, it is rarely that any one tribe exists for more than two generations (fifty years) in the same place and under the same conditions. Where one tribe predominates over another, it leaves its mark on the inferior race.

To attempt to go into a detailed account of the history of the groups would be outside the scope of this paper, and to classify them into tribes as if they were separate entities would be incorrect. We have, therefore, divided the natives into two main classes: (1) the sub-tropical, or as they are known on the mines, East Coast Natives, that is, Natives coming from between the Zulu border and Latitude 22° S.; and (2) Tropical Natives, or those coming from between the Zambesi River and German East Africa. These two groups are well separated from one another, and are composed of quite distinct types.

For the purpose of this paper, we have further sub-divided the sub-tropical or East Coast natives into Shangaans, or natives from Gazaland, Mytopis, Inhambaans, and Maputos or Tongas; and the tropical natives into, natives from Tete, Quilimanes, Moçambiques, and Portuguese Nyassas.

Before attempting to give details of these various groups, we would point out that the tribal wars previously mentioned, coupled with the fact that these wars often originated over the question of women, and certainly always terminated in the acquisition by the victorious tribe of all marriageable females, have brought about an extraordinary intermingling of race. Even when at peace, diplomatic exigencies frequently entailed the exchange of women between the various chiefs. Again, in early times, the results of the slave trade must have had a great effect on the intermingling of the tribes, and at a later date, the Portuguese policy of bringing black soldiers or

"cypaes"* from one colony to another, and of deporting chiefs and their followers from one part to another, has also had its effect in the same direction. In spite of the above-mentioned intermingling, the tribal peculiarities are still so marked as to make us hazard the suggestion that we believe we can, after our experience with natives, give a fairly accurate opinion as to the tribe of any native coming under our observation, and this from his general appearance. Of course in many cases an opinion is unconsciously formed from some tribal peculiarity or marking; however, we know from experience that it is not so easy to determine the tribe of a native when seen in the mortuary after death, so that probably a variety of scarcely recognised factors enter into the formation of one's judgment. It is remarkable that whereas Europeans are known to have cohabited freely with native women of the various tribes in tropical areas, yet the result in the way of half-castes is scarcely apparent.

It may be of interest to the reader unfamiliar with the movements of the native races, if we give a brief resumé of the recent history of the chief tribes dealt with in this paper.

The Shangaan. These people are an uncircumsised race of superior type to their neighbours. There are several accounts of their origin, and we think it probable, that while none of them are absolutely correct, elements of the truth are to be found in all. One story is as follows:—The Shangaans are descendants of impis sent north by Chaka; the best known of these was one which crossed the Zambesi, and eventually settled in the territory now known as British Central Africa, and from which the Angoni tribe of to-day originated. Some of these people eventually found their way into the country round Beira—old Gazaland. From this point they raided the neighbouring territories of Inhambane and Villainculos, driving out the original inhabitants, and forming small settlements throughout the districts. Spreading south they met the Mytopi, a fighting and stubborn race, who strenuously, and for many years resisted the invasion. Eventually, this warlike branch of the Zulu stock were victorious, and extended as far as the Limpopo River. Here they met the Portuguese, and were defeated by them near Chibuto, in 1896, their chief, Gungunyana, being captured and exiled.

Another version is as follows:—Umzilagazi, being sent north by Chaka, did not return to Zululand, but established himself in the Transvaal. He was driven out by the Boers by way of Umzilagazi's Nek in the Magaliesburg Mountains, and eventually established himself in Matabeleland. The remnants of his people are still to be

* English, Sepoy. French, Cipaye.

found round Middleburg; they call themselves Mandibile, and speak Zulu. From Matabeleland various raiding impis were despatched into the neighbouring territories. One under Soshangan went west and then south, until having had four leaders, namely, Soshangan, Manekuz, Muzila, and Gungunyana, it was conquered by the Portuguese in the present Gazaland, and Gungunyana deported.

It is interesting to note that the language of the "Abangoni"—who, according to this version, are an offshoot of Umzilagazi's troops, which went north of the Zambesi—is called "isi Nguni," and the Shangaans of the present day call the Zulu language "isi Nguni" in the same way as the Maxosa people call it "isi Chaka." It would appear that the present Shangaans last heard Zulu from the "Abangoni," and when they met it on their return south they called it "isi Nguni." The language of the Shangaans appears to have suffered a much greater deterioration from true Zulu than that of the Angonis.

There is still another version, namely, that Chaka sent an impi to the Limpopo, and that it was practically destroyed by fever, the remnant gradually spreading northward. Round the Limpopo there are still a few natives who say that they came from the south, and that their fathers died, not fighting, but in some catastrophe.

These sketches will serve to indicate how impossible it is to regard even a superior Bantu race as even approximately a pure stock. The women of the conquered races are always the perquisites of the victors. They further indicate the extreme difficulty of obtaining reliable historical accounts of native movements, even when confined to comparatively recent times.

The Mytopi. Although beaten by the Shaangaan they are still a virile race with distinct tribal peculiarities and customs. Formerly both males and females were tatooed with very distinct tribal markings, but of late years this practice has been almost entirely confined to the females.

The Inhambanes may, we think, be described as a heterogeneous collection of many tribes, harassed in turn by the slave-traders, the Shangaans, the Mytopis and others; they have never had a settled country, or attained any pre-eminence. Although living in a fertile and prolific country, they are of a somewhat inferior physique, and have been considered "dogs" by their more virile neighbours.

The Tongas, or natives of Maputaland, have been living for generations in the vicinity of Delagoa Bay, a port occupied for many generations by Europeans, Arabs, and Indians. They probably possess, therefore, more alien blood than any of the races already described. In addition, their close proximity to the Swazies has resulted in a

considerable intermixture with this race. The word Tonga implies "outcast," and as we see, they are a bastard race of, however, a somewhat higher degree of intelligence, and often of superior physique to that of their Bantu neighbours.

Natives from Tropical Areas.

The natives from the district of Tete consist largely of two main tribes, the Angoni and the Agawa. There are, however, a certain number of other, and, in our opinion, inferior tribes from the surrounding districts, which are comprised in this group.

The Angoni, as we have already stated, are of Zulu descent, being an offshoot of Umziligazi's force which settled in Matabeleland. They are a powerful, intelligent, and well built race, which has spread itself widely throughout Central Africa, some sections having spread as far to the north-east as German East Africa.

The Agawa (Yao) are, however, we consider, the finest race from these districts. Originally and principally slave-traders living in the hills surrounding Lake Nyassa, it was their custom to establish collecting stations on the eastern shores of the lake, to which slaves from the western side could be brought, and then handed over to the Arab dealers; in short, they were native middlemen in the slave trade of these parts. We believe they are, and have for long been, the predominant race, both mentally and physically. Many of them have embraced the Mohammedan religion.

We wish here to state definitely that our opinions in regard to the physical and mental characters of these natives are derived solely from the type of "boy" we have seen on the Rand, as neither of us has had an opportunity of visiting this part of Central Africa.

Natives from Portuguese Nyassaland vary considerably in type. Many have Swahili blood in their veins, while some appear to be practically pure Swahili. The Arab type of feature is very pronounced in a number of natives inhabiting the coastal belt of this district as well as of that further south. The Swahili language is understood by many, and serves as the *lingua franca* among the coastal natives of Nyassaland. While a large number of Nyassaland recruits come from the coastal districts, a smaller number are recruited from the interior, and are of a totally different type.

The Moçambique natives are a very heterogeneous class, but may be roughly sub-divided into four groups: the coastal native, the Makuas, the Lomwes, and the Parapatos.

The coastal native is of very mixed origin. Many show signs of Arab and Indian parentage, and not rarely have hair of an Asiatic character. The influence of the Portuguese custom of moving native troops from one part of the country to another, even bringing West

Coast troops to East Africa and *vice versa*, has left its mark in this as in other parts of the country. Traffic with the island of Moçambique, an old and important slaving centre and a modern port of some importance, has not been without its influence in this district. A large number of the natives profess the Mohammedan religion. Educationally and physically, the coastal native is in general of a better type than the native from the interior.

The Makuas are to be found in the north and north-eastern parts of this district. The name apparently denotes the wild or savage man, and no native acknowledges himself to be a Makua; they admit, however, that their language is the chi-makua. This group is sub-divided into many tribes, among which are Maravi's people, Nhamarals, Itoculos, Nacavala, Nacaroa, Moagems, and Irades. They all have deep incisions on the face, and are more or less tatooed on the body. The tribal markings vary considerably and are distinctive. Mr. Shepherd thinks that the Makuas are very old inhabitants, and in spite of the fact that their physique is better than that of any of the other inhabitants of the interior of this district, slave trading, tribal fighting, and small pox have prevented them from becoming a powerful race.

The Lomwes. These people inhabit the western and south-western parts of Moçambique. They came originally from the Lomwe, Higher, and Lower M'locue districts of Quilimane, spreading into the south-western part of Moçambique, which at that time was practically uninhabited. These people still maintain considerable inter-communication with the Lomwes across the Ligonha River. The Lomwes are much less tatooed than the Makuas. They are a wandering tribe, constantly on the move; this is due to a variety of causes, partly to the poverty of the land, which soon becomes exhausted when cultivated, partly to tribal feuds, and to avoid the inroads of the white man with its consequent taxation. Their language is very similar to that of the Lomwes of Quilimane, but contains many words which would not be understood by the latter. The Lomwes are physically a poor race. Being very lazy, and living in an unfertile country, they have frequently suffered from famine. Owing to these conditions they have not been able to obtain women from neighbouring tribes, and continual inbreeding has still further helped to deteriorate an already inferior race.

The Parapatos. This term includes the natives living in the district of Angoshe, a triangular area bounded, on the north by about the fifteenth parallel of latitude, and to the south by the Ligonha River. The most important tribe in this country are the Imbamellas. They are probably fairly old inhabitants, having affinities in language

and customs with the Lomwes, but are not tatooed to the same extent. The Arab influence among them has been considerable. They are tall, but otherwise not physically a fine race, and on the Rand show very little resistance to disease. They are chiefly engaged in agriculture, trading ground nuts to the Indian storekeepers; they are, however, lazy, and at times neglect their crops, so that they suffer unnecessarily from famine.

The district of Quilimane can be divided into four areas, namely:— Lomwe, Higher M'Locque, Lower M'Locque, and Maganja da Costa.

The natives in the Lomwe district are of poor physique. On two occasions in recent years they have been almost annihilated by famine and disease. They are exceedingly lazy, and will not take the trouble to plant crops, and even when this has been done, frequently neglect to harvest them. The inhabitants of Higher, and Lower M'Locque are very little superior to the Lomwes. Natives from the district of Maganja da Costa are a much finer race than those just referred to. They are a coastal tribe of superior physique and intelligence.

The above brief sketch of the various native races comprising the population dealt with in our records is not put forward with any claim to accuracy of detail, which it is exceedingly difficult to obtain even if at all possible. Our only object in touching on this matter here is to give the reader—unacquainted with the conditions among these races—some idea of the nature of the material, and to demonstrate the futility of attempting to regard any tribe as a pure strain even if only for a few generations. Nevertheless, there are very marked differences between the natives from tropical districts, and those coming from south of latitude 22° S., and when we come to sub-divide these groups, differences are still discernable though to a less extent. We reproduce drawings by Miss O. M. Vieich of native faces. These "boys" were chosen by Mr. Lloyd as typical of the race they represent; they further serve to illustrate the facial markings which are so noticeable a feature among many Bantu tribes.

We wish here to record our thanks; to Mr. B. G. Lloyd, General Manager of the Witwatersrand Native Labour Association, for reading through the manuscript of this part of our paper, and for giving us much valuable advice, and further, for allowing us to reproduce the drawings referred to above; and also to Mr. W. C. A. Shepherd, Chief Agent of the Witwatersrand Native Labour Association in Moçambique, for sending us notes on the natives of this district, from which we have quoted freely.

We can now turn to an examination of the actual records of the data obtained at the post-mortem examinations, on these natives, conducted in Johannesburg.

STATURE.

The measurements of stature, here considered, were obtained after death in the following manner:—The body being placed as straight as possible on the post-mortem table, the distance from the heel to the crown of the head was read off on a graduated staff. We had some misgiving as to whether this method might not introduce serious errors, owing possibly to post-mortem rigidity and to the unusual position of the body. These factors, however, if they be effective in appreciably altering the observed height from its true value would probably act in opposite directions; thus, muscular contractions would tend to diminish, and the dorsal-recumbent position, owing to a flattening of the spinal curves, to increase the apparent height. Judging from values found by other observers for living Bantu Natives, our post-mortem records do not suggest that any very large errors are introduced by this method of obtaining the measurement.

In Table I. the mean height in centimetres, the standard deviations, and coefficients of variation, are given for the different territorial classifications; the natives being grouped, as already explained, under headings according to the country from which they came.*

TABLE I.

Stature.

District.	Mean.	σ	C. of V.	N.
Moçambique	167·05 ± ·20	6·105 ± ·142	3·65	410
Quilimane	166·53 ± ·38	6·462 ± ·277	3·88	123
Port. Nyassaland	166·65 ± ·38	5·601 ± ·274	3·36	95
Tete	169·70 ± ·66	7·488 ± ·472	4·41	58
Total from Tropical Areas ...	167·16 ± ·15	6·269 ± ·114	3·75	693
Inhambane	168·99 ± ·51	6·599 ± ·363	3·91	75
M'chopi	171·22 ± ·53	5·255 ± ·381	3·07	43
Gazaland	170·49 ± ·56	6·597 ± ·404	3·87	61
Maputaland	166·83 ± 1·22	6·028 ± ·866	3·61	11
Total from East Coast	169·70 ± ·30	6·005 ± ·208	3·54	190
South lat. 22° S.	169·70 ± ·30	6·005 ± ·208	3·54	190

**Note.*—In this and subsequent tables the numbers in the total groups do not always correspond with the additions of the numbers in the sub-groups, because of the inclusion of some cases which could not be classed under the sub-headings given, and were not sufficiently numerous to warrant the construction of further sub-groups.

It will be noticed that the Natives from South of Latitude 22° S. are taller and rather less variable in height than those from north of this parallel, and the question as to whether this difference may be regarded as a racial characteristic, or is due to the selection of the sample, must be considered. In the returns here dealt with, the Natives from Tropical Areas were mainly "new-boys," that is, "boys" detained in compound before allotment to the mines, while among those from the East Coast, the greater number had died while detained in compound on their way home, that is, most of them were being repatriated as being medically unfit, having usually some chronic disease, for example, tuberculosis. It is evident, therefore, that if there is any selective death-rate in regard to height, this point must be first investigated before conclusions as to the significance of the observed difference between these two groups can be drawn.

In Table II. the two main groups have been divided into, "new-boys" and "mine-boys," the former term applying to Natives who died while detained before allotment to the mines, and the latter to those who died while in compound after rejection by the mines as medically unfit.

TABLE II.

Stature and Disease.

Disease.	Mean.	σ	C. of V.	N.
Tropical Natives. "New-Boys."				
Tuberculosis	169·57 ± ·76	5·616 ± ·536	3·31	25
Intestinal Diseases ...	167·57 ± ·48	6·675 ± ·333	3·98	91
Cerebro-spinal-meningitis ...	167·44 ± ·33	6·975 ± ·231	4·17	207
Hydronephrosis	167·16 ± ·56	5·984 ± ·396	3·58	52
Pneumonia	167·14 ± ·25	6·533 ± ·173	3·91	322
Other medical causes ...	166·91 ± ·41	7·028 ± ·284	4·21	139
Total	167·29 ± ·15	6·698 ± ·112	4·00 ± ·07	836
Tropical Natives. "Mine-Boys."				
Tuberculosis	167·49 ± ·56	4·935 ± ·391	2·95	36
Other medical causes ...	168·00 ± ·56	5·474 ± ·404	3·26	42
Total	167·77 ± ·43	5·545 ± ·300	3·31 ± ·18	78
East Coast Natives. "New-Boys."				
Total	167·95 ± ·69	6·711 ± ·488	4·00 ± ·29	43
East Coast Natives. "Mine-Boys."				
Tuberculosis	170·13 ± ·41	6·025 ± ·287	3·54	100
Other medical causes ...	169·14 ± ·53	5·916 ± ·371	3·50	58
Total	169·78 ± ·33	6·005 ± ·229	3·54 ± ·13	158

In the group Tropical Natives "new-boys," no disease, with the exception of tuberculosis, is associated with any great variation in height from the mean. In the small group of deaths from tuberculosis here recorded, the mean height is over 2 c.m. above the average for the group. In this group there are, however, a few Natives who have worked on the Rand at some previous time, and are again coming up to work; it is among Natives in this class that tuberculosis is most frequently met with.[1] It is, we think, reasonable to suppose that this group therefore may be a selected group. Further, the coefficient of variability is rather smaller than that in any of the other sub-groups. In both of the main groups, the coefficient of variability is smaller among the "mine-boys" than among the "new-boys," while the mean height is greater. This could be explained on the assumption that there is a selective death-rate on the shorter "boy" in respect to acute diseases, in other words, the undersized and generally less developed subject is more prone to die from such diseases as cerebro-spinal-meningitis and pneumonia. It must not be forgotten, however, that there is apparently a racial difference in height, and that there is no doubt that there is a racial difference in liability to both the above-mentioned diseases. The highest pneumonia rate occurs amongst the Quilimane Natives, while the rate from cerebro-spinal-meningitis is highest among the Moçambique Natives, those from Nyassaland coming second, while the Quilimane Natives have a considerably lower mortality from this disease than either of the two former groups.

Considering these points in relation to the data here discussed, it seems fair to state that apparently there is some evidence in favour of the hypothesis that the death-rate may be selective in regard to stature, on the ground that the Natives who die after working on the mines—that is, after some months residence on the Reef—are not only taller than the newcomers, but the coefficient of variability of this measurement is smaller.

It will be necessary, therefore, to bear these facts in mind before any deductions are drawn from small differences obtained from these, and similarly selected classes. In regard to age, the bulk of the Natives considered may be classed as young adults; no Natives under eighteen and few of over fifty years are included in the returns.

Many observations among Europeans have shown that distributions of heights, when the data are drawn from a fairly homogeneous population, are very closely represented by the Normal or Gaussian Curve. In our figures the most homogeneous group of approximately sufficient size from which the type of the distribution could be calculated, was that of the Moçambiques. This group, however, is

not really homogeneous; the Natives from the Southern district, that of Angoche, being in many respects quite different from those of the Northern portion of this area. The constants obtained from the recorded height of the four hundred and ten Natives in Table I. is as follows:—

Mean	167·0548
σ	6·1050
β_1	0·0035
β_2	2·9966

$$y = 67{\cdot}633\, e^{-x^2/74{\cdot}5420}$$

It is seen that this distribution conforms to the rule of normality mentioned above.

In Table III. a few mean heights from other races are given to enable the reader to compare the values with those just recorded. They have been selected from among the numerous published records, and their source acknowledged. We have also included some values for local native races compiled by the late Dr. Brodie, which we believe have not been published before. We have converted inches into centimetres when necessary, in order to facilitate comparison.

TABLE III.

Table of Heights.

*			
3.	Cambridge Undergraduates. (1077) Galton	...	175·01
3.	British Middle Class. (1000) Pearson	...	172·83
3.	Galton S. Kensington Laboratory Series	...	172·47
5.	Bantu. Fritch	...	171·8
3.	New South Wales Criminals. (1000). Ages 25-30	...	170·95
4.	Young Males. Swedes	...	170·18
4.	Young Males. Bohemians	...	169·42
4.	Young Males. Hessians	...	167·29
6.	East Coast Natives. (1337)	...	168·91
6.	British Basuto	...	168·91
5.	Bechuanas. Fritch	...	168·4
6.	Cape Colony. (680)	...	168·28
5.	American Negroes (pure). Gould	...	168·00
6.	Transvaal Basuto. (521)	...	167·64
6.	British Central African Natives. (121)	...	166·37
6.	Rhodesian Natives. (199)	...	166·37
6.	Bechuanas. (66)	...	166·37
6.	Zambesia Natives. (319)	...	163·20

* Reference number to bibliography at end of paper.

BRAIN WEIGHT.

The method of obtaining the brain weights was as follows:—The brain on removal from the skull was weighed to the nearest five grams without the removal of the pia-arachnoid. The pons, medulla, and cerebellum, were then separated, and the weight of the cerebrum alone noted. Nearly all the post-mortem examinations were conducted within twelve to twenty-four hours after death, the bodies being kept in the refrigerator pending examination. No deaths from accident are included in these returns, the cause of death in the majority of cases being some acute disease, for example, pneumonia.

TABLE IV.

Cerebrum Weights.

District.	Mean.	σ	C. of V.	N.
Moçambique	1136·1 ± 3·3	98·17 ± 2·31	8·64	410
Quilimane	1127·1 ± 5·6	92·40 ± 3·97	8·20	123
Port. Nyassaland	1128·6 ± 5·3	76·70 ± 3·75	6·80	95
Tete	1147·4 ± 8·8	99·60 ± 6·24	8·68	58
Total Tropical Natives ...	1134·7 ± 2·5	94·87 ± 1·72	8·36	693
Inhambane	1109·5 ± 6·7	85·55 ± 4·71	7·71	75
M'chopi	1195·7 ± 9·6	93·73 ± 6·82	8·55	43
Gazaland	1107·2 ± 7·1	81·78 ± 4·99	7·39	61
Maputaland	1098·9 ± 31·1	152·85 ± 21·98	13·91	11
Total East Coast Natives ...	1104·9 ± 4·7	95·74 ± 3·31	8·66	190

TABLE V.

Cerebellum, Pons, and Medulla.

District from where recruited.	Mean.	σ	C. of V.	N.
Moçambique	166·36 ± ·52	15·68 ± ·37	9·43	410
Quilimane	163·14 ± ·89	14·63 ± ·63	8·97	123
Nyassa	166·27 ± 1·13	16·34 ± ·80	9·83	95
Tete	172·02 ± 1·30	14·60 ± ·92	8·49	58
Total	166·27 ± ·40	15·72 ± ·28	9·45	693
Inhambane	168·42 ± 1·35	17·50 ± ·96	10·39	75
M'chopi	165·00 ± 1·87	17·92 ± 1·32	10·86	43
Gazaland	168·72 ± 1·62	18·90 ± 1·14	11·20	61
Maputaland	162·50 ± 4·13	17·30 ± 2·92	10·65	11
Total	167·54 ± ·90	18·32 ± ·64	10·93	190

As these values are obtained from Natives who died from disease, it is clear they cannot be regarded as random samples of tribal weights, unless there is no selective death-rate in respect of this character. The cause of death may also have some effect on brain-weight by altering the quantity of blood in the vessels, or of cerebro-spinal-fluid in the ventricles. In this connection we must not overlook the observations of J. B. Blakeman. In a paper written by him in conjunction with Dr. A. Lee and Professor Pearson some figures are given which suggest that when death was occasioned by chronic diseases, the brain weight was less than when an acute disease was the cause. They write: "It will thus be seen that, with the exception of the males over forty-six, the cause of death makes a very substantial difference in the average brain weight."[7] It will be noticed that our results as they stand do not confirm this result, but as will be seen, there may be special reasons for this apparent want of agreement. As our groups are unavoidably heterogeneous in character, a tribal constitutional liability to a disease might lead to an undue number of cases from one source being included in the returns; and if the particular group of Natives had a tribal difference in brain weight from that of the remainder of the group, a false estimate as to the relation of cause of death and brain-weight might result. That tribal differences in liability to pneumonia and cerebro-spinal-meningitis do occur has been shown in other publications.[2]

These figures comprise data from a similar source to that already dealt with under the heading "Stature," the reader will therefore realise that most of the Natives in the group "Tropical" died from acute disease before going to work on the mines, while in the East Coast group the larger number were old "mine-boys" among whom the more chronic complaints predominate.

In Table VI. the cerebrum weights are recorded and classed according to the cause of death for the four groups, "Tropical new-boys" and "mine-boys," East Coast "new-boys" and "mine-boys."

From this table it will be seen that in the group Tropical Natives "new-boys" that even excluding cases of death from cerebro-spinal-meningitis, the average cerebrum weight is rather higher than that found for the whole group in Table IV., while for the group "mine-boys" it is distinctly lower. We can attempt, by the method devised by Professor K. Pearson "On the Probability that two Independent Distributions of Frequency are really Samples from the same Population,"[8] to determine whether these differences are accidental, or should be regarded as significant.

TABLE VI.

Tropical Natives. "New-boys."

Cerebrum Weights.

Disease.	Mean.	σ	C. of V.	N.
Cerebro-spinal-meningitis ...	1166·98 ± 4·17	90·13 ± 2·95	7·72	212
Hydronephrosis	1164·75 ± 11·20	115·02 ± 7·95	9·88	48
Intestinal diseases	1146·66 ± 6·89	96·90 ± 4·87	8·45	90
Pneumonia	1138·75 ± 3·42	90·71 ± 2·42	7·97	320
Tuberculosis	1137·50 ± 12·13	88·10 ± 8·58	7·74	24
Other medical diseases ...	1132·8 ± 5·11	93·12 ± 6·31	8·22	151
Total	1147·04 ± 2·19	94·20 ± 1·55	8·21	845
Total less Cerebro-spinal-meningitis	1140·36 ± 2·54	94·59 ± 1·79	8·29	633

Tropical Natives. "Mine-boys."

Disease.	Mean.	σ	C. of V.	N.
Tuberculosis	1108·33 ± 10·88	96·77 ± 7·69	8·73	36
Total	1097·94 ± 7·85	99·41 ± 5·55	9·05	73

East Coast Natives. "New-boys."

Disease.	Mean.	σ	C. of V.	N.
Total	1150·00 ± 10·09	89·77 ± 7·14	7·81	36

East Coast Natives. "Mine-boys."

Disease.	Mean.	σ	C. of V.	N.
Tuberculosis	1095·16 ± 6·93	99·08 ± 4·90	9·05	93
Total	1104·05 ± 5·44	98·10 ± 3·85	8·39	148

The following values were obtained by grouping the weights into units of one hundred grams and calculating χ^2.

Tropical Natives.

"New-Boys" and "Mine-Boys."

$\chi^2 = 19·075$ $P = ·008$

East Coast Natives.

"New-Boys" and "Mine-Boys."

$\chi^2 = 4{\cdot}4058$ $P = {\cdot}495$

Tropical "Mine-Boys" with East Coast "Mine-Boys."

$\chi^2 = 8{\cdot}1106$ $P = {\cdot}231$

The number of cases in the groups "mine-boys" is unfortunately very small, nevertheless it will be noticed that among both Tropical and East Coast Natives, the "mine-boys" have a considerably lighter cerebrum than the "new-boys," and that the Tropical "mine-boys" agree more closely with the East Coast "mine-boys" than with Tropical "new-boys"; and further, that East Coast "new-boys" have actually a higher cerebrum weight than Tropical "new-boys," although in Table IV. it appeared that the East Coast group had the lighter cerebrum. It will be evident, therefore, that caution must be used before deducing any conclusions from the tribal differences shown in these tables.

It appears probable that at any rate among Tropical Natives, there is a difference in cerebrum weight according to whether the Native has worked on the mines before death or not; but whether this difference be due to the nature of the disease, to the effects of mine work, or is evidence of a selective death-rate on the "boys" who have the lightest cerebrum on the mines, or the newcomers who have the heaviest cerebrum, remains to be determined. There does not seem to be any definite evidence that an acute disease such as pneumonia tends to be associated with a brain of above the mean weight or that tuberculosis is associated with a particularly light brain. On the other hand, the intestinal diseases, which in this group are chiefly represented by dysentry, are apparently associated with a brain slightly above the average weight; this, if it be a real relationship, is the more remarkable, in that it is not likely that any increase in the weight is due to an additional amount of blood in the cerebral vessels; for this disease is accompanied by considerable loss of the body fluids. Having regard, however, to the size of the sample and its variability, too much stress must not be laid on this observation.

Although the "mine-boy" has apparently in both of the main groups a lighter cerebrum than the "boy" dying before being allotted to work, yet, as we have seen, he is on the average a taller "boy." If in the group of deaths among "mine-boys" here dealt with, the taller Native has the lighter brain, we might expect to find—bearing in mind the fact that in these groups the brain weights show larger coefficient of variation than among "new-boys"—that there is a lower coefficient of correlation for height and weight of cerebrum than among the "new-boys." Among all Tropical Natives we find the correlation of stature with weight of cerebrum is considerably larger than that among East Coast Natives (see Table VIII.), and as already mentioned, the former group contains very few "mine-boys," while in the latter the majority belong to this class. It will be necessary to collect larger numbers before any definite opinions can be formed in regard to a selective death-rate in respect to brain weight; nevertheless, these figures serve to point a warning, namely, that great care must be exercised before racial differences are asserted to exist from the examination of records of post-mortem weights, when the conditions under which the subjects were living prior to death were not comparable. While the cerebrum weight of the Tropical Native is apparently greater than that of the East Coast Native, there is no evidence that any similar variation occurs in regard to the weight of the cerebellum, pons, and medulla.

One curious feature is noticeable on reference to Tables IV. and V. At first sight we should hardly expect to find the coefficient of variability of the cerebellum, pons, and medulla, to be greater than that of the cerebrum, but in each of the above cases it is so. Dr. Raymond Pearl has drawn attention to the fact that the cerebrum is more variable than the whole brain; he writes: "The cerebral hemispheres are markedly more variable in weight as judged by the coefficient of variation than is the entire encephalon. This greater variation may denote a really greater variability of this part of the brain, or it may be due to the variable element which enters as the result of the separating of these organs from the rest of the brain. It seems likely to me that it is in part, at least, real for the following reasons: first, the cerebral hemispheres have attained relatively enormous development late in their phylogenetic history; and again from the functional standpoint the cerebrum is the most variable part of the brain."[9] We agree with Dr. Pearl in regard to his latter surmises, but as to the greater variability being possibly due to "a variable element which enters as a result of the separating of these organs," we think there would probably be considerably more variation produced by severing the medulla at different distances from the pons,

than in separating the cerebrum by division of the crura. Further, the greater variability of the cerebellum, pons, and medulla, observed in our figures may, we think, probably be due to this variation in length of the medulla included in the specimens: clearly these organs will have two such sources of error, while the cerebrum can have but one.

The weight of the cerebrum is correlated with the weight of the rest of the encephalon, but our figures do not permit of any accurate measurement of this value for strictly homogeneous groups. The following table gives the correlation of cerebrum weight with that of the cerebellum, pons, and medulla.

TABLE VII.

Cerebrum with Cerebellum, Pons, and Medulla.

		Moçambique.	Total Tropical.	East Coast.
r	=	·4975 ± ·0250	·4604 ± ·0202	·3565 ± ·0428
$r\frac{\sigma_c}{\sigma_p}$	=	1·2451	1·1010	·7271
$r\frac{\sigma_p}{\sigma_c}$	=	·1988	·1910	·1748

Much has been written in regard to the relation of stature to brain weight, and a short consideration of this point will not be out of place. It has been claimed by some authors that there is a close agreement between height and brain weight. This may be true as regards tribal values for similar races, but recent researches prove that the correlation among individuals is in all cases only a low one. Our observations show that this is also the case in regard to these Bantu races, and that the correlation values are similar to those obtained from European data.

Dr. Raymond Pearl[10] gives the following values for the correlation of Brain-weight and Stature in the following groups, for young males:—

Swedes	·1830 ± ·0320
Hessians	·1823 ± ·0299
Bohemians ...	·2034 ± ·0397
Bavarians	·1664 ± ·0343

Cerebrum and Stature Eng. Males r = ·1202 ± ·0397.

Our values are as follows:—

TABLE VIII.

Stature with weight of Cerebrum.

		Moçambique.	Tropical Natives.	East Coast Natives.
r	=	·1415 ± ·0326	·1391 ± ·0251	·0402 ± ·0495
$r\frac{\sigma_c}{\sigma_s}$	=	·2329	·2131	·0651
$r\frac{\sigma_s}{\sigma_c}$	=	·0860	·0908	·0248

Stature with weight of Cerebellum, Pons, and Medulla.

		Moçambique.	Tropical Natives.	East Coast Natives.
r	=	·0957 ± ·0330	·1740 ± ·0248	·1065 ± ·0490
$r\frac{\sigma_c}{\sigma_s}$	=	·0634	·1094	·0784
$r\frac{\sigma_s}{\sigma_c}$	=	·1444	·2769	·1447

In both the latter groups the correlation of stature and cerebrum is lower than that of the rest of the brain and stature, the Moçambique group, however, is an apparent exception to this rule if it may be so termed. In regard to the cerebrum and stature value for Tropical Natives, this does not differ materially, having regard to the probable errors, from that found by Dr. Pearl for English Males. The value for the East Coast Natives is considerably below that for the Tropical Natives, and for English Males. We have already seen that, for some reason or other, among "mine-natives" the cerebrum weights are apparently less than that of Natives dying before allotment to the mines, and on the other hand these "mine-natives" may have a higher stature. If the explanation that selective death-rates in regard to these characters are taking place be correct, this may have some influence in lowering the correlation between these characters in this group; and the fact that there is little or no evidence of selection in regard to cerebellum, pons, and medulla weights, might account for the higher values found for these organs when correlated with stature. The following suggestion may be put forward as a possible explanation of this observation. The Native with the heavier brain and shorter stature conforms more closely to the European ratio of cerebrum weight to height, and he may therefore represent a higher type of development than the mean of his race, and thus be less stable, and also less resistant to abnormal conditions.

The ratio of stature in c.m.s. to cerebrum, and to cerebellum, pons, and medulla weights in grams for the various groups is shown below:—

TABLE IX.

Ratio of Weight, (1) Cerebrum, and (2) Cerebellum, Pons, and Medulla, to Stature.

Weight in Grams to Stature in Centimetres.

Country of Origin.	Cerebrum.	Cerebellum, Pons, and Medulla.
Moçambique	6·80	0·996
Quilimane	6·77	0·980
Nyassa	6·77	0·998
Tete	6·76	1·014
Total Tropical	6·79	0·994
Inhambane	6·56	0·997
M'chopi	6·40	0·964
Gazaland	6·49	0·990
Maputaland	6·59	0·974
East Coast Total	6·51	0·987

Marshall has given the ratio for Europeans of cerebrum in grams to height in centimetres as seven. If we accept this as the correct ratio for Europeans, it will be apparent that the ratios here recorded are of a rather lower value, and the cerebrum weights would have to be increased by about thirty-five grams for Tropicals, and eighty-six grams for East Coast Natives to bring the ratio to the value seven. From the table of weights of cerebrum and stature for English Males given by Dr. Pearl, and already referred to, we find the ratio to be 6·9, and presumably all adult ages may be included in this table. It has been shown by many writers on the subject that brain weight is negatively correlated with age after growth is complete. We might expect, therefore, that this ratio would show diminishing values as the mean age of the group was increased, unless the decrease in height with age occurred at a similar rate, which there is reason to doubt. Thus, there is some *a priori* reason for considering that the Bantu cerebrum is rather lighter in relation to stature than that of the European.

The following table gives the constants for the distribution of cerebrum weights for the Mocambique group:—

TABLE X

Mean	=	1136·41 ±3·26
σ	=	98·2325 ± 2·3085
β_1	=	·0189 ± ·0074
β_2	=	2·7780 ± ·1823
N	=	412

These values for the " betas " are not far from those required to give a normal distribution. The actual type is Pearson's Type I., and the mean is in advance of the mode. Having regard, however, to the probable errors, it would not be safe to conclude that this distribution is not in reality normal, particularly when we recollect that the group is not really homogeneous.

SKULL THICKNESS.

There is a general impression current that the Native's skull is thicker than that of the European. We have heard it urged that the native's immunity to the ill effects following head injuries is due to this cause. We have formed the opinion, after witnessing many post-mortems on natives and examining their skulls, that this is probably an incorrect view, so far at least as it applies to the races here dealt with. We are aware that general impressions of this kind are very apt to be misleading, and we merely record ours here without wishing to attach to it any undue value.

The difficulty of dealing with this subject in an accurate manner is considerable, and we have not been able to devise any method of recording the average thickness of a skull by one number. The thickness of individual skulls varies greatly even in closely adjacent portions. We thought, however, that tribal or racial differences might be discovered, if present, by taking a series of measurements at more or less fixed points and determining average values. The method of obtaining the measurements were as follows:—After the " skull-cap " had been removed, the thickness of the skull at the line of incision was determined by calipers at eight points, viz., (1) occipital protuberance, and (2) at about one and a half centimetres on either

side of the thick portion. The mean of these two readings was recorded. (3) The thinnest portion of the skull on each side under the temporal muscle lying within about two centimetres anterior to the external auditory foramen. These two measurements were added together, so that, to obtain the mean value for one side, the recorded measurements require to be divided by two. (4) The greatest depth of the frontal crest measured to the inner table of the skull, even when this did not occur on the line of incision; and (5) a value on each side of this eminence and distant about a centimetre from it (unless a frontal sinus was present at the level of removal of the "skull-cap," in which case the measurement was taken at the extremities of this cavity) and the mean of these two values recorded as the frontal thickness. We may here remark that the frontal sinuses of these natives, more particularly those from Tropical Areas, appear to be much larger than these spaces in the European, and often extend upwards from three to even six centimetres from the level of the supraorbital arch.

On Plate I. are shown three sections (actual size) of the anterior portion of the skull, cut at the usual level for removal of the skull-cap, as examples of the not uncommon development of the frontal sinuses. The photographs (Plate II.), which were taken by illuminating the skull from the interior, indicate the height to which the sinus extends. The sinus shown in figure 1 extends five c.m.s. from the line of incision. In all these specimens the bone appears to be absolutely normal; it does not exhibit any roughening of the surface or other pathological condition.

TABLE XI

Skull Thickness in Temporal Region.

Combined measurement of both sides.

Country of Origin.	Mean.	σ	C. of V.	N.
Moçambique	4·3604 ± ·0328	1·2074 ± ·232	27·69	616
Nyassa	4·2810 ± ·0739	1·2827 ± ·0523	29·96	137
Quilimane	4·4111 ± ·0969	1·3634 ± ·0667	30·91	90
Tete	3·6429 ± ·1513	1·1867 ± ·1070	32·58	28
Total Tropical	4·3301 ± ·0284	1·2425 ± ·0201	28·69	871
East Coast	3·7778 ± ·0733	1·1290 ± ·0518	29·88	108

TABLE XII.

Average Thickness of Skull at Side of Occipital Protruberance.

Country of Origin.	Mean.	σ	C. of V.	N.
Moçambique	6·1656 ± ·0353	1·3000 ± ·0250	21·08	616
Nyassa	6·1861 ± ·0749	1·3000 ± ·0530	21·01	137
Quilimane	6·3000 ± ·0894	1·2578 ± ·0615	19·97	90
Tete	6·6082 ± ·1291	1·0125 ± ·0913	15·32	28
Total Tropical	6·1855 ± ·0307	1·3440 ± ·0217	21·73	871
East Coast	5·8611 ± ·0911	1·4041 ± ·0644	23·96	108

TABLE XIII.

Average Thickness of Skull to Side of Frontal Crest.

Country of Origin.	Mean.	σ	C. of V.	N.
Moçambique	5·0214 ± ·0443	1·6507 ± ·0313	32·86	631
Nyassa	5·1087 ± ·0892	1·5531 ± ·0631	30·40	138
Quilimane	5·5899 ± ·1112	1·5553 ± ·0786	27·82	89
Tete	5·2778 ± ·1478	1·3147 ± ·1045	24·91	36
Total Tropical	5·1018 ± ·0366	1·6234 ± ·0259	31·82	894
East Coast	4·8894 ± ·0729	1·5588 ± ·0515	31·88	208

TABLE XIV.

Depth of Frontal Crest.

Country of Origin.	Mean.	σ	C. of V.	N.
Moçambique	11·6569 ± ·0876	3·2637 ± ·0620	28·00	631
Nyassa	11·9203 ± ·2027	3·5296 ± ·1433	29·61	138
Quilimane	11·6683 ± ·2198	3·0748 ± ·1555	26·35	89
Tete	10·9445 ± ·2391	2·1271 ± ·1691	19·44	36
Total Tropical	11·6801 ± ·0734	3·2567 ± ·0591	27·88	894
East Coast	10·4567 ± ·1368	2·9242 ± ·0967	27·96	208

TABLE XV.

Values of β_1 and β_2 in the Moçambique Group.

Region.	β_1	β_2
Temporal	0·1319 ± ·0381	2·7292 ± ·1052
Occipital	0·0585 ± ·0220	2·8859 ± ·1264
Frontal	0·6784 ± ·2189	3·9372 ± ·6608
Frontal Spine	0·2758 ± ·1054	3·2277 ± ·3105

In all cases the native from Tropical Areas appears to have a slightly thicker skull than the native from the East Coast, South of Latitude 22° S. The variability in the thickness is approximately the same for all measurements in the two groups. The occipital measurement is, however, slightly more constant than any of the other recorded values. In all the distributions for the Moçambique natives the type is that of Pearson's Type I., and the mean is in advance of the mode. Although the actual values of the " betas " lead to skew curves, the probable errors make us hesitate to suggest that if our population were homogeneous and the numbers larger, we should not find that these distributions would be well fitted by the normal curve of errors.

Having obtained the above values for native skulls, we thought it would be of interest to compare the results with similar measurements for Europeans. We were unable, however, to find any similar records, and so referred the matter to Dr. D. E. Derry, University College, London. We are much indebted to him for sending us a report on the " Thickness of the Human Skull," by Dr. R. J. Anderson, published in 1882. Unfortunately, the sites at which most of our measurements were taken do not correspond with those adopted by Dr. Anderson, and we regret that we were not aware of his work at the time when our measurements were first undertaken. Two of his measurements, however, appear to correspond approximately with ours, namely, " G. in the middle fossa, near the centre of the squamous part of the temporal bone," and " I. occipital at the middle of the inferior fossae." We have, therefore, obtained the mean value of his series for male skulls in these positions, and converting inches into millimeters the values are as follows:—G. = 5·63 and I. = 7·89. It will be seen that if these points are really comparable with our measurements at " Temporal Region " and " Side of Occipital Protruberance " the

native skull is appreciably thinner than that of the European. We do not consider that we can lay any stress on the comparison for the reasons given, but at any rate there is here no evidence to support the contention that the native skull is thicker than that of the European.

CEPHALIC AND CRANIAL INDICES.

It has only been possible for us to obtain head and skull, length and breadth, measurements in a comparatively few cases. Horizontal length and breadth measurements were taken before removal of the scalp, and subsequently on the skull, after its removal at approximately the same places. The analysis of the values obtained are given in Table XVI., the natives being classed into only two groups, "Tropical" and " East Coast."

TABLE XVI.

District of Origin.	Mean.	σ	C. of V.	N.
Skull Length.				
Tropical	186·14 ± ·26	6·1448 ± ·1846	3·30	252
East Coast	186·92 ± ·76	6·7757 ± ·5386	3·63	36
Head Length.				
Tropical	190·63 ± ·27	6·3500 ± ·1908	3·33	252
East Coast	192·08 ± ·75	6·7139 ± ·5337	3·50	36
Skull Breadth.				
Tropical	133·61 ± ·20	4·8167 ± ·1447	3·61	252
East Coast	132·81 ± ·61	5·4151 ± ·4304	4·08	36
Head Breadth.				
Tropical	139·19 ± ·20	4·6649 ± ·1401	3·35	252
East Coast	137·75 ± ·65	5·7657 ± ·4583	4·19	36

In the following table we have collected some of the measurements of skull length and breadth, and the cephalic index, for negroes, which have already been published.

TABLE XVII.

District or Tribe.	Length.	Breadth.	Cephalic Index.	N.
11. North of Africa	182·85	133·15	72·87	39
11. Algeria, Soudan, and West Coast...	185·04	135·20	73·28	54
12. Congo	177·78 ± ·62	138·52 ± ·48	77·99 ± ·25	50
12. Gaboon. (1864)	179·48 ± ·53	135·48 ± ·32	75·48 ± ·26	50
12. Gaboon. (1880)	182·33	138·22	75·86	18
12. Angoni	184·34	134·58	73·05	25
12. Kaffir	190·62	137·36	72·13	36
12. Zulu	184·15	137·05	74·27	19
12. Negro, Northern	182·85	133·15	72·87	39
Tropical Natives	186·14 ± ·26	133·61 ± ·20	73·01 ± ·12	252
East Coast Natives	186·92 ± ·76	132·81 ± ·61	71·53 ± ·38	36

In Table XVIII. we give the cephalic and cranial indices for the natives from the two main geographical areas, dividing those from tropical districts into sub-groups.

TABLE XVIII.

District of Origin.	Mean.	σ	C. of V.	N.
Cranial Index.				
Moçambique	71·65 ± ·15	2·8660 ± ·1091	4·00	157
Quilimane	71·18 ± ·47	3·6845 ± ·3321	5·18	28
Nyassaland	72·61 ± ·32	2·9000 ± ·2244	3·99	38
Tete, B.C.A.	71·98 ± ·35	2·7621 ± ·2446	3·84	29
Total Tropical	71·65 ± ·13 β_1 = ·0043	2·9951 ± ·0900 β_2 = 3·5362 ± ·7253	4·18	252
East Coast	70·35 ± ·37	3·1635 ± ·2587	4·50	36
Cephalic Index.				
Moçambique	72·86 ± ·14	2·6876 ± ·1023	3·69	157
Quilimane	72·61 ± ·44	3·4676 ± ·3125	4·78	28
Nyassaland	73·66 ± ·35	3·2406 ± ·2507	4·40	38
Tete, B.C.A.	73·16 ± ·30	2·3965 ± ·2122	3·28	29
Total Tropical	73·01 ± ·12 β_1 = ·0010	2·8319 ± ·0851 β_2 = 3·2912 ± ·4972	3·88	252
East Coast	71·53 ± ·38	3·2583 ± ·2665	4·56	36

It will be noticed that in regard to the distributions of Tropical Natives, both the distributions of the cranial and cephalic indices are, within the limits of the probable errors normal, and conform to the observations recorded by Miss Fawcett, who wrote: " With the series of skull measurements such as the present, which are long for the craniologist, if short for the statistician, we shall reach for most practical purposes adequate graphical representation of the frequency by using the normal curve of deviation: $y = y_o e^{-x^2/(2\sigma_2)}$

The mean cephalic index is, among Tropical Natives, 1·36 units, and for East Coast Natives 1·18 units greater than the mean cranial index. The constants for the distribution of the difference of the two indices, including both Tropical and East Coast Natives in the series, are as follows:—

Cephalic Index minus Cranial Index.

Mean	=	1·2366 ± ·0524
σ	=	1·3210 ± ·0371
β_1	=	·0193 ± ·1412
β_2	=	3·2556 ± ·5000
N	=	288

Thus, while for the whole series of measurements the cephalic index is greater than the cranial index, this is not necessarily the case when individual examples are dealt with.

Table XVI. shows that the average allowance to be made for scalp thickness, is for length, for Tropical Natives 4·5 m.m., and for East Coats Natives 5·16 m.m., and for breadth, 5·58 and 4·94 respectively. These values are considerably smaller than those obtained by direct measurement of scalp thicknesses. The thicknesses given in Table XIX. were obtained by placing a finely graduated rule against the freshly cut edge of the scalp and reading off the thickness. By this method no compression was exercised which it was difficult to avoid if calipers were used; on the other hand, it is possible a certain amount of flattening and evertion of the edges took place, giving a reading rather too high. When using calipers to the head a considerable compression of the scalp may take place, and this may account for the discrepancy between these two sets of measurements.

SCALP MEASUREMENTS.

The records in regard to thickness of scalp for Tropical Natives have been tabulated for "new-boys" and "mine-boys" in order to determine whether the class which suffered most from the wasting diseases had thinner scalps than the new arrivals. It will be observed that in the group "mine-boys" the thickness in the case of both measurements is less than that in the other groups, and also that the variability is greater. The number in the latter group is unfortunately very small, nevertheless, there is some indication that wasting diseases may bring about a small reduction in scalp thickness. The measurements were taken approximately at the sites where the calipers would be applied when measuring head length and breadth.

TABLE XIX.

Thickness of Scalp.

Tropical Natives.

	"New-boys."		*"Mine-boys."*	
	Temporal measurement. Two sides added together.	Frontal plus Occipital measurement.	Temporal measurement. Two sides added together.	Frontal plus Occipital measurement.
Mean	7·44 ± ·05	7·71 ± ·05	6·76 ± ·27	6·91 ± ·32
σ	1·8986 ± ·0341	1·9543 ± ·035	2·0452 ± ·1877	2·4665 ± ·2264
C. of V.	25·52	25·35	30·25	35·69
N.	704	704	27	27

Total East Coast Natives.

Mean	7·06 ± ·13	6·73 ± ·12
σ	1·9717 ± ·0917	1·8128 ± ·0828
C. of V.	27·93	26·94
N.	109	109

HEART WEIGHTS.

In considering the question of heart weights among the Natives comprised in our returns, an important point arises in connection with the change of residence which these "boys" undergo when arriving on the Rand. Many of them come from coastal and low lying districts, and are rapidly transferred to an altitude of nearly six thousand feet. It is usually assumed that a compensatory hypertrophy of the heart

takes place as a consequence; the hypothesis being, that owing to the decreased amount of oxygen per volume of air, more work must be undertaken by the heart. That this is so, has not, we consider, been definitely proved. It has been established that an increase in the number of erythrocytes occurs when an individual resides at an altitude, and that the viscosity of the blood is thereby increased; but whether this increased viscosity is compensated for by the greater oxygen absorbing efficiency of the blood, or whether there is still a balance of excess of work for the heart, has not yet, we think, been finally settled. If, however, when living at an altitude the heart is called upon for a greater amount of work (after acclimatisation has taken place) then it would seem reasonable to suppose that the normal heart would show signs of hypertrophy, and that we should find the average weight of hearts collected from post-mortem records of people dying after a period of residence at an altitude, was greater than among similar records from a coastal community.

Assuming the hypothesis that residence at an altitude produces cardiac hypertrophy to be correct, it would appear reasonable to expect that "mine-boys" would on the average have heavier hearts than "new-boys," for in addition to the fact that this latter class have only resided on the Reef for a few days, or at most a week or two before death, they also have not been doing the hard physical work to which the "mine-boy" has become accustomed. Reference to Table XX. will show that the figures recorded here do not support this assumption. Among "Tropical Natives" the "mine-boy" has an appreciably lighter heart than the fresh arrival, while among East Coast Natives, in this respect, there is no apparent difference in the two classes. The "mine-boys" in both groups, Tropical and East Coast, show greater variability in regard to heart weight than the "new-boys."

It cannot be assumed, however, that this observation proves the contention, that residence at an altitude is associated with hypertrophy of the heart, is unfounded, for the disease causing death is a factor which cannot be ignored. There are other possible factors concerned; for instance, it is conceivable that natives who have abnormally small hearts, or who have not the power to produce a compensatory hypertrophy, are more prone to develop chronic diseases; and thus an undue proportion of small hearts will appear in the mortality statistics of "mine-boys"; in other words, there is a selective death-rate in respect to the undersized heart. It has been contended that the tuberculous subject has on the average a smaller heart than the normal, but we do not know on what evidence this statement is made. Atheromatous degeneration of the arteries is very

rarely seen among these natives; and we are informed that it is also uncommon among European residents.* If it be true that cardiac strain is a factor in the production of this disease, its rarity may have some interest in this connection.

The constants for the distribution of heart weights for the four classes referred to, grouped according to the cause of death, are given in the table below. In cases where the heart itself was obviously diseased, that is where pericarditis or endocarditis was present, the weights have not been included when calculating these values; that is to say, only apparently healthy hearts have been included.

TABLE XX.

Heart Weights.

Disease.	Mean.	σ	C. of V.	N.
Tropical Natives. "New-boys."				
Intestinal	237·32 ± 3·19	42·79 ± 2·25	18·03	82
Tuberculosis	253·08 ± 7·82	59·11 ± 5·53	23·36	26
Other Diseases (excluding Heart Disease)	256·85 ± 3·10	51·21 ± 2·19	19·94	124
Hydro-nephrosis	260·58 ± 5·23	55·91 ± 3·70	21·46	52
Cerebro-spinal-meningitis ...	283·12 ± 2·40	51·96 ± 1·69	18·35	214
Pneumonia	285·44 ± 2·16	56·72 ± 1·53	19·87	313
Total	273·04 ± 1·33	56·06 ± 0·94	20·53	811
Tropical Natives. "Mine-boys."				
Tuberculosis	253·40 ± 8·84	65·51 ± 6·25	25·85	25
Total	252·85 ± 5·22	62·38 ± 3·69	24·67	65
East Coast Natives. "New-boys."				
Total	259·68 ± 4·94	50·24 ± 3·50	19·35	47
East Coast Natives. "Mine-boys."				
Tuberculosis	249·34 ± 4·84	62·62 ± 3·43	25·11	76
Total	260·00 ± 4·01	70·83 ± 2·83	27·24	142

* Glancoma, another disease frequently associated with high arterial tension, is, we are informed by Dr. Napier, much less common on the high veld than at the coast.

In the following table the heart weights recorded by Dr. M. Greenwood in his paper on Weights of Human Viscera[13] are given; ounces have been converted into grams for the convenience of comparison.

TABLE XXI.

General Hospital Population	383·57—369·68
Apparently healthy organs	318·94—312·98
Cases of Pneumonia	354
Cases of Valvula Disease and Aortic Aneurism ...	541

It is doubtful how far these figures are comparable with those in Table XX. Greenwood has shown that there is a sensible correlation of heart weight with age, and it is probable that his figures were derived from cases with a higher average age at death than ours. Nevertheless the figures suggest that the mean heart weight of the European is heavier than that of these Natives. Unfortunately we have not been able to obtain records of heart weights of Europeans dying in Johannesburg.

The distribution of heart weights is apparently slightly skew and leptokurtic. The value of the "betas" for the group "Tropicals" pneumonia, and "All Tropicals," is as under. It will be seen that the arithmetic mean is a fairly close approximation to the modal values of the distributions.

Hearts from cases of	β_1	β_2
Pneumonia (among Tropical Natives)	·1351 ± ·0295	3·4564 ± ·1386
All Tropical Natives, excluding deaths from heart disease	·1676 ± ·0185	3·4136 ± ·0801

SPLEEN WEIGHTS.

The question of the average spleen weights of residents in tropical and malarial regions is of some importance. It is generally believed that inhabitants of these districts have larger spleens than residents in non-malarious countries. The splenic enlargement is especially marked in children, and the use of the "splenic index" as a measure of the prevalence of malaria, is generally assumed to be practically of little value unless confined to children.

Among the Natives here dealt with the spleen weight is exceedingly variable, and the distribution very skew, so that the mean weight does not approximate to the modal or commonest weight; and,

therefore, if used in the sense of commonest weight will be quite misleading. The distribution of spleen weights cannot be fitted by a single Pearson curve. For " Tropical Natives " the constants lead to a J shaped curve with the start at about one hundred grams; this is clearly an incorrect value, and the unsatisfactory fit is, we consider, due to the heterogeneous nature of the material, owing to racial factors and cause of death. Dr. Greenwood's figures show similar irregularities, but not to the same extent.[13] For purposes of comparison we have combined two of his tables of spleen weights, namely, 358 cases, ages 25-35, and 536 with ages 35-45. The constants of these 894 spleen weights are: Mean 196·75 grams, $\sigma = 101·7323$, C. of V. 51·71, $\beta_1 = 1·6770$, $\beta_2 = 4·7421$, Mode 87·03. In this case, judging from the crude distribution, we might expect the modal value to be somewhere in the neighbourhood of 142 grams. The variability of these spleen weights is about ten per cent. less than that obtained from our returns.

TABLE XXII.

Spleen Weights.

Tropical Natives.

District.	Mean.	σ	C. of V.	N.
Moçambique	267·01 ± 4·63	162·46 ± 3·27	60·84	560
Quilimane	235·21 ± 7·51	132·63 ± 5·31	56·39	142
Nyassaland	295·72 ± 7·84	139·48 ± 5·54	47·17	144
Tete	332·04 ± 13·85	173·06 ± 9·80	52·12	71
Total Tropical	267·04 ± 3·50	157·33 ± 2·48	58·92	917

East Coast Natives.

Inhambane	368·33 ± 19·11	268·76 ± 13·51	72·97	90
M'chopi	316·86 ± 16·37	159·19 ± 11·58	50·24	43
Gazaland	399·61 ± 20·20	237·69 ± 14·28	59·48	63
Maputaland	320·84 ± 20·44	105·00 ± 14·46	32·73	12
Total East Coast	374·02 ± 11·19	239·15 ± 7·91	63·94	208

It will be noticed that the mean spleen weight of Tropical Natives is considerably higher than that of Europeans, as judged by Dr. Greenwood's figures, and that the East Coast Native has a still higher average weight. We are unable to suggest any reason for the fact that the East Coast figures show an increase in weight of forty-three per

cent. over that obtained from the Tropical Natives. The spleen weight from cases of tuberculosis is apparently higher than that obtained when other diseases were the cause of death, and there is a greater percentage of deaths from this cause among East Coast Natives, but the following table shows that the spleen weight of tuberculous East Coast cases is thirty per cent. heavier than that of Tropical Natives dying from the same disease, and a similar difference exists for other medical diseases.

The value of the "betas" for the group "All Tropical Natives" are, $\beta_1 = 3{\cdot}9347$, $\beta_2 = 8{\cdot}6664$.

TABLE XXIII.

Spleen weight in respect to cause of death.

Tropical Natives.

Disease.	Mean.	σ	C. of V.	N.
Tuberculosis	318·44 ± 16·99	196·76 ± 12·02	61·79	61
Pneumonia	280·48 ± 5·37	148·33 ± 3·80	53·88	347
Cerebro-spinal-meningitis...	266·28 ± 6·55	141·45 ± 4·63	53·12	212
Other medical causes ...	251·03 ± 7·28	159·72 ± 5·15	64·58	219
Intestinal diseases ...	204·87 ± 8·72	113·47 ± 6·17	55·39	77
East Coast Natives.				
Tuberculosis	410·72 ± 18·07	274·53 ± 12·78	66·84	105
Other medical causes ...	322·58 ± 12·89	193·89 ± 9·11	60·11	103

LIVER WEIGHTS.

The native from Portuguese territory is very constantly infected with bilharziosis, and it is not uncommon to find the embryos of the schistosomum hæmatobium in the liver on post-mortem examination. It appeared possible that the presence of this parasite might have some effect in increasing the weight of this organ, as it has been stated that pathological changes accompany their presence in the liver. To determine whether an increase of weight was associated with its presence, five hundred and seventy-nine liver weights of Tropical Natives were classified according to whether the parasite had been observed or not, with the following result.

TABLE XXIV.

Liver weights in relation to bilharziosis.

Tropical Natives.

	Mean.	σ	C. of V.	N.
Embryos present	1438·16 + 10·34	267·40 + 7·31	18·59	304
Embryos not found ...	1395·45 ± 10·46	257·27 ± 7·40	18·44	275

It will be seen that while the livers in which embryos have been found were rather heavier than the others, the difference can hardly be considered significant, and it seems unlikely that the frequency of this disease will materially affect the average liver weights in these groups.

TABLE XXV.

Liver Weights.

Territory.	Mean.	σ	C. of V.	N.
Tropical Natives.				
Moçambique and Nyassaland ...	1417·88 ± 7·36	262·74 ± 5·21	18·53	579
Quilimane	1480·37 ± 18·59	320·25 ± 13·15	21·63	135
Tete	1535·42 ± 31·18	257·38 ± 22·05	17·94	48
Total Tropical	1437·50 ± 6·84	277·92 ± 4·83	19·33	752
East Coast Natives.				
Gazaland	1550·00 ± 28·68	272·30 ± 20·28	17·57	41
M'chopi and Inhambane ...	1530·65 ± 20·75	296·67 ± 14·67	19·38	93
Total East Coast	1532·52 ± 16·23	287·82 ± 11·48	18·78	134

The other constants for the distribution of Total Tropical weights are, Mode 1357·23, β_1 ·5044 ± ·1537, β_2 4·1678 ± ·6224.

KIDNEY WEIGHTS.

Hydronephrosis of the kidney is not an uncommon condition of the Tropical and East Coast Native. This is due to the thickening and occlusion of the ureter due to bilharziosis. Such kidneys have been omitted from the table of weights given below.

TABLE XXVI.

Kidney Weights.

	Mean.	σ	C. of V.	N.
Tropical Natives	267·50 ± 1·29	58·37 ± 0·91	21·82	936
East Coast Natives	279·90 ± 2·92	59·93 ± 2·07	21·41	191
All Natives	269·60 ± 1·16	57·48 ± 0·82	21·32	1127

Mode 249·24, β_1 1·462 ± ·3838, β_2 5·8502 ± 2·3708.

INTESTINAL MEASUREMENTS.

TABLE XXVII.

Small Intestine.

	Mean.	σ	C. of V.	N.
Tropical Natives	736·28 ±2·76	109·16 ±1·95	14·83	713
East Coast Natives	678·93 ±8·20	128·13 ±5·80	18·87	111
Large Intestine.				
Tropical Natives	162·93 ±0·62	25·00 ±0·44	15·34	734
East Coast Natives	159·18 ±1·88	29·05 ±1·33	18·25	109
Appendix.				
Tropical Natives	11·54 ±0·06	2·47 ±0·04	21·40	734
East Coast Natives	11·74 ±0·18	2·75 ±0·13	23·42	105

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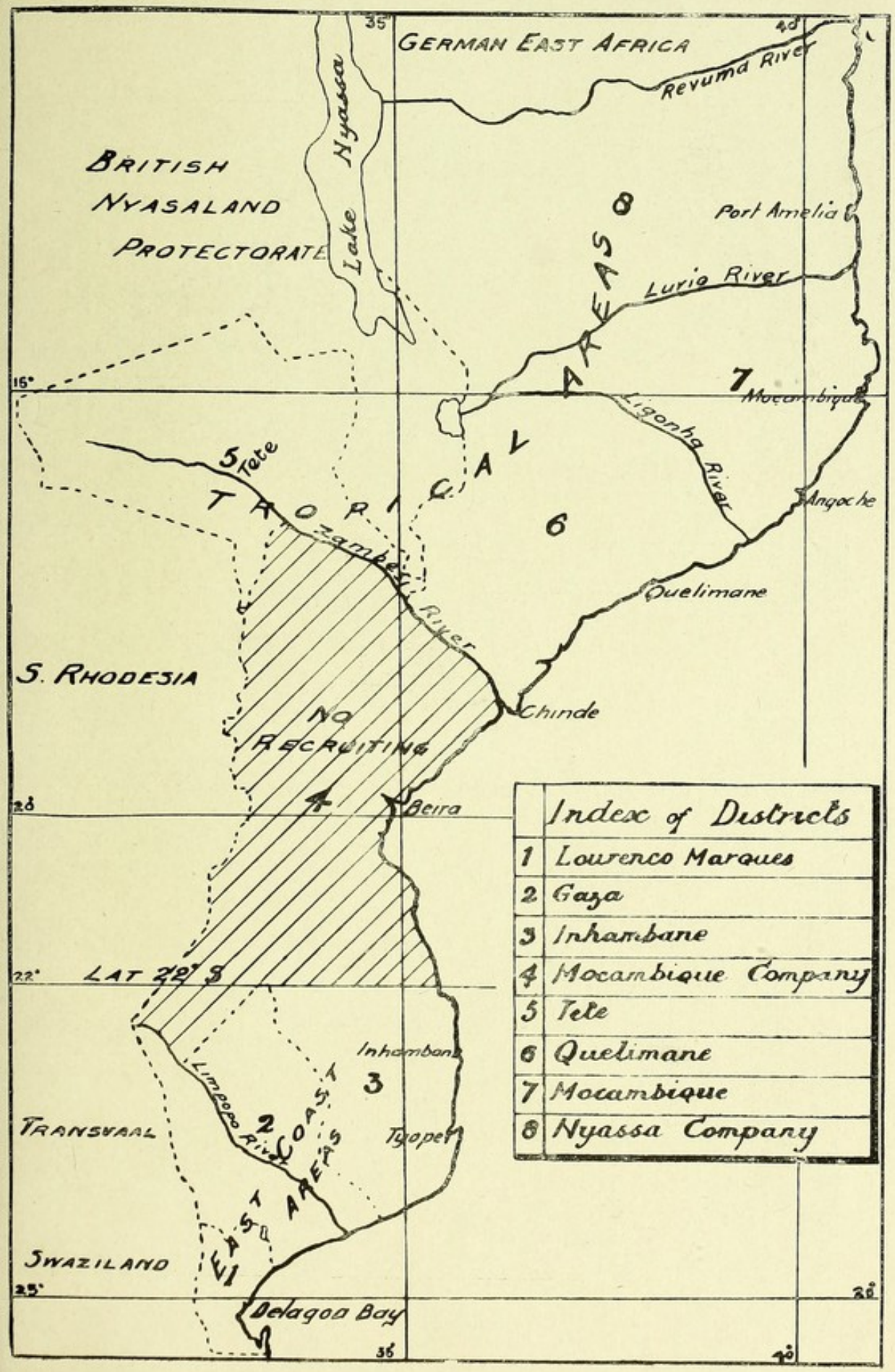
PORTUGUESE EAST AFRICA,

Showing recruiting areas of W.N.L. Association, Ltd.



	Index of Districts
1	Lourenco Marques
2	Gaza
3	Inhambane
4	Mocambique Company
5	Tete
6	Quelimane
7	Mocambique
8	Nyassa Company

PLATE I.

Sections through skull showing frontal sinuses at line of incision for removal of skull cap.

(Actual size.)

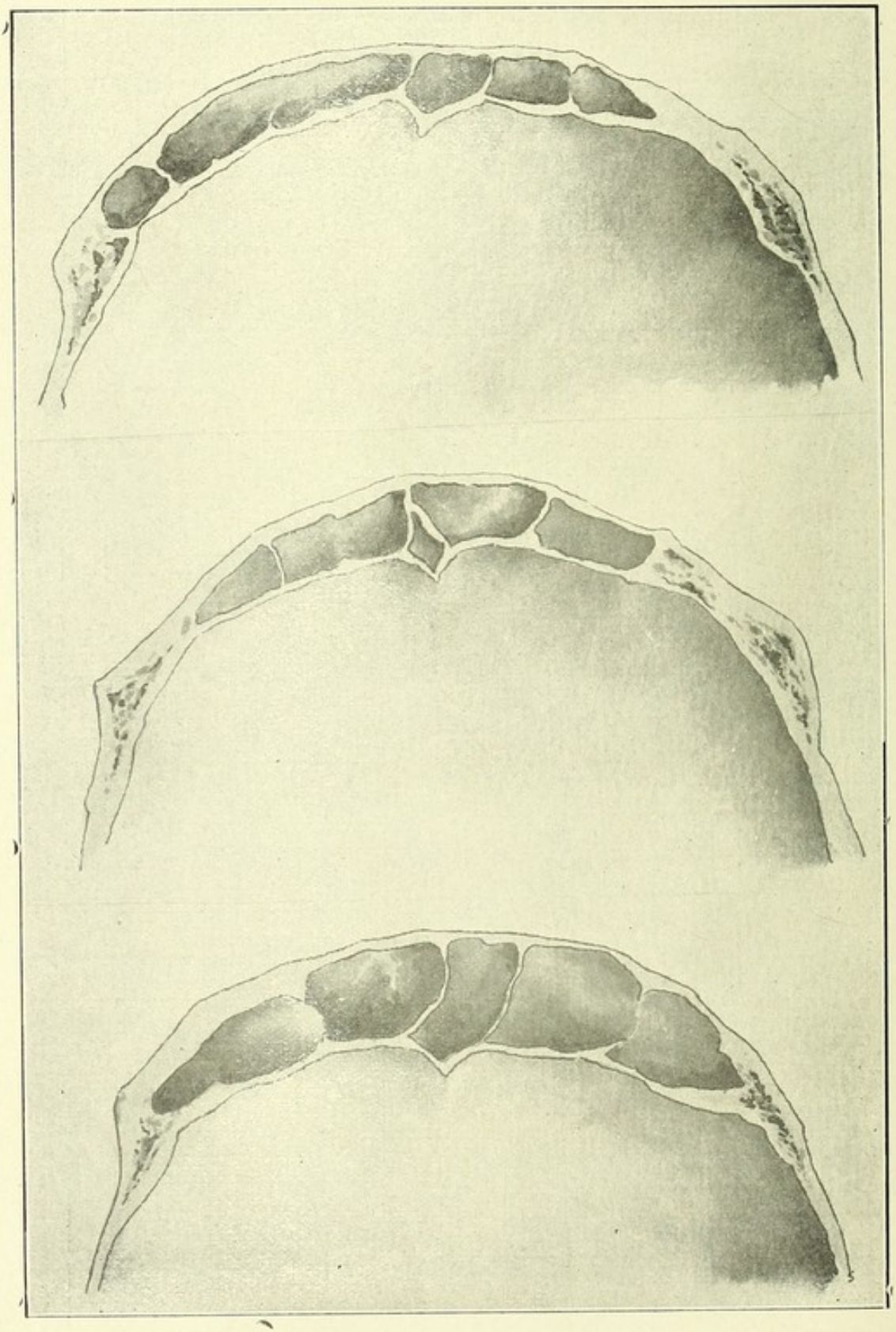
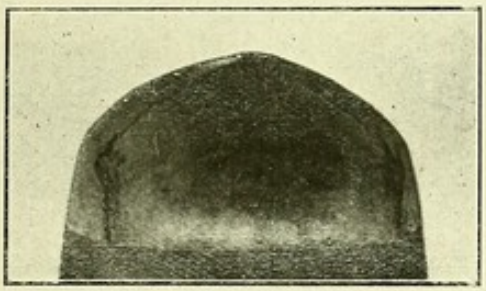
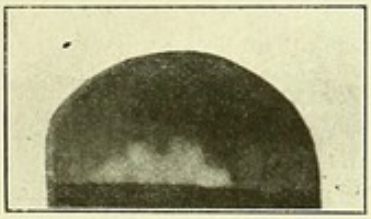
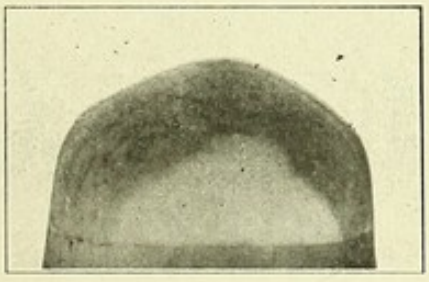


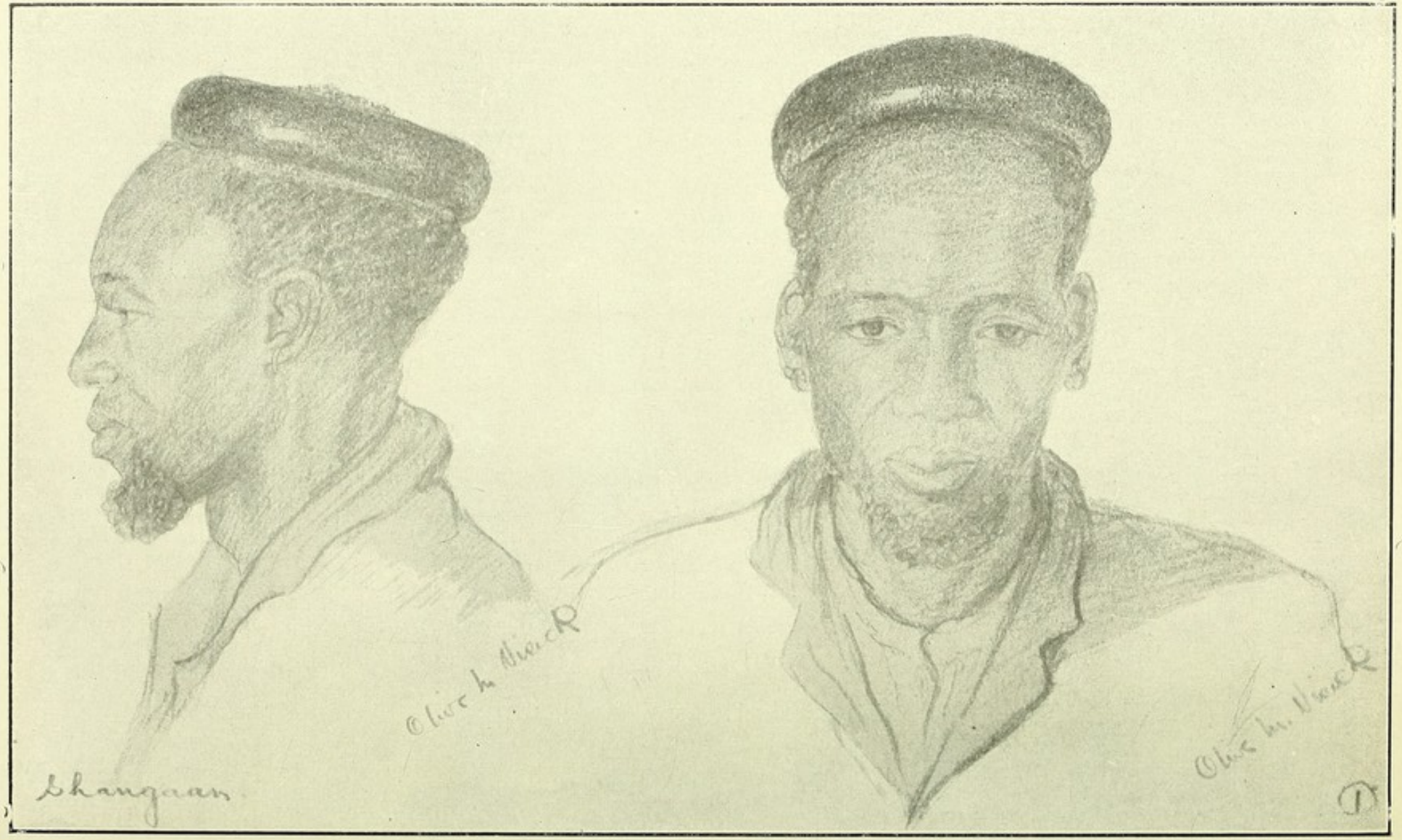
PLATE II.

Photographs showing development of frontal sinuses, corresponding to sections in Plate I.

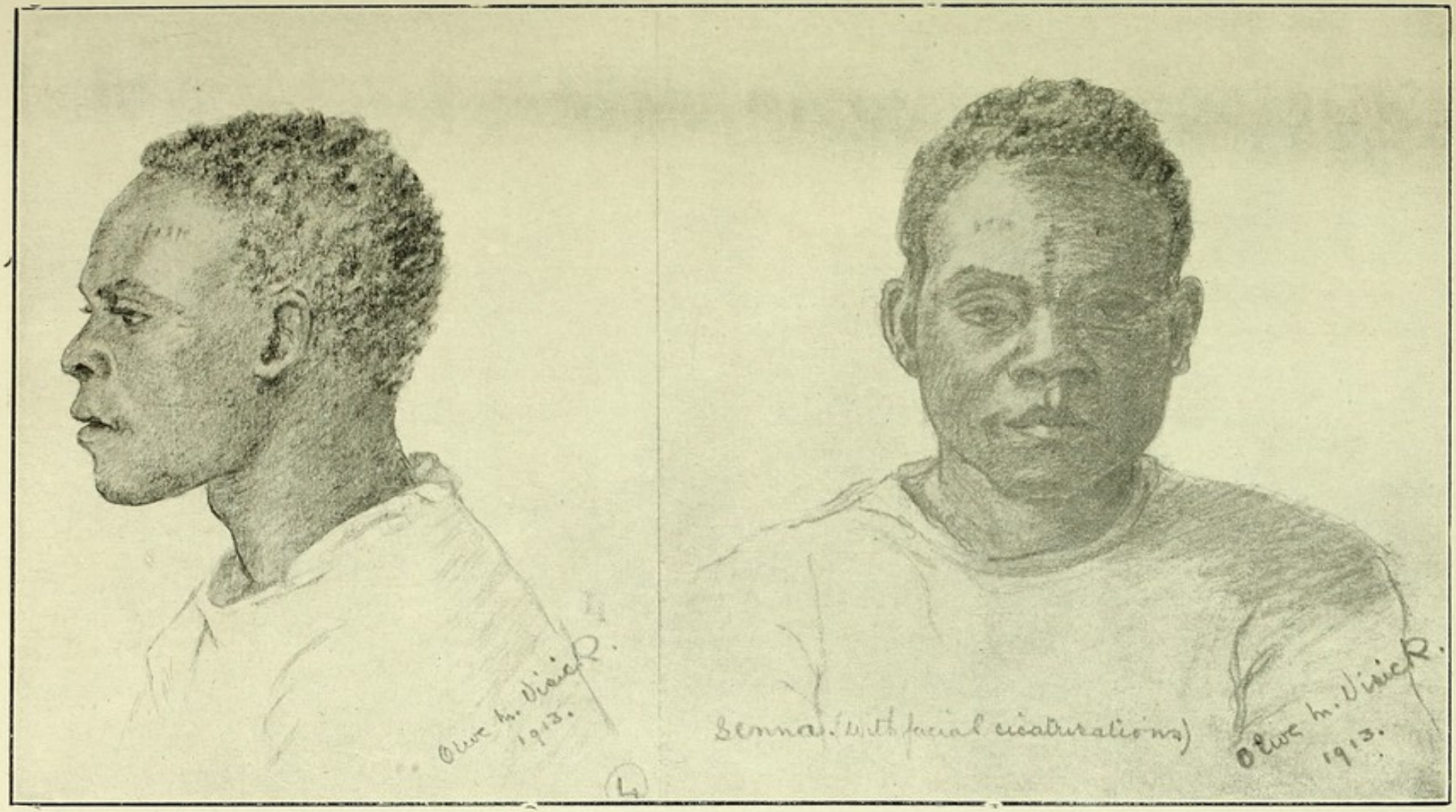




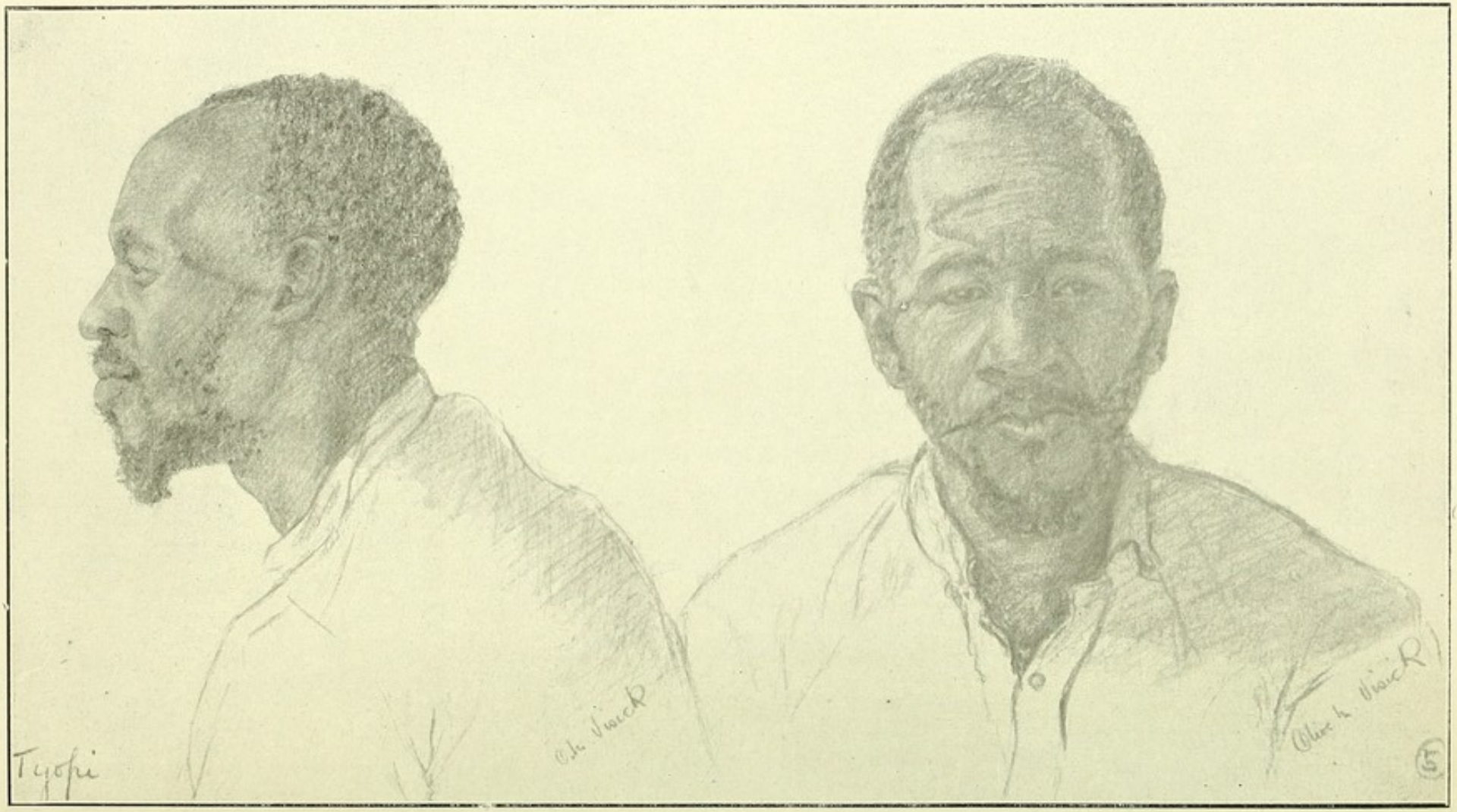




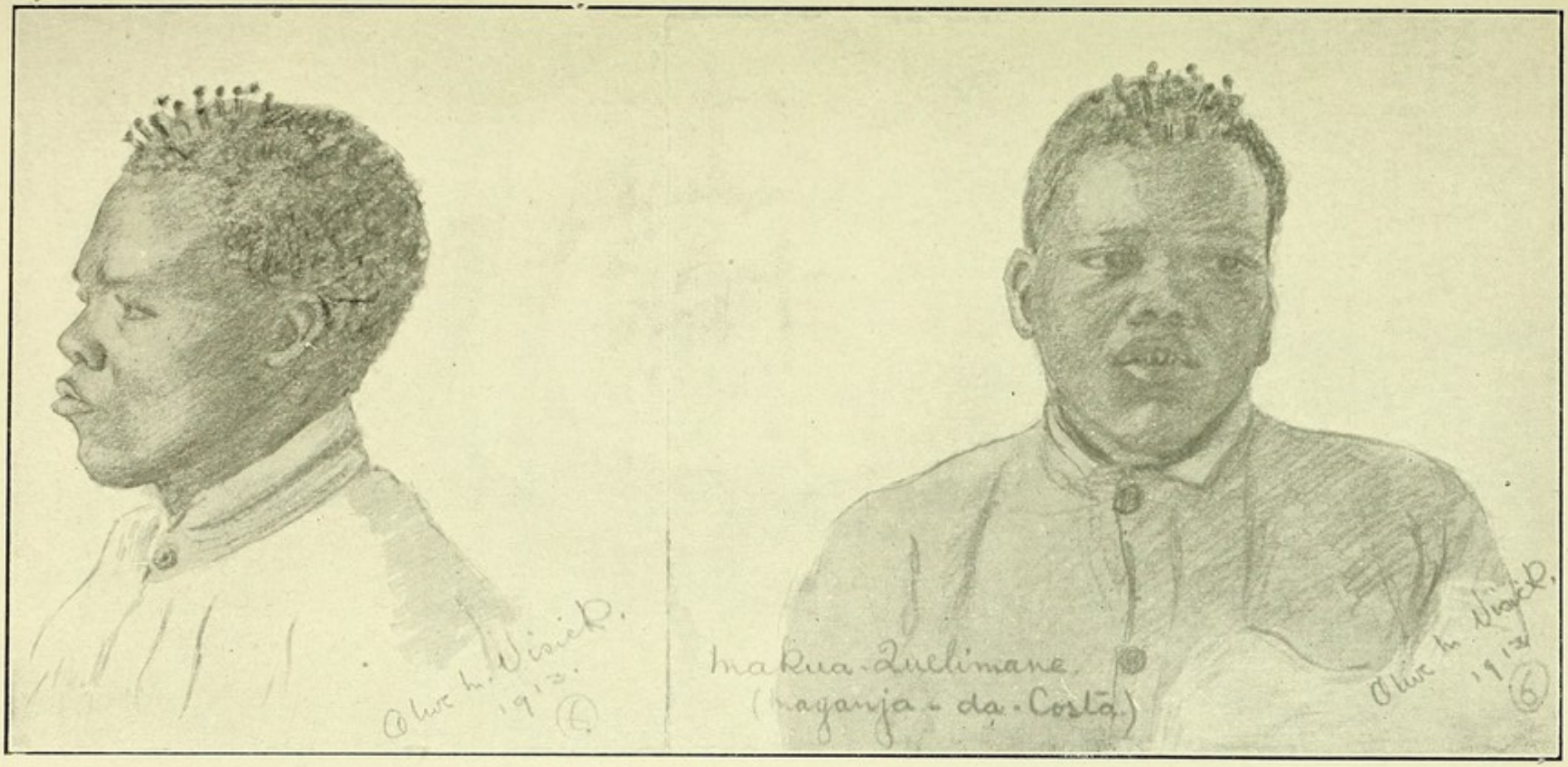
Shangaan.



Shangaan (from Senna).



Tyopi.



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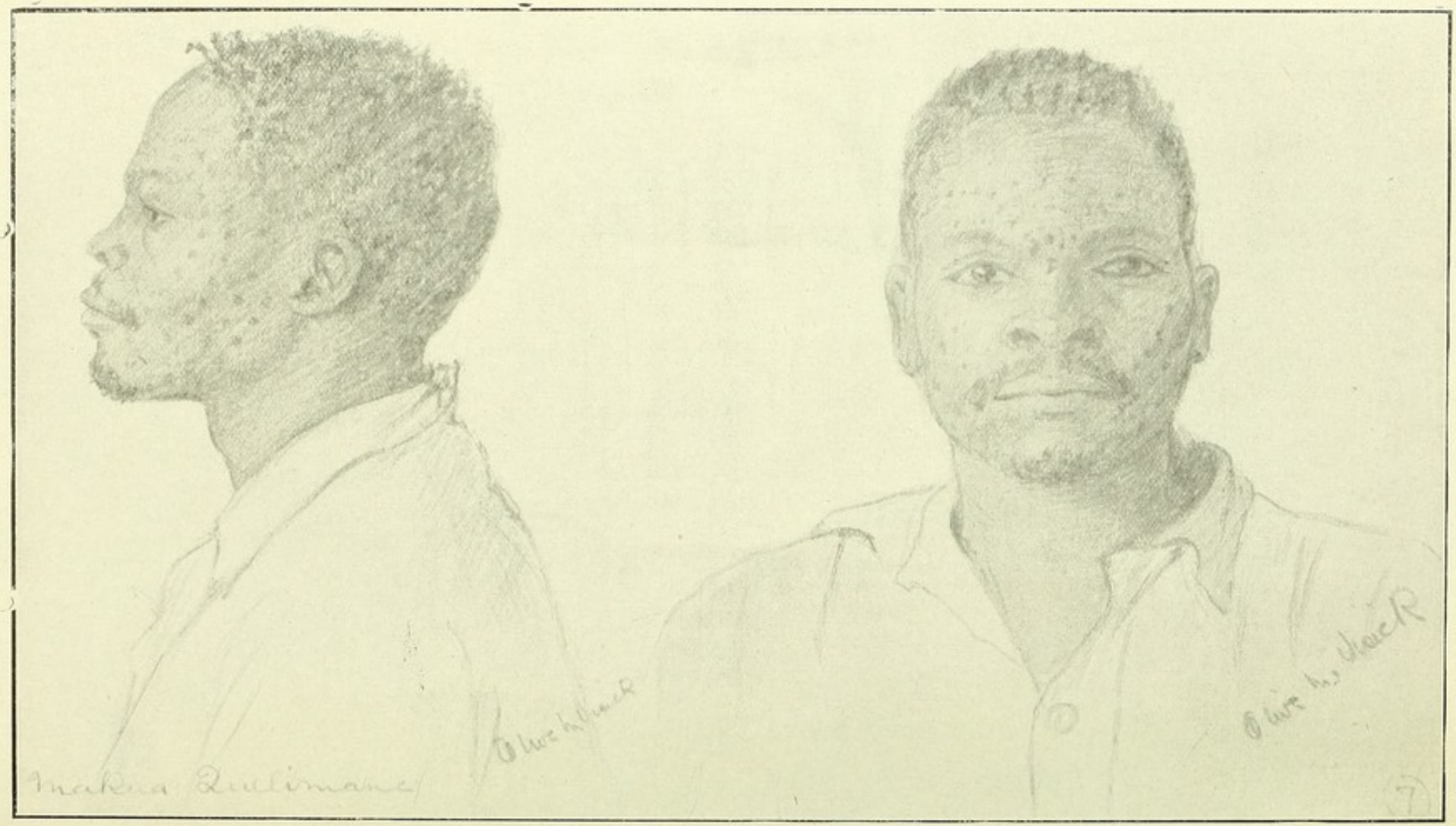

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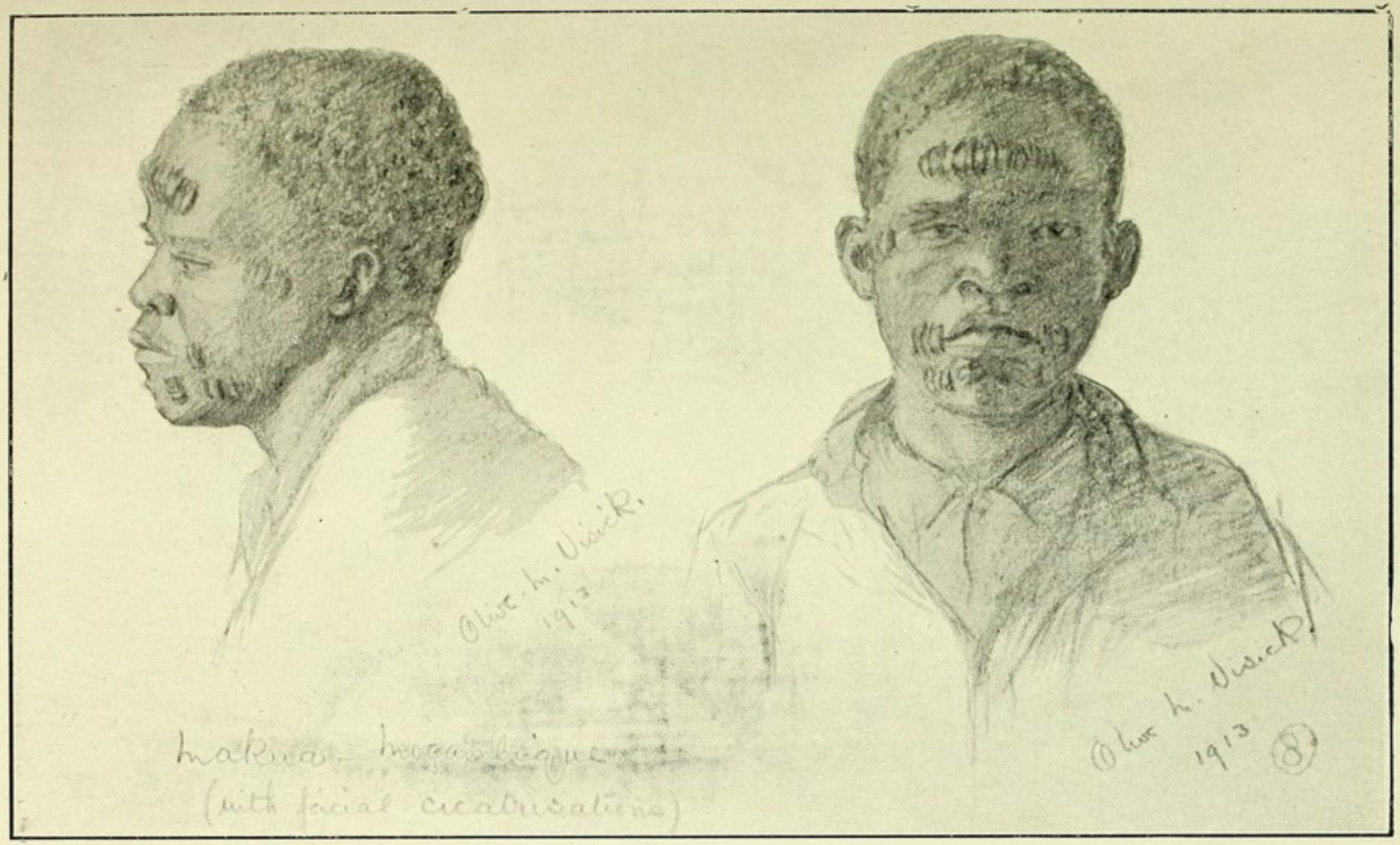

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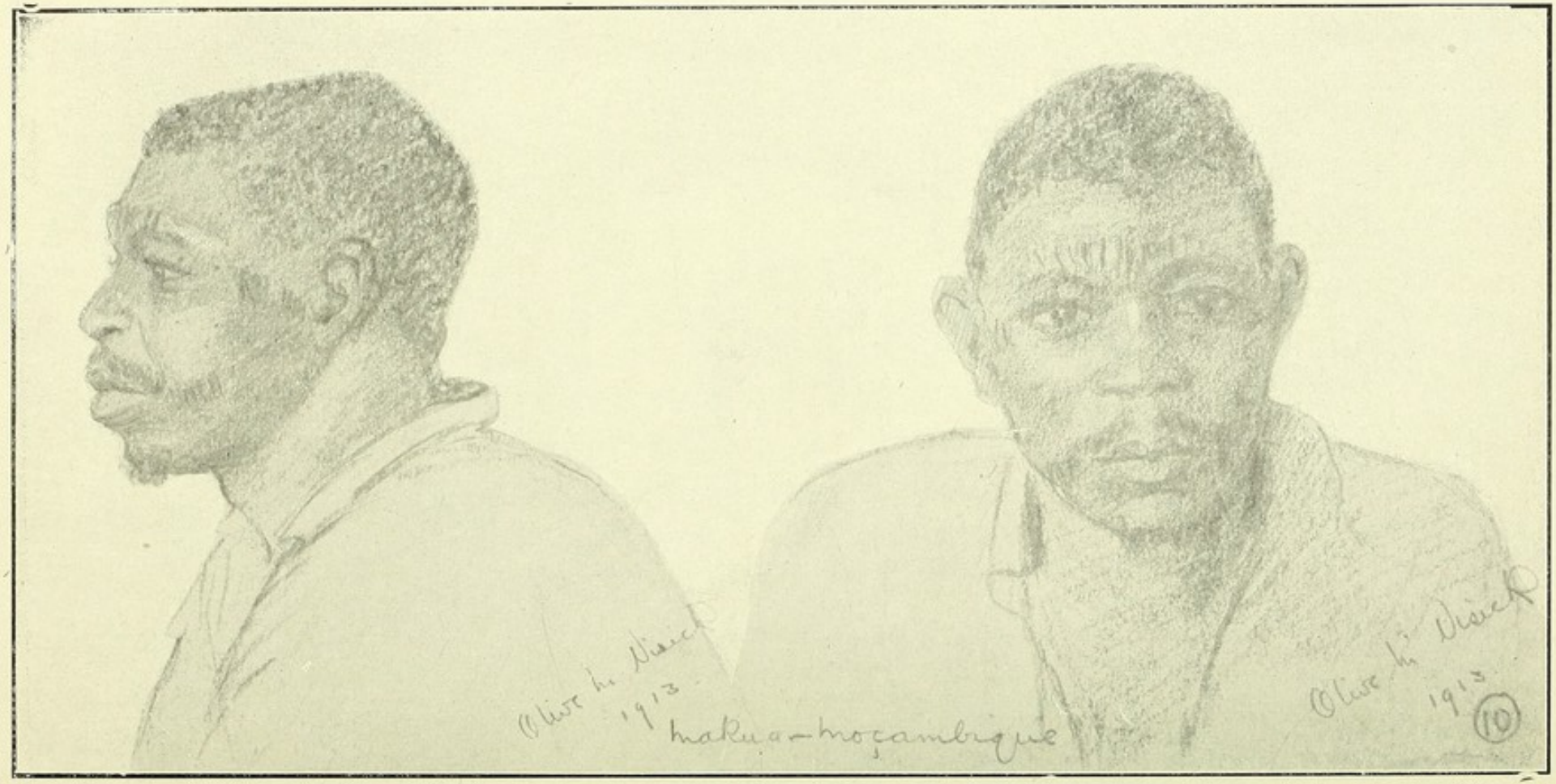

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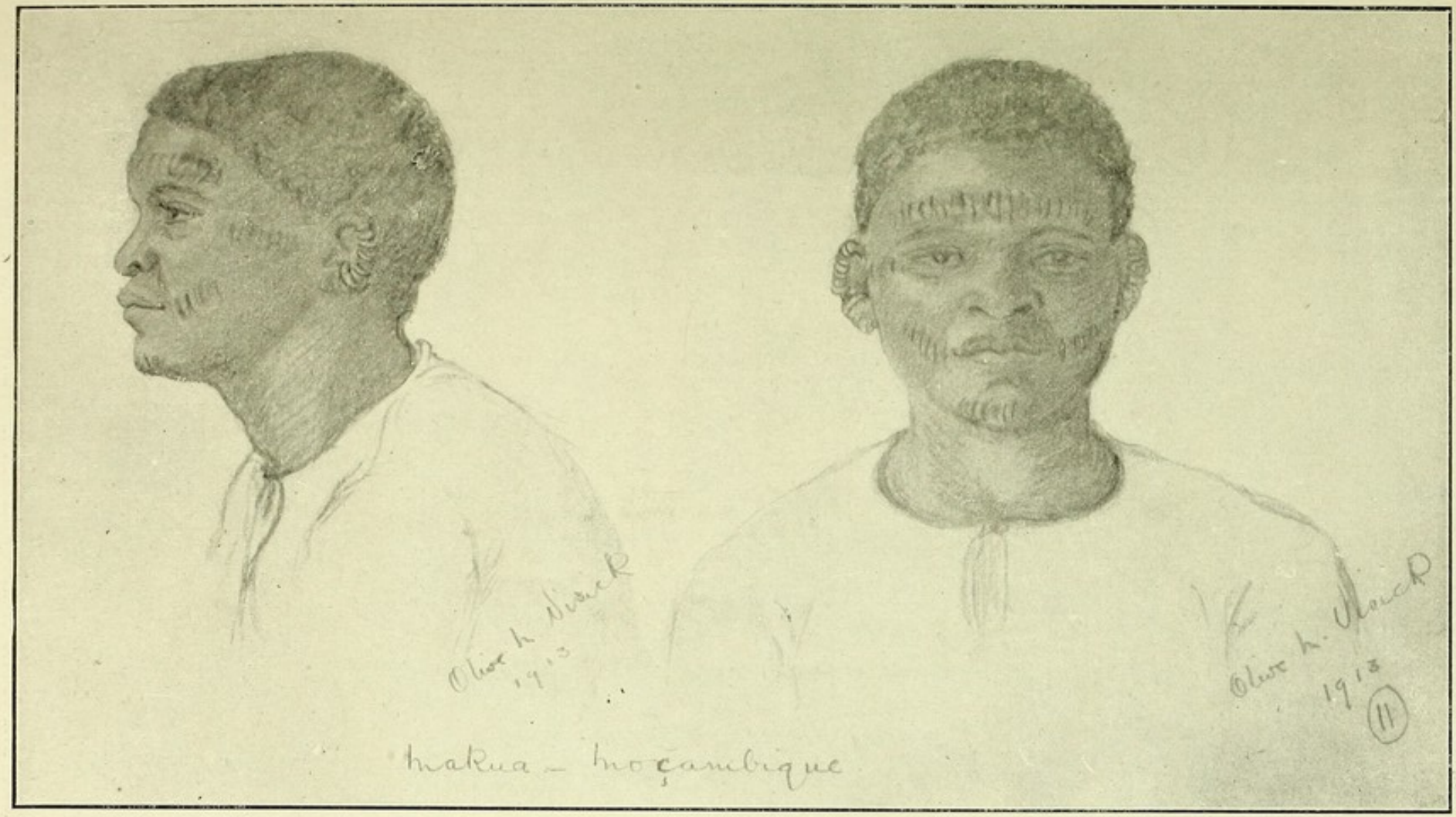

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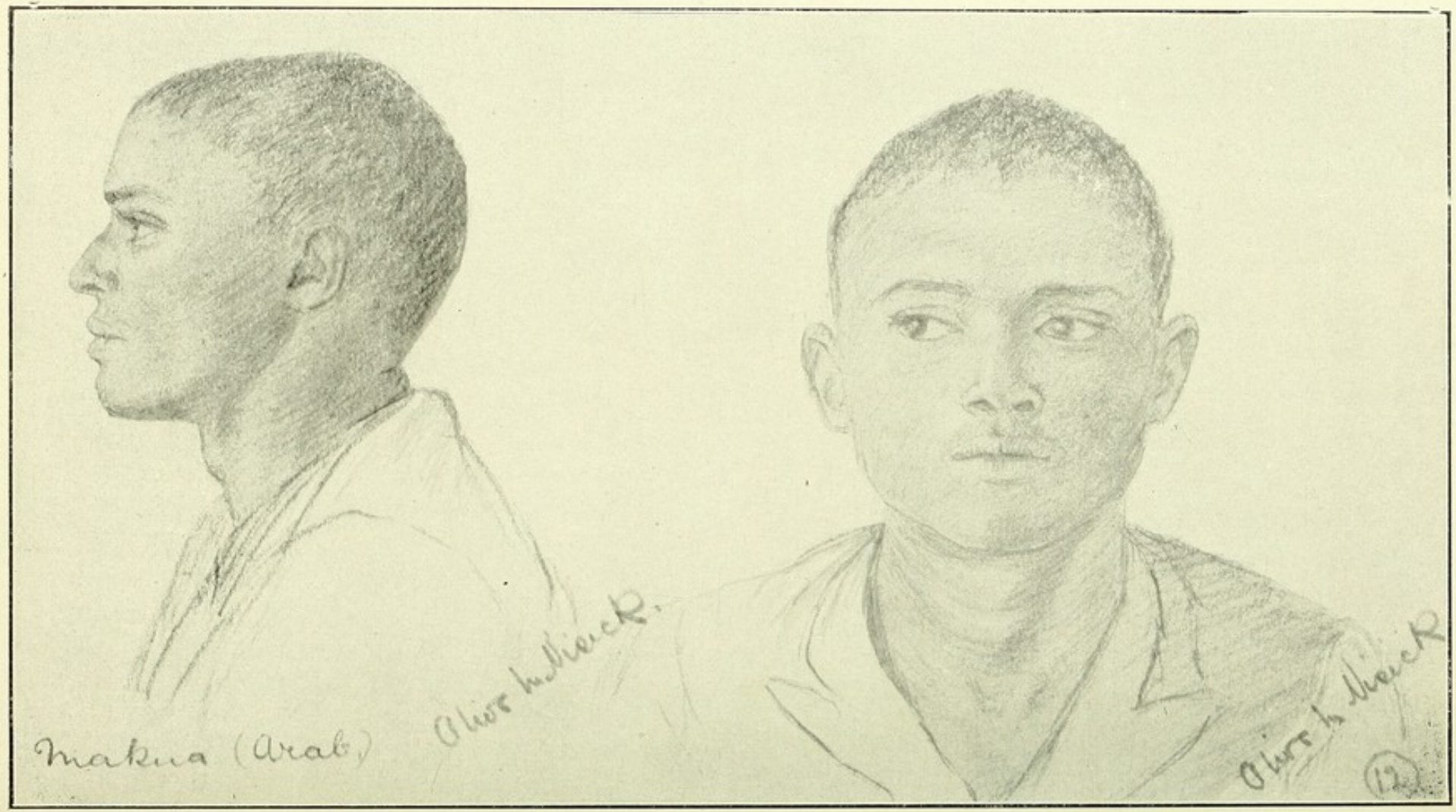
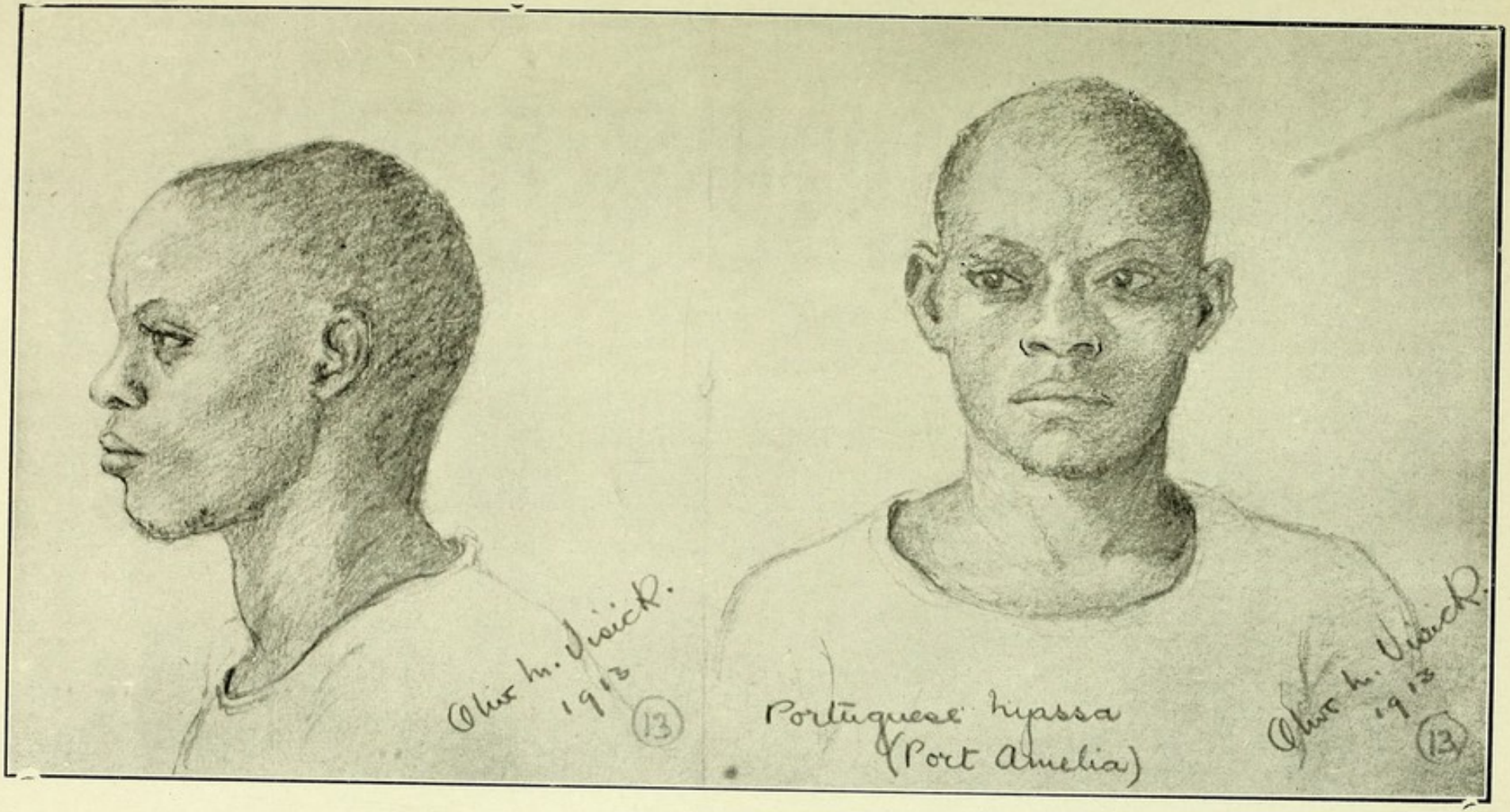
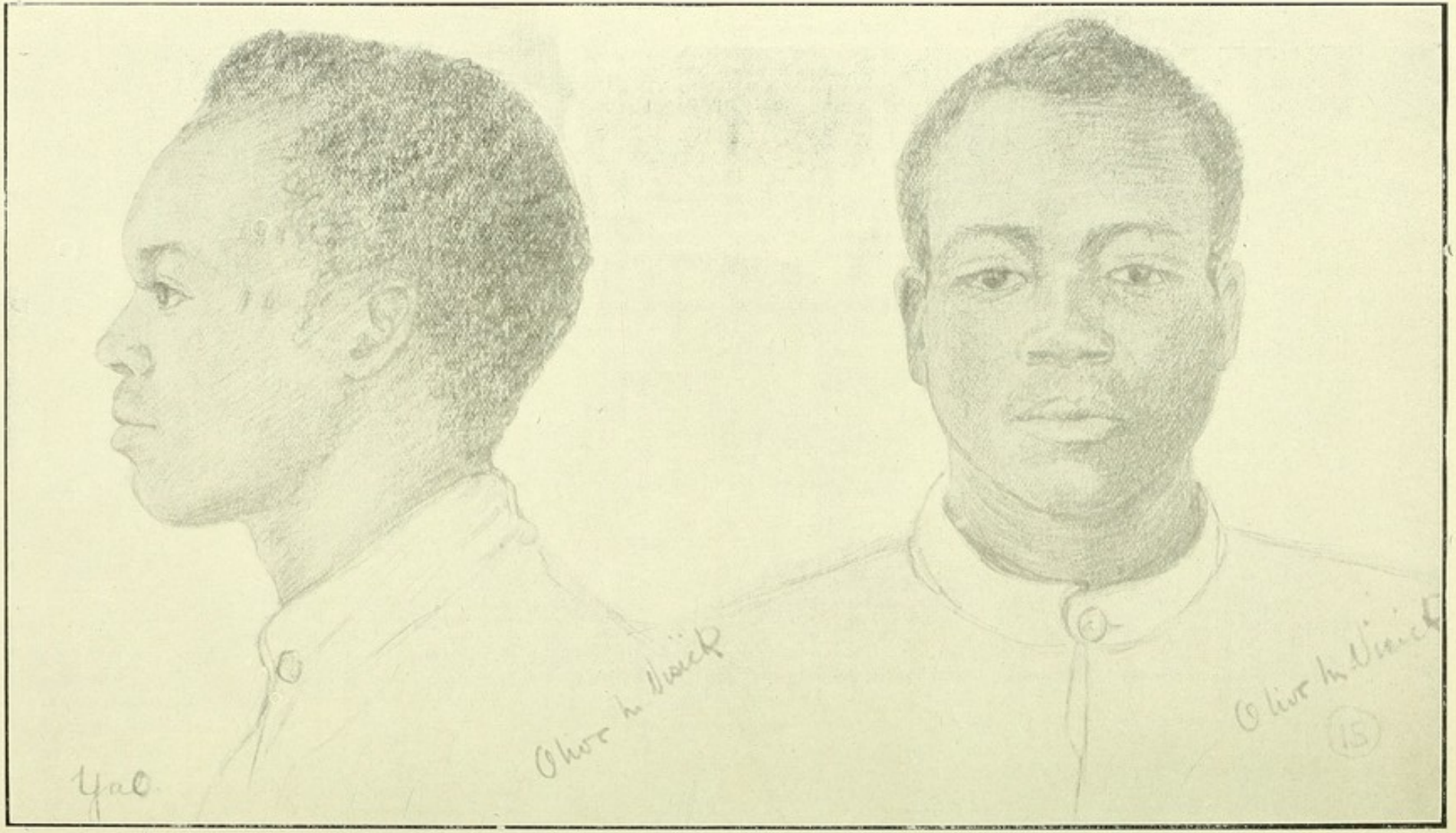


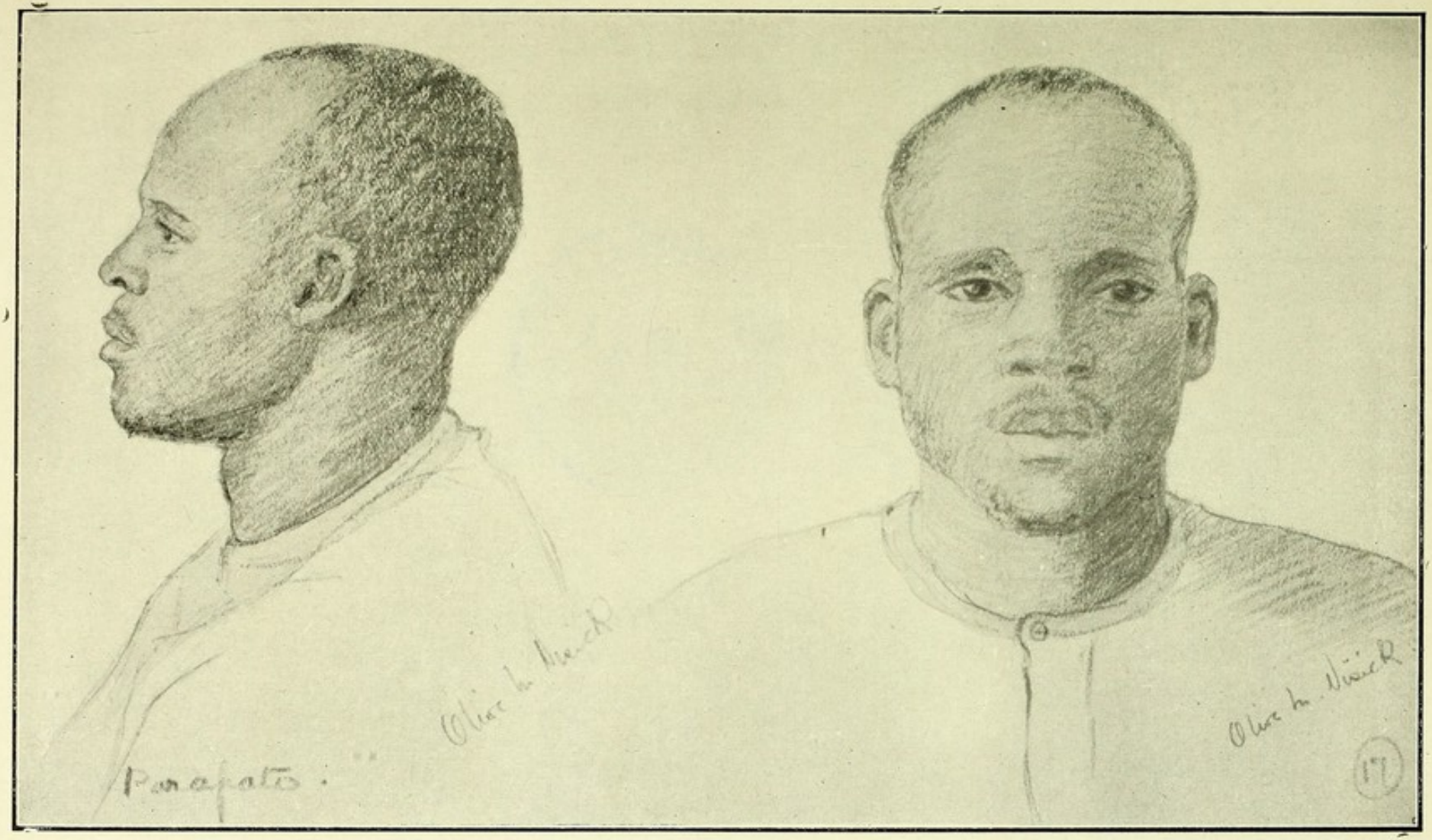
Makua (Arab).



Nyassaland Native.



Yao.



Parapato—Moçambique.