

TANGANYIKA NOTES AND RECORDS

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Editorial Note

WITH this number of *Notes and Records* we are making a new departure: in publishing A. T. Culwick's article "New Beginning" we have opened the door to controversy, hitherto excluded. We would welcome criticism and discussion of Mr. Culwick's paper, and we invite readers who are interested in the future of Tanganyika from a social and scientific point of view to submit their ideas and suggestions.

We have also included in this edition an article of a more professional standard than usual—Mr. and Mrs. Hornby's "A Contribution to the Study of the Vegetation of Mpwapwa". If material is forthcoming we would like to publish one such scientific article in each number.

The Editor has received several letters expressing appreciation that *Notes and Records* is able to continue publication in difficult circumstances. We have weathered three years of war by dint of stern paper economy, in reducing the issue, limiting the number of pages, and considerably cutting down the number of separates supplied to contributors. In this way it will, we trust, be possible to carry on until better days. But obviously our life depends on contributions, and we hope that Tanganyikans and others will continue to find relaxation from the daily round in "writing something" for the periodical which they themselves brought into being.

New Beginning

By A. T. Culwick

SPECULATION on the nature of the post-war world is widespread to-day, and in Tanganyika, as elsewhere, many are wondering what the peace will bring. Some entertain high hopes of a rapid change for the better, others, so often disillusioned in the past, refuse to indulge in what they term "wishful thinking" and steel themselves to enduring a continuation of a state of affairs which even the most complacent among us now acknowledges to be far from satisfactory.

The exigencies of war have made plain to all many weaknesses in the organization of this Territory, and have focussed the searchlight of reality on the product of a quarter of a century of British rule in East Africa, throwing up in bold relief against a background of shattered hopes a native population still riddled with disease, badly housed, poorly fed, living in the most abject poverty and, I personally believe and so do others, threatened with extinction in many areas.

When we compare this state of affairs with what we set out to do we cannot but be appalled and frightened, so frightened indeed that there is a tendency to counter our fears by denying, or at least refusing to face, the facts, may be even praying "Not in MY time, O Lord!" But the facts are there plain for all to see, and it is the object of this paper to examine some of them in the hope that others will continue the process in subsequent numbers of this journal.

The fundamental problem of Tanganyika is as old as man himself. It is the problem of controlling the environment and exploiting it in such a way that not only this but succeeding generations may be able to attain their full potentialities, both physical and mental. It is primarily a scientific problem in which all branches of science, physical and social, have an essential part to play—a platitude may be, but one nevertheless which is frequently overlooked.

During the European occupation of Tanganyika much has been learnt about the country, its soils, minerals, water and other resources, but much less about its people. In Tanganyika, as in most other parts of the world, the social sciences lag far behind the physical sciences, and so we are to-day in the rather ridiculous plight of possessing valuable knowledge on the physical side which we cannot apply because we do not know how to. For example, we know with great exactitude what an African needs in the way of food to maintain himself in perfect health; we know how best to produce a properly balanced ration in many different localities; but we do not know how to make

the African apply this knowledge, to change his agricultural and feeding habits, and so much of our agricultural and biochemical knowledge lies "filed away" while the African continues to suffer from a variety of serious bodily defects which it is within his power to eradicate completely.

The recent policy of the British Empire has been built up on the doctrine of "the sanctity of the individual", one which in my view represents the high-water mark of political thought. We believe the individual is more important than the State, that the latter was made for man, and not vice versa. Many go further and also believe that he can best attain his full potentialities by being left alone within wide limits to work out his own salvation, that the struggle for existence is of itself sufficient stimulus to ensure at least gradual development, and that the principal task of governments should be to maintain peace without and law and order within so that nothing may retard this "natural" upward trend of the human race. But while the idea of the sanctity of the individual is growing in importance, many are wondering whether he is best served by being left to his own devices. Are there not abundant signs all over the world that the free struggle of individuals for survival produces chaos, and that individuals themselves are clamouring for a co-ordination of their efforts? We hear so much these days of planned societies where individual liberty is restricted for the general good, and are apt to regard this notion as an invention of our day and generation, forgetting perhaps that such a society existed in Bantu Africa until we came along and either deliberately, or unknowingly, tore it to pieces, introducing in its place an individualism which in a few decades we ourselves are regarding as obsolescent even in Europe and the United States of America.

The native of this Territory lives in a very unfriendly environment. Most parts of it suffer either from drought and consequent periodic food shortages, or from excessive moisture which, combined with high temperatures, tend to result in serious parasitism of man and beast. Before we came along, he had a society planned to suit this environment, very imperfectly planned, but planned nevertheless. The production, consumption and storage of food were controlled. Communal food reserves were built up. The African kept down tick-borne infections in his herds by over-grazing.* He controlled human parasitism by periodically moving villages when sickness became a serious menace. He planned communal hunts to provide animal foods and to prevent the destruction of crops. His annual grass fires retarded the regeneration of woody growth on his pastures, and prevented a bush or forest climax being established on his grazing lands, which would, of course, have reduced their carrying capacity and also have favoured the spread of tsetse. I do not for a moment suggest that he was more than dimly aware of what we mean by "the law of causality", or that his life was planned on an entirely rational

*H. E. HORNBY, *East African Agricultural Journal*.

basis. On the contrary, his society, though undoubtedly carefully organized, rested on emotional rather than rational foundations, and Bantu society, in common with other primitive societies, did what it *felt* (not thought) to be appropriate to a given situation, a "feeling" based on a lengthy process of trial and error.

Unfortunately, native customs were inextricably bound up with a mass of teleological ideas of the most doubtful validity, which blinded us to the fact that they rested ultimately on centuries of experience of a physical and social environment which we as yet but imperfectly understand. In attacking the African's concepts of the supernatural basis of life either directly, or indirectly, by introducing new economic, social and religious ideas, we have irreparably damaged the old social structure, the mechanism he used for controlling his environment, so that although we now know far better than he ever did how to bend nature to our will in Africa, we lack the social machinery for putting our ideas into practice. If this meant stagnation it would be bad enough, but it is worse than that. It means retrogression. It means disorganization, the breaking up of families, villages and tribes; it results in many areas in small scattered population units in the tsetse bush, an easy prey to sleeping sickness, and the breaking up of population units brings in its train a breakdown of discipline which is also fostered by the growth of individualism and transport facilities. To-day it is so easy to move about. You can steal a girl and run off with her, and the chances of either you or her being found are remote. You can raise a family over which nobody else has any control. You can seduce half a dozen married women and drive away for good on your lorry before their husbands discover they have contracted venereal disease from their wives. And even if you are caught, you no longer get your ears lopped off, but are served politely with a summons, a timely warning to move further afield before a native court has a chance to exact legal retribution.

An attempt to lock the stable door after the horse had bolted was made by Sir Donald Cameron in 1926 when he extended in a modified form the idea of stabilizing native society by using indigenous native political institutions, a policy originally applied to certain areas by von Götzen in the first decade of this century. He hoped to build a structure on indigenous foundations capable of withstanding the shocks of modern life in Africa. If he had started in 1896 the history of the Territory might conceivably have been different, but by 1926 modern economics, modern transport, missions and numerous other forces had already battered the old Bantu political, social and religious system to pieces in most places, and the native rulers then installed, chosen frequently from a reactionary aristocracy with powers originating from the accident of birth, an ancestor's prowess with spear and shield, or even his ability as a medicine-man or murderer, could not hold Bantu society together, let alone intelligently apply the lessons of science to African life, which is

what was needed to establish a more satisfactory relationship between man and his environment.

Cameron has been severely criticized for trying to go too fast, but it must be remembered that even the pace he set would have been insufficiently rapid to keep up with the powerful forces of disintegration which swept over Africa. Nor could he hope to avoid catastrophe with the staff and funds at his disposal. Nobody could. The Territory was expected to pay its way, and it has done so in human life and suffering by the rush exploitation of its human and material resources. The Imperial Child has been forced by The Mother of Parliaments to pay its own school bills by selling its supper, so we need not bother to register pained surprise at the emaciated appearance of the adolescent wreck we toast as "The Land we Live in"—poor land! The lack of adequate funds meant the curtailment of essential work, the starving of research on which alone a rational policy could be based, cheapjack education for the very few and, what was worst of all, the ruination of its administrators, who had it hammered into them that stringent economy, which necessarily means a curtailment of effort, was one of the crowning virtues of the public servant, next only to wringing revenue from a poverty-stricken population.

But let us leave the rulers—there is never any dearth of writers to put *them* in their place—and let us look at the ruled. My first lessons in administration were from a man who above all was a realist. He knew what he wanted, and he got it. *He* was the Government in his district, and everyone knew it. He did condescend now and again to get the Native Authority's signature to an order—"one must cover oneself sometimes", he would explain—but as his backward tribesmen could never see the necessity for any change, he did not often bother. But I soon discovered that his policy, which was so very successful, was not that of Government. The "little brown books" presented quite a different picture. In them, and in the policy of other officers, I saw the doctrine of the liberty of the subject applied to East Africa. I saw the virtual abolition of forced labour for the chief, the old Bantu insurance policy; I saw the curtailment of privilege, which meant the smashing of much of the old tribal authority; I saw the commuting of tribute by a salary drawn from the revenue, a reform which has altered and debased the idea of chieftainship in many places; I saw many other things, but most important of all I saw the African given a degree of personal liberty he never before enjoyed and for which he has shown himself on the whole to be as yet unfitted.

Here is a typical instance of what has resulted. The scene is a small *jumbeate* of some one hundred families scattered over roughly one hundred square miles. Formerly they lived in a village settlement, cultivated in a block, and moved *en masse* when the soil had to be rested. They had to, or have their throats cut by the Wangoni. Every man had to pay tribute in

food or labour to the *jumbe* and the chief, and this formed a local reserve for hard times. But the *pax Britannica* has altered all that. Everyone can live where he pleases, so owing to petty quarrels, intrigues and adulteries, family groups live as far away from one another as possible. To alter this is, of course, "impossible". Such action would constitute "an unwarranted interference with the liberty of the subject", so the elephants and pigs and baboons get half the crops, and so comes scarcity. But they cannot call on the charity of the chief, because *they* give *him* nothing. We abolished that in the name of Freedom, so they must needs grow thin. They would, of course, not grow quite so thin if they were not infected with helminths, but you cannot force them to hospital to be dewormed, for that would constitute another interference with the liberty of the subject—the same with venereal diseases which seem to be spreading rapidly, and also leprosy. Nothing can be done (legally). Liberty must be preserved, even if used to commit wholesale suicide.

My fellow officers could multiply this single instance indefinitely from their own experience, and I know many in East Africa, men who really have the African's welfare at heart, who will agree with my contention that the doctrine of the liberty of the subject *as applied in Tanganyika* is incompatible with the scientific control and exploitation of the environment for the African's good, may be incompatible even with his continued existence under modern conditions.

There is a growing body of opinion in Tanganyika which holds that our post-war life must be planned, planned as an oecological whole, that haphazard excursions along different lines of "advance" must give way to a broadly conceived scheme based on the scientific utilization of our resources, human and material. This, of course, implies somewhat drastic changes in the organization of Government. Its present form obviously will not do, because it was not primarily designed for the co-ordination of scientific work; rather have the scientists been regarded as appendages to the main administrative body, called in every now and again for consultation when a scientific question cropped up. If, however, the running of the Territory is to be regarded primarily as a scientific affair—and it surely should be so regarded—then the emphasis must change, and administration, hitherto looked upon as all-important, becomes merely the mechanism for putting the big scientific plan into operation.

The sort of plan I have in mind will be not one but rather several co-ordinated regional schemes, an essential point, because it is obviously absurd to expect the same proposals to be equally suitable to areas of mangrove swamp, desert, evergreen forest and mountain grassland. Above all, the plan must be flexible, and must include provision for research, so that with the passing years it may evolve to keep pace with the ever altering conditions of human life and the ever changing environment it itself is moulding.

But no plan is of any use unless it can be applied. We want practical results, and we want them quickly if we are to stop the rot. This means intensive propaganda coupled with research into propaganda methods, a sadly neglected line of investigation, the rapid training of a large skilled staff, drastic changes in our administrative technique and a complete reconsideration of our ideas concerning the liberty of the subject. We must be prepared to teach, persuade, compel, adopting whichever line of attack is best suited to the people and conditions with which we have to deal. Nothing less will make the individual worthy of, or even fit for, the liberty we wish to bestow upon him.

My friends on the "financial side", if they have been patient enough to read so far, will by now have dubbed me an impractical visionary (if they are polite) or crank (if they are not!), one devoid of any financial "sense". They will point out that such a plan, a concerted advance against ill health, ignorance and poverty all along the front, will cost millions. It will. That is the capital necessary to ensure a steady dividend of health, wisdom, prosperity and efficiency, and if that capital is not forthcoming? . . . Well, it is up to *them*, not *me*, to suggest an answer to the sorry plight of the natives of this country, an answer worthy of the ideals for which we profess to be fighting.

The Sewn Canoes of Victoria-Nyanza : Construction and Origin

*By James Hornell, F.L.S., F.R.A.I.,
late Director of Fisheries, Madras Government*

I.—CONSTRUCTION

IN 1926, when at Jinja on the Victoria-Nyanza, I had opportunity to become familiar with the details of the great canoes used by the Baganda and the Basese living in this region of the lake. The result confirmed the belief I had long held that the type of these craft and of those seen and figured by Stanley⁽¹⁾ is one which is not of African origin, and is to be referred to the time when Indonesians colonized Madagascar and exercised cultural influence upon neighbouring tribes from trading and slaving stations at scattered intervals along the coast of East Africa⁽²⁾.

These Baganda canoes, as will be seen on reference to the photographs on plates A and B, are large, well-built craft, constructed of two broad strakes raised upon each margin of a narrow dug-out base. The lower strake flares outwards at a considerable angle, the upper is vertical (Fig. 1). The planking is sewn together and to the base by means of twine made of palm fibre, passed several times through holes in the adjacent edges; these holes are bored by means of a red-hot iron rod. To prevent leaks, a pad of plantain fibre is

Fig 1

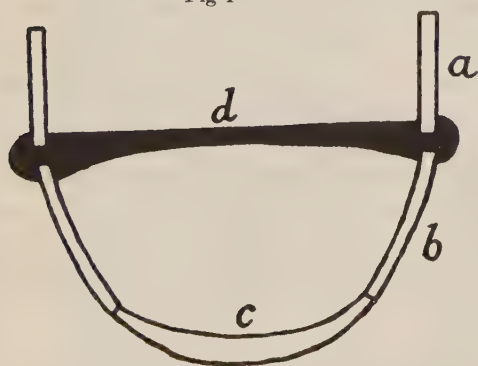


Fig 2

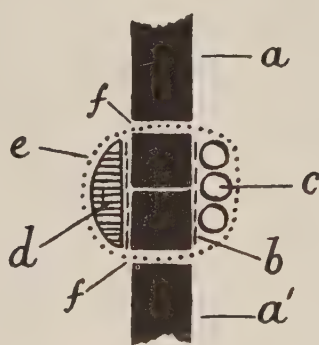


Fig. 1. Diagrammatic section through the hull of the canoe. *a*.—The upper strake; *b*.—The lower strake; *c*.—The dug-out base; *d*.—A thwart.

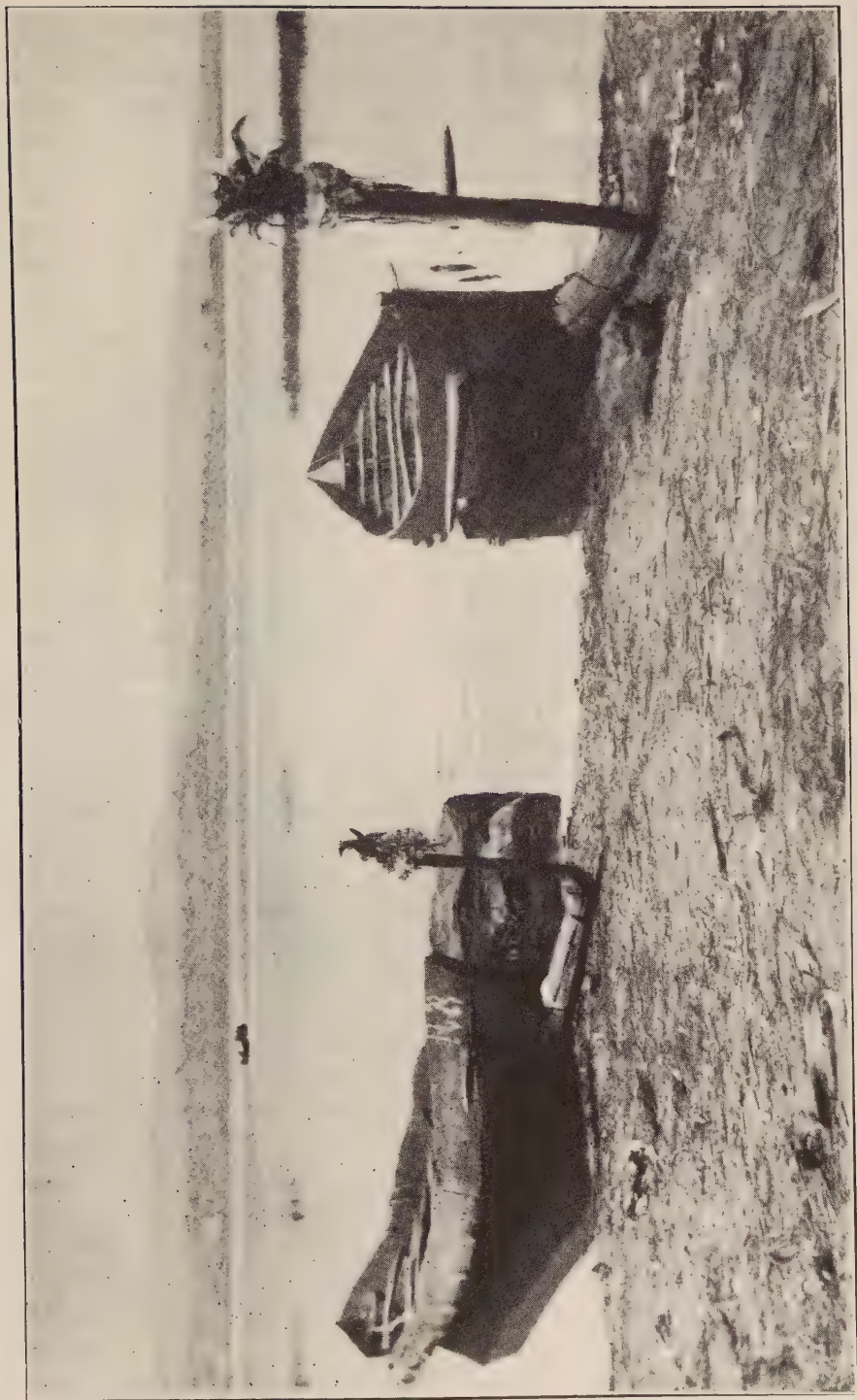
Fig. 2. A diagram showing the method of closing the seams. *a*.—Upper strake; *a'*.—Lower strake; *b*.—Packing of plantain fibre; *c*.—Three stems of elephant grass; *d*.—Strip of wood tapped in under; *e*.—The twine sewing the edges of the strakes together; *f, f'*.—The holes through the edges of adjacent strakes. (*Not to scale.*)

applied to the seams on the inner side and this is kept in place by several stems of elephant grass arranged longitudinally against it, the whole being pressed tightly against the seam by the twine binding which "sews" the planks together, and which binds in this caulking material at the same time. Another pad of plantain fibre is placed against the seam on the outside, the pressure necessary to keep the packing tight being obtained by tapping in, slowly and carefully, a narrow strip of tough wood under the twine stitching on the outer side (Fig. 2). The holes in the opposed edges of the planks through which the twine passes are caulked with vegetable fibre with the aid of a pencil-shaped stick. In spite of these precautions a certain amount of water continually leaks in; this collects in a bailing hollow excavated in the floor towards the after end; the second man in front of the steersman is the bailer in a ten-thwart canoe.

The form of the bow and the arrangement of the thwarts are other outstanding peculiarities of this type of canoe. The former is strongly bifid, the narrow dug-out base, the equivalent of the keel in European boats, being prolonged at the fore-end into a stout ram-like projection extending several feet beyond the base of the true stem-post to which the fore-ends of the side planking are attached. As figured on Plate A, the ram end of the "keel" is produced to a considerable distance forwards and then upwards by means of a long elbow-shaped attachment, whereof the inner and horizontal arm is bound upon the upper surface of the ram, whilst the vertical and distal arm towers well above the true stemhead; the latter projects little or nothing above the upper edge of the top strake. The head of the false prow, carved into a knob, with several encircling grooves below, is usually decorated with a great bunch of feathers rising from out of a mop of fluffy raw cotton, while several strings of glass beads and glass rings hang pendent below. A cord hung with long strips of white cotton cloth is usually stretched from the summit of the true stem to the decorated head of the false one.

This scheme of decoration of the false prow appears to be a comparatively recent modification of that figured and described both by H. M. Stanley⁽¹⁾ and Sir H. H. Johnston⁽³⁾. In their day a pair of horns, usually of antelope, rising from a great "beard" of long grass, occupied the position of the feather tuft of the present day, while from the taut line steadying the false prow and connecting it with the true stemhead, hung a deep and heavy fringe either of banana filaments or of long grass. Stanley in one place describes this fringe as waving like a mane when one of these canoes came charging down upon him, "bold and confident, propelled by forty paddlers".

As for the thwarts, they are both massive and numerous; they serve to tie the sides together as well as furnish seats for the paddlers. In most instances seen by me they numbered ten, inclusive of the short one on which the steersman sits. Their great peculiarity is that they pass through the sides of the canoe, their ends appearing as prominent rounded bosses on the



Canoes at Jinja, in Uganda, on the Victoria-Nyanza.

Photo by J. Hornell

outside. One of specially stout form, said to be the seat of the headman, is fitted across the bows about a foot abaft the stem; it projects outboard eighteen inches or more on each side, thereby giving the impression of the hull having its own pair of horns; these projections are of use when the canoe has to be hauled ashore, affording hand-purchase analogous to the transverse hauling beam so conspicuous in the seining boats of the Sinhalese, which are also examples of craft built of planking sewn together much in the same way as are these Baganda canoes.

Occasionally a square sail is used nowadays; when it is, the mast is stepped in a "shoe" or socket excavated in the dug-out base, a little abaft mid-length; it is steadied by being passed through a hole in one of the thwarts. This is, however, a modern innovation, for Sir H. H. Johnston(*) comments on the strange fact that the Baganda never conceived the idea of using sails, although Arab sailing craft trafficking on the lake had been familiar to them for years.

Dimensions.—The average length of the hull from stem to stern in canoes of the larger sizes measured in 1926 was 26 feet; beam, 40 inches in one, 48 inches in another; depth, 32 inches. Length of stem-post, 42 inches; of the false prow attachment from inner end to the farther end of the elbow, 6 feet; vertical limb, 3 feet in height. Width of the upper strake, 12 to 14 inches; of the lower strake, 16 to 18 inches; of the dug-out base, 22 inches.

The dug-out base is nearly straight, so, the strakes being nearly the same width from end to end, the gunwale line of the hull shows little sheer, slightly greater, however, at the fore-end.

Sixty years ago far larger canoes were in existence. The largest which Stanley saw measured 72 feet in length, 7 feet 3 inches in breadth, and was 4 feet deep from keel to gunwale. In this canoe there were thirty-two thwarts and, as they paddled double-banked, sixty-two paddlers formed the full complement.

The people who build and employ these canoes are of Bantu stock; the names given to the respective parts are as follows:—

Forward end : *bulamba* (Roscoe gives *mutwe*, "head").

After end : *bulumba*.

Stitching along seams : *kivula*.

Stem-post : *kiyenda*.

Stitching at stem and stern :

Ram projection : *lulimi* (tongue).

mufumo.

Upper strake : *mpero*.

Thwart : *banga*.

Lower strake : *mabasi*.

Aftermost thwart : *kumba*.

Dug-out base : *kigongo* (*mugongo*,

Projecting "horns" of first thwart :

Roscoe).

gammi (*igani*, Roscoe).

An excellent account of the building of a canoe is given by the Rev. John Roscoe in *The Baganda*, pages 386-91 (London, 1911).

II.—MODIFICATIONS OF THE BASIC DESIGN

Variety A.—Going eastward to the Kavirondo Gulf and its neighbourhood, we find the Jaluo people using several types of very primitive craft in their fishing operations, ranging from the rudest of floats, sometimes formed of ambatch stems, sometimes of bundles of papyrus stems, to a clumsy copy of the Baganda canoe. In this last the general form of its original is retained; however, as the planks employed are narrower and shorter and sometimes of irregular shape, three strakes have usually to be used to obtain adequate height of freeboard. According to Worthington⁽⁷⁾ these canoes are shorter, with a wider proportionate beam and have rather more sheer, particularly at the forward end. The details of the false prow, the form and arrangement of the thwarts and the method of sewing the strakes together are similar to those of the Baganda canoe, allowing for the effects of inferior craftsmanship on the part of the builders.

As we go south of Buganda on the western shore of the lake and thence along the southern coast, degeneration from the Baganda type becomes more marked in the canoe designs in use by the coast people.

Variety B.—In the first stage in this deterioration, the hull duplicates most of the original features, but differs in the arrangement of the thwarts, and the horizontal limb of the false prow is so shortened that the upper end of the vertical limb rests against the stemhead, to which it is lashed. The thwart arrangement is distinctly retrograde; instead of a single series of which each end passes to the exterior through the upper strake immediately above its junction with the lower one, there are two series, an upper and a lower one. The poles which serve as the upper or rowing series are slender as compared with the Baganda type of thwarts and each is inserted tightly athwart the canoe immediately within the gunwales to which the ends are securely lashed. Those of the lower series are similarly lashed in between the sides on a level with the seam between the upper and lower strakes. The original purpose subserved by this lower series is to afford rests for the feet of the paddlers, owing to the greater height at which the rowing thwarts are here fitted as compared with those in the Baganda canoe; another purpose incidentally served is to compensate for the reduction of rigidity consequent upon the diminished thickness of the rowing thwarts. These canoes have notable sheer towards the head.

Variety C.—Much more numerous in the same localities is a varietal form in which the false prow has been entirely discarded. The stem- and stern-posts have a more pronounced overhang, due to being inclined at a greater angle from the horizontal than is usual in the Baganda canoes. As the dug-out base sheers sharply into an exceptionally long ram-prolongation, quite two feet in length, the hull has a very pronounced sheer forwards; at the after-end the sheer is less.



Photo by J. Hornell

Interior of a Baganda Canoe, Jinja, 1926.

The arrangement of the thwarts may be either on the Baganda model or on that of Variety B.

Worthington gives illustrations of Varieties B and C. That of the latter shows the bows to be ornamented along the gunwale with a neat pattern of triangles of contrasting colours, arranged as a marginal band, below the gunwale.

Absence of an outrigger.—If it be objected that an Indonesian origin of the design of these canoes is negatived by the fact that they do not possess outriggers, whereas the fishing canoes of the Kenya and Tanganyika coasts (which have an undisputedly Indonesian ancestry) have retained this feature, no difficulty in understanding this will be experienced by those acquainted with the history of the outrigger in Indonesian waters.

In the ninth century even two-masted Javanese ocean-going ships of considerable burden (seemingly between one hundred and two hundred tons) were equipped with this stabilizing device; in the sixteenth century outrigger craft of varying size were common in all the Indonesian islands, equally in Sumatra and Java as in the rest of the Archipelago. To-day the outrigger has disappeared from the Sumatran coast and survives in Java only at the eastern end. Elsewhere, except in Borneo, it continues in common use. In Ceylon too, where coasting vessels of about fifty tons burden, fitted with outriggers, were still to be seen in the early years of the present century, to-day these have disappeared and only small fishing craft continue to fit an outrigger to the hull. The same transformation is being enacted in Polynesia.

It is therefore not difficult to understand that when built-up canoes of great relative beam began to take the place of narrow unstable dugouts on the waters of the Victoria-Nyanza the use of an outrigger was gradually abandoned, for, although storms are frequent, a friendly shore is always within easy reach.

The false prow may have been added to give opportunity to add bravery to the canoe's appearance, in those older days when these craft were used in naval engagements upon the lake. It may also have some practical advantage, as when punting through reedy shallows. The ram was used in naval engagements as in classical and mediaeval times (Roscoe, page 386).

III.—ORIGIN

Great difficulty confronts us when we seek to find a solution to the problem of the origin of the peculiar features of design present in these curious craft, so strangely different from all other plank-built African canoes which have not been modified by European or Arab contact.

Three alternative theories have been suggested. These are :—

- (1) Through influences emanating from Ancient Egypt and thence spread southwards by diffusion.
- (2) Local and independent evolution from a simple form of dug-out.

- (3) Introduction, with subsequent degeneration, of the bifid type of craft common in Indonesia, by immigrants from Java and Sumatra into Madagascar and thence transmitted to the lake region from Indonesian trading centres on the East African coast.

The first of these hypotheses was put forward by Elliot Smith⁽⁵⁾ who believed that many of the most important features of old-time culture radiated from Ancient Egypt and eventually spread throughout the greater part of the Old World. Accordingly, he saw no difficulty in correlating the origin of the rude figures of bifid-ended vessels graven during the Bronze Age upon Scandinavian rocks with that of these Baganda canoes. He visualized the diffusion of this type northward from the Nile, through the Mediterranean and thence on to Sweden; eastwards he considered that it spread to Indonesia, whilst southwards he saw it travelling to the lakes of East Africa⁽⁶⁾. On examination, the resemblances emphasized by him are found to be illusory and to be based on several misconceptions and misreadings. The principal of these was his initial statement that in Tutankhamen's time, Egyptian sea-going ships "had a curiously distinctive double bow, which still survives in boats in Victoria-Nyanza"^(6a), and that these vessels may both be linked up not only with Bronze Age Swedish boat-petroglyphs, but also with the *mon* boats of the Solomon Islands. On the same page he gives a reproduction of a photograph of what is unmistakably a handsome Baganda canoe fully manned, but the legend appended states that it hails from the Solomons! Neither has his reference to the boats carved on the ivory handle of the Gebel el Araq knife any significance apart from the fact that one bears the horned head of a bull on the prow (Fig. 3).

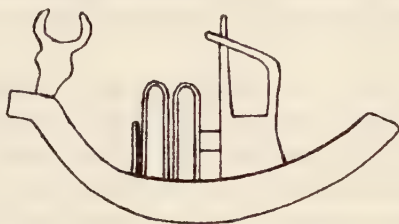


Fig. 3. Representation of a Predynastic Egyptian ship, graven on the ivory handle of the Gebel el Araq knife, which, however, has not a bifid prow.

Furthermore, the Swedish petroglyph boats are bifid at both ends whereas the Baganda canoe is bifid only at the forward end. Next, if we compare the details of the two types, we find that whereas a horned head is sometimes borne on the end of a prolongation upwards of the stem-post in the Swedish petroglyphs, there is no such prolongation in the Baganda canoe, where the horned head when present was mounted on the upturned end of the false prow. In Elliot Smith's figure⁽⁶⁾ of a Baganda canoe this arrangement is misinterpreted. It may have been that he was deceived by a certain haziness in

Stanley's drawing, for in the figure which he gives purporting to be a copy of this sketch, he has substituted a stout pole in place of the *cord* connecting the horned head of the false prow with the true stemhead, although this was clearly and correctly described by Stanley; again, instead of showing the false prow as an elbow-shaped addition to the keel-ram, with the horned head at the upturned extremity, he terminates it abruptly some distance below the horned prow head of his figure and entirely *unconnected* therewith—treatment which creates a fictitious parallelism between the African and the Scandinavian type.

Definitely there exists no evidence whatever to support the view that any Egyptian boat, ancient or modern, ever possessed this bifid characteristic. This fact taken alone automatically destroys Elliot Smith's conclusion.

I have gone into this point at length because Elliot Smith's reputation is so well recognized that his opinion is apt to cloud the issue and be accepted at its face value unless the mistakes on which it is based be set forth in detail.

Apart from this problem of prow form, an Ancient Egyptian origin of certain other constructional features of the hull design of the Baganda canoe would seem a plausible hypothesis in view of the numerous customs prevalent among Central African tribes which many authorities consider to be traceable to this source, brought about by slow diffusion from tribe to tribe through the many centuries during which Ancient Egypt received supplies of ivory, ebony, aromatic gums, leopard skins and even dwarfs from the equatorial regions of Africa. Expeditions in search of these products were of frequent occurrence, directed by the Lords of Elephantine, "Keepers of the Southern Door of the Kingdom", who, from their seat at the second cataract and from their outposts in Nubia, were in periodical or seasonal contact with the tribes of hunters and cattle folk living along the banks of the White Nile and its tributaries. It would not, therefore, have been strange if this commercial contact had eventually exercised considerable influence upon the design of the river craft in that region and eventually upon that of the canoes used upon the great lake that gives birth to the Nile. It is a tempting theory, easy to accept because of its seemingly inherent probability. However, when analysed, there is found to be little or no evidence to support it and much to negative it. Indeed, the sole structural resemblance between the boats of Ancient Egypt and those of Victoria-Nyanza is that in some of the former the ends of the thwarts and cross beams pass through the sides and show as slight projections on the exterior.

As against this, we have to note that the method employed of joining the planks together is entirely different. The whole of the direct evidence available shows that in Ancient Egyptian river craft the plank connections were effected by means of an elaborate dual system, consisting partly of broad dowels

and partly of double-ended dove-tailed tenons, as seen in the ancient twelfth dynasty barges found at Dahshur, and now on view in the Cairo Museum. No trace of either method is present in the Baganda canoes; in them the planks are always sewn together with palm-fibre twine, a method never seen in any representation of Egyptian vessels unless it be represented by the zigzag pattern* along the side of the sailing vessels of Sahure's bipod-masted fleet (fifth dynasty), which in nearly every respect are exceptional and suggest thereby the presence of a transient foreign influence (Fig. 4); hardly any other Ancient Egyptian vessel known to us shows markings along the sides even remotely suggestive of "sewing", while the bipod form of mast is not known in Egypt subsequent to the seventh dynasty. In every other respect there is no resemblance; keel projection beyond the stem is, in particular, a feature never seen in Egypt.

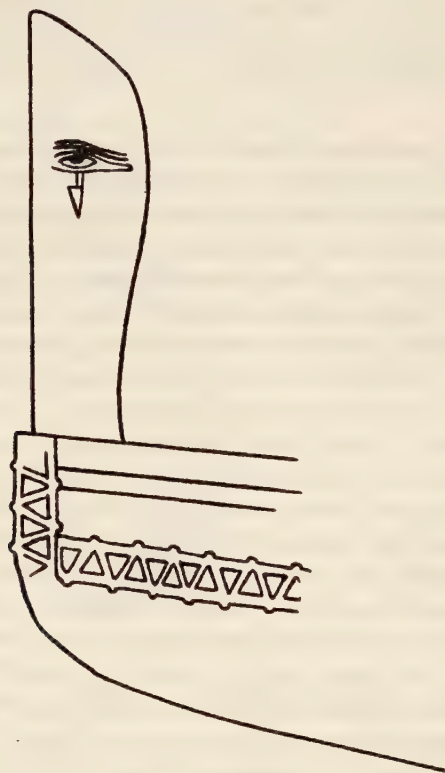


Fig. 4. Fore-end of one of Sahure's sea-going ships (5th Dynasty) showing along the bow a band which probably represents the sewing over the seam below the washstrake.

*If this represents "stitching", it is on a different and more complex system than that seen in Baganda canoes, where the "stitches" consist of simple lacing loops, as in the lacing of a sail to its yard.

Even the primitive dug-outs in use by the Nuers of the Bahr el-Zaraf branch of the Nile, in which while some sewing is present, bear no relationship to the Baganda canoes; they are without thwarts, keel and side-planking. The sewing present occurs only in canoes in which the tree trunk dubbed out is too short for the length required; in such case a portion of another trunk is shaped to fit on to the truncate end of the major section, the two ends secured together by a clumsy lacing of coarse cord; the result is a weak and insecure joint between the two open ends, butted together. When subjected to the strains set up when afloat in rough water, these canoes are leaky and are apt to break in two.

Of the two remaining hypotheses, that of indigenous or local evolution which Dr. E. B. Worthington⁽⁷⁾ favours, is attractive and has the merit of simplicity. According to this, the comparatively complex features of the Baganda canoe have been evolved from a simple dug-out, without accessory parts, found in the same region. It is presumed that this has taken place by progressive modifications whereof the majority are represented by existing types which, if not all present in the Victoria-Nyanza, still persist in one or other of the neighbouring equatorial lakes. This theory would command ready acceptance if we were to take it by itself and without reference to other considerations.

But, when investigating the history of any invention made by man, its origin may no more be disassociated from the cultural relations and contacts of the people concerned than may a sentence be quoted apart from its qualifying context in an opponent's argument. In the present connection, I am concerned chiefly with the possible remaining sources of outside influence which may have been exerted upon the canoe designs of the lake people of East Africa in bygone times. Of these the only ones that need to be considered are the Persian, Arabian, Indian and Indonesian.*

The last-named, the Indonesian, is the only one that has any considerable probability. The main evidence to be put forward rests principally upon two main facts, namely :—

- (a) The universal use of double-outrigger canoes by the fishermen who pursue their calling along the whole of the coast stretching from Somaliland in the north to Mozambique in the south, the double-outrigger being, as is well known, a type distinctively Indonesian, for it is employed elsewhere solely by the Indonesian peoples of the Malay Archipelago and by the Malagasy-speaking coast tribes of Madagascar; and

*In this article the term "Indonesian" is used as a convenient geographical name to cover the peoples and cultures of the western and central islands of the Dutch East Indies; it also includes the Malagasy people of Madagascar descended from Sumatran and Javanese immigrants.

- (b) The similarity in the basic features of construction of the Baganda canoe with those of certain of the coasting craft of Java and Madura at the present day. This is shown more particularly in the presence in both of a bifid stem and of thwart ends passed through slots in the side planking; battens sewed over the seams to prevent leakage, of the peculiar form present in Baganda canoes, are also duplicated in certain of these far-eastern designs.

Any day small coasting vessels having most of these peculiar features are to be met with in the ports of eastern Java. They are also particularly numerous in the adjacent island of Madura as I have good reason to remember, for I was arrested as a spy when photographing some of them in 1918 (Plate C). The Madurese lavish much gaudy decoration upon the prows and in some instances have an ornamental "bowsprit" of no obvious use, but undoubtedly the homologue of the functional bowsprit seen in the large ocean-going craft sculptured on the walls of Boro Budur dating from about the ninth century A.D. Usually these Madurese boats have a large wooden-horned ornament on the head of the stem and this appears to be correlated to the horns formerly used to decorate the false prow of the Baganda canoe. The deck beams which pierce the sides show conspicuous on the exterior as their ends are often painted a different colour from the rest of the hull; the ram-like projection of the keel so characteristic of these boats is short and stout.

Worthington, while admitting that the occurrence of double-outriggers on the East African coast appears to prove definitely the existence of Indonesian influence in former times in that locality, objects to the idea of any extension to the lake region because "there is apparently no relic of this type of bifid stem along the diffusion line postulated, i.e. Java-Madagascar-East African coast"; he infers also that if the bifid stem of Javanese vessels had been adopted by the Baganda, the Javanese sail would also have been incorporated in the lake design.

The problem cannot be disposed of so easily; the whole range of cultural subjects involved in the relationship of Indonesia with East Africa must be taken into account when weighing up the respective probabilities of evolution *versus* diffusion. I am by no means a rabid diffusionist. I believe, with Nordenskjöld, that independent evolution of devices, usually however of secondary importance, has occurred not infrequently among primitive communities faced with similar needs and living in parallel environment; in the present instance I admit that the evolutionist is able to make out, *prima facie*, a seemingly good case for his hypothesis. But this inference carries conclusive weight only so long as the former extent of Indonesian contact is denied the importance which is its due. I have no hesitation in saying that the impact of Indonesian culture upon East Africa was more important, more intimate, more ancient and much longer sustained than has been currently believed



Madura Coasters.

Photo by J. Hornell



The bifid prow of a small cargo vessel,
Sourabaya harbour, Java.

Photo by J. Hornell

hitherto except by Stuhlmann, who clearly appreciated these considerations in his *Handwerk und Industrie in Ostafrika*⁽⁸⁾. In support of this generalization the following evidence is forthcoming :—

From Chinese records, translated by P. Pelliot⁽⁹⁾, we learn that Zenj (negro) slaves were among the items of tribute sent to China by Sumatran and Javanese potentates in the eighth and ninth centuries of our era, and Bozorg bin Shahriyar in the *Kitab 'ajajib al-Hind*⁽¹⁰⁾ gives particulars of an armada of one thousand Sumatran ships which made a determined attack in the year A.D. 945 upon Kanbaloh, a town on the East African coast, probably in Mozambique, in order to make it a base for commercial operations. The Sumatrans are stated to have told some of the Kanbaloh people that one of their objects was to obtain a number of Zenjs (East African negroes) as these “are strong men, able to endure heavy labour”. Kanbaloh, the town attacked, was probably an early foreign settlement, for we see by the context that the inhabitants were not Zenjs.

The presence of a predominantly Bantu element in the present population of Madagascar is almost certainly due to the old-time importation of negro slaves from the African coast by the Indonesian colonists. It is extremely improbable that Bantus colonized Madagascar by their own unaided efforts. So far as historical and other evidences go, no Bantu coast folk have ever adventured unaided oversea or out of sight of land; as far back as A.D. 1154 we find Edrisi stating definitely that “the Zenjs [that is the Bantus of East Africa] have no ships for voyaging”. Except they were carried to Madagascar as prisoners or slaves, there is no satisfactory alternative solution to the problem of the presence of *Malagasy-speaking* Bantu tribes in Madagascar. The association between the ancestors of the present Bantu stock and the Indonesian immigrants must have been exceedingly intimate to cause the Bantus to discard their own language and to adopt the Malayo-Polynesian dialect of the immigrants. Slavery involves just such intimate relationship between peoples of different races as is necessary to bring about this result. It is because of this that the languages of American negroes conform to those of the men who held their forefathers in the bonds of slavery. In the United States and Jamaica, English is the speech of the negro population; in Brazil, the negroes speak Portuguese; in Spanish America their speech is a corrupt Castilian, and in Haiti, it is French.

Apart from old references to slaves and slaving, there can be no doubt that extensive Indonesian trade existed on the African coast as late as the middle of the twelfth century. Edrisi, who wrote an Arabic Geography in 1154⁽¹¹⁾, says: “The Zenjs have no ships for voyaging. . . . The people of the isles of Zabag [here Zabag = Western Indonesia] come to the country of the Zenjs in large and small ships. They trade with them and export Zenj merchandise, for they understand each other’s language”; on page 65, he adds,

“The people of Zabag and the surrounding islands come to seek here [at Sofala on the south-east coast of Africa] for iron to transport to the Indian mainland and islands, where they sell it profitably, for it is an important article of trade and is utilized on a large scale in India”. Again on page 78 he says, “The people of Komr [Madagascar] and the people of the Maharaja [Srivijaya in Sumatra] came among them [the negroes of the south-east coast of Africa] and being well received, carry on trade with them”.

The statement that the people of Zabag (Sumatra and probably Java in this instance) could understand the language of the people of Zenj is difficult to understand unless it be granted that there were Malagasy or Indonesian settlements on the Zenj coast. Any suggestion that Zenj here includes Madagascar is inadmissible, for Madagascar had no merchandise suitable for export; there was nothing of value apart from foodstuffs, which were not wanted.

Very important light on this question is shed by Ibn al-Mujawir in his *Tarih al-Mustabsir*, a queer title which translated is “History by one who observes with understanding”⁽¹²⁾. This work, written about A.D. 1233, records a tradition current in Aden of a foretime occupation of this place by people of Al-Komr (Madagascar). After giving some particulars of the occupation and the causes which led to its abandonment by the Malagasy, he mentions that although the usual time taken for a voyage from Aden to Al-Komr, occupied a period of three seasons or monsoons, the people of Al-Komr were “formerly accustomed to perform the same voyage in a single season”. He added, “One ship actually performed the voyage from Komr to Aden in this way in A.H. 626 [= A.D. 1228-29]; starting from Al-Komr and bound for Kilwa, it anchored at Aden. *Their vessels have outriggers*”. Evidently the vessel here referred to had been blown out of her course and had to make Aden instead of Kilwa as intended.

Indonesian influence on the African coast, whether exerted from the homeland or from the colonies in Madagascar, had evidently waned at this date and any settlements which they may have previously possessed on the African littoral must have passed into other hands. By the beginning of the sixteenth century we find Sulayman al-Mahri, the Arab navigator who piloted Vasco da Gama across the Indian Ocean to Calicut, remarking in his *Nautical Instructions*, as quoted by G. Ferrand⁽¹³⁾, that the navigation of the Komr (Malagasy) was at that time restricted to voyages to the eastern coast of Africa. The connection with Aden, India and the mother countries of Sumatra and Java had been severed.

However, even so late as 1597 when the later part of *Da Asia* was written by De Couto, we find this old Portuguese writer stating⁽¹⁴⁾ that “the Javanese are all men very skilful in the art of navigation, insomuch that they claim to have been the earliest navigators”.

The objection which has been raised that no relic of bifid-prowed vessels appears to exist along the line of diffusion postulated, loses its force in face of the fact that the bifid prow, characteristic of certain Indonesian craft, has now been found to persist in a vestigial form in several localities in Madagascar and the Comoro Islands.

The best examples which I have seen were at Mayotte in the Comoro Islands. In these (as shown in Fig. 5, A and B) each end of the hull is fashioned into a distinctly bifid form, comparable with the bifid stem of the Javanese coaster figured on Plate D.

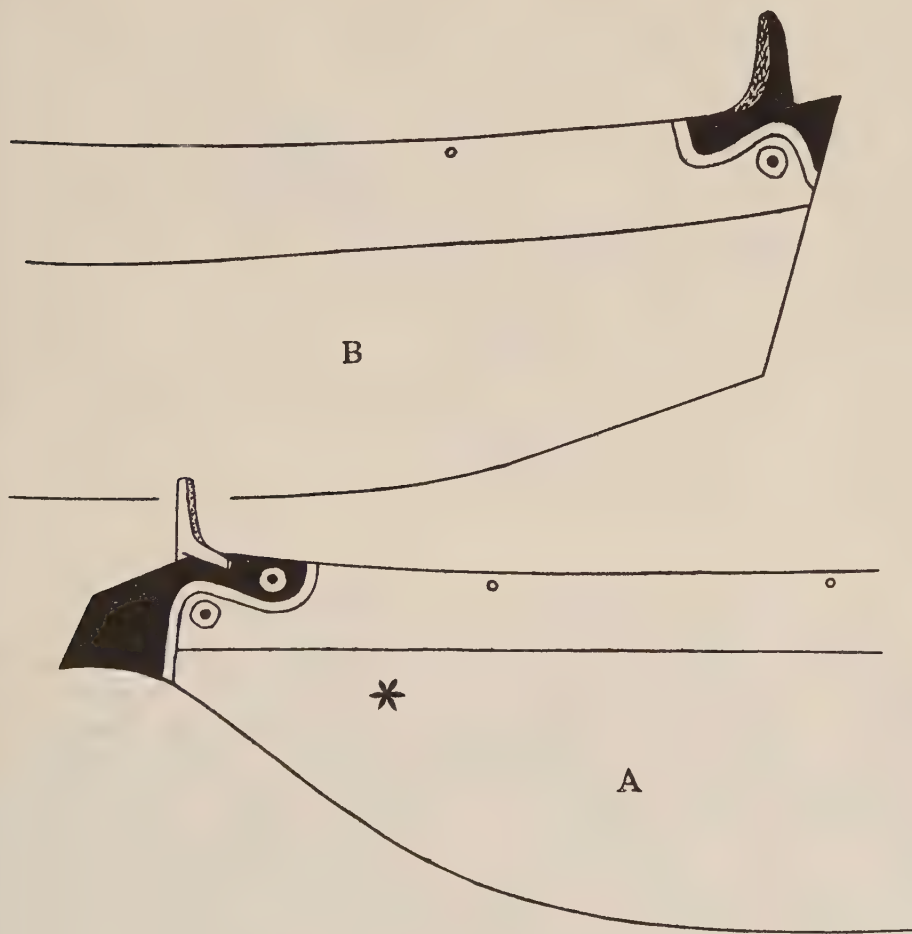


Fig. 5. A.—The bifid prow of a large canoe of Mayotte, in the Comoro Islands;
B.—The bifid stern of the same.

Other evidence of derivation from a Javanese source is furnished by the presence of oculi on *both* ends of the hull, a duplication most unusual but possessed here in common with the ninth century ships of the Boro Budur sculptures.

Additional examples of vestigial relics of the bifid stem are to be seen at Nossi-bé and at Majunga, both in Madagascar.

At Nossi-bé some of the fishing canoes have a finial pegged upon the head of a <-shaped end-piece of the form seen in Fig. 6. Another, less dentate, is fitted upon the head of the stern.

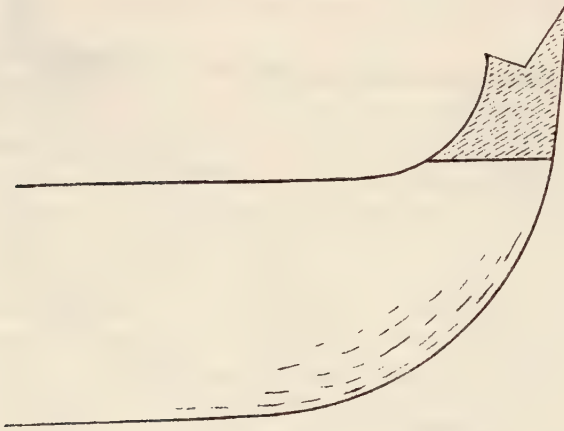


Fig. 6. The bidentate finial on the prow of a fishing boat, Nossi-bé, Madagascar.

In the fishing canoes of Majunga, the most elegant of all those in use in Madagascar, the underbody consists of a narrow and rather deep dug-out; upon each side a deep washstrake flares outwards; these boards are closed in at stem and at stern by an end-piece cut from the solid. This is V-shaped in plan, its wings joining each washstrake in an oblique joint. The outer part of each added piece is fashioned, by means of short pieces of plank, into a thin, sharp end, upwardly curved, of the respective forms seen in Fig. 7, A and B. There are also two small affixes, made separately and pegged on, one upon the stem end-piece, the other upon the after one; the former is a backwardly curved hook-shaped object, the latter has a vertical limb, closely resembling the corresponding process at the stern of the Mayotte canoe (Fig. 5, B). These affixes appear to represent in a vestigial manner an originally bifid termination to each end of the hull.

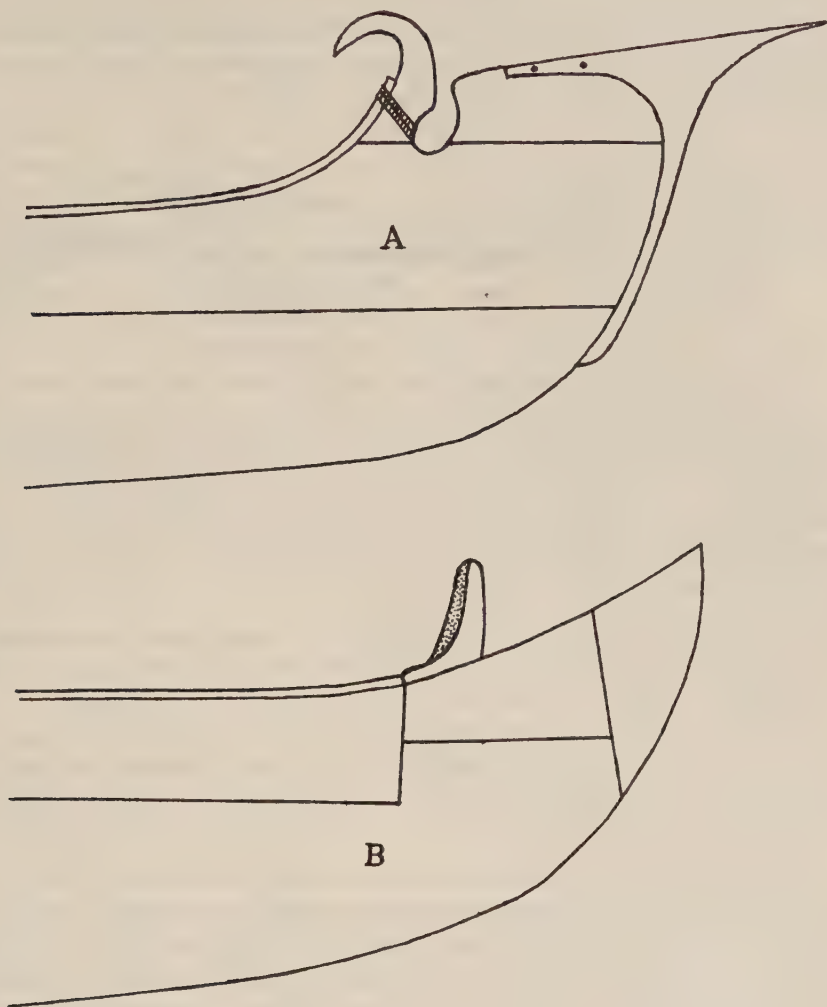


Fig. 7. A.—Stem of a fishing canoe of Majunga ; B.—Stern of the same.

In this connection it has to be remembered that fashions in boat design sometimes change rapidly; alterations in commercial relations with other countries may cause great modifications in the dimensions and types of the craft in use. The absence of a link is not *a priori* a reason for the denial of its former existence. We have to note, for example, that no relic survives in Madagascar of the great two-masted ocean-going ships in which Sumatran and Javanese sailors and emigrants performed voyages between the homeland and their overseas settlements in Madagascar—vessels of which the figures are sculptured on the gallery panels of the Buddhist stupa of Boro Budur. Only small in-shore craft survive. Even in Java it is only certain types of

coasting and fishing boats which retain the bifid type of prow (Plates C and D and Fig. 8). Hence the bifid stem of the Baganda canoe would seem to represent the survival of a design much more widely distributed in former times than it is to-day.



Fig. 8. A bifid-ended fishing canoe seen at Menado in the Celebes, 1918.

The lack of a sail in the lake craft, until it was introduced by the Arabs, was probably due to want of skill on the part of the Bantu borrowers of the hull design. The African negro is notoriously deficient in ability to handle sailing craft except after prolonged tuition by the European; none of his primitive craft is used normally under sail, paddling being the characteristic method of propulsion.

It has also to be borne in mind that the negro in no other part of the continent has ever evolved a boat design in any way comparable in complexity and skilful construction with the canoes of the Victoria-Nyanza. The latter stand apart, exceptional and foreign to all other products of negro canoe-building, for elsewhere canoe design is crude and primitive and without any of the refinements seen in the craft of this great lake, a locality within trading distance from the coast.

At the same time it is certainly true that the more advanced and intelligent of African tribes have quite considerable adaptative talent. They are fully capable of appreciating the better qualities of foreign devices and methods which come under their notice and often are skilful enough to imitate them. Such for example is the adoption by certain tribes of the use of the cross-bow from mediaeval Portuguese sources and the wonderful bronze work of Benin; possibly also the design of the great conical tower of Zimbabwe, and the chequer pattern seen in the construction of some of the walls of several of the stone-built ruins of Rhodesia. This possibility is peculiarly apt to the present issue, for we find Miss Caton-Thompson⁽¹⁵⁾ saying of the Zimbabwe ruins that "one or two features may perhaps not unreasonably be attributed to a foreign original in some coastal settlement, filtered through the Bantu mind and adapted by Bantu hands into the form familiar in the ruins". A similar process is exactly that which I have predicated for the origination of the characteristic and non-negro features of the Baganda canoes of Victoria-Nyanza, from which the various inferior kinds of watercraft found

in this region have probably been derived by a simplification of one or more of the basic features of construction present in the more specialized type.

A direct origin of the Baganda design is, however, by no means improbable, for Ibn Said, who lived 1208-86, as quoted by Ferrand⁽¹⁶⁾, mentions a great migration of Malagasy people from Madagascar into Africa, with eventual settlement in the neighbourhood of the "Mountains of the Moon". This suggests a trek inland into the highlands of Kenya and the immediate vicinity of Victoria-Nyanza, similar to that migration of the Merina (Hova) tribe from the south-eastern coast of Madagascar to the high central plateau of the island which is an accepted historical fact.

In addition to the reasons detailed above for believing that Indonesian influence was at one time powerful on the East African coast, we have to note that the introduction of the coconut palm was due probably to this cause as it appears to have been in Ceylon. With the coconut came the coconut scraper of form identical with that of Sumatra and Java. The distribution of the Indonesian flat-bar zither in East Africa, extending as it does down the Swahili coast and penetrating inland to Lake Tanganyika, is even more significant⁽¹⁷⁾; this and the employment of the double-outrigger along the coast from Somaliland to Mozambique, are perhaps the two strongest pieces of evidence we have of the former wide extent of Indonesian influence on the East African coast and in its hinterland.

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DESCRIPTION OF THE ILLUSTRATIONS

PLATE A.—Two plank-built canoes at Jinja, on Victoria-Nyanza, showing the bifid prow characteristic of these craft, the decoration of the false stem-head, and the protrusion of the thwart ends through the sides.

PLATE B.—Interior of a Baganda canoe under construction to show the form of the thwarts and the method of sewing the planks together over canes applied to the caulked seams.

PLATE C.—Madura coasters having the fore end of the keel prolonged into a ram-like projection below the broad stem. The ends of several squared thwarts are seen projecting slightly through the side planking.

PLATE D.—The bifid prow of a small cargo vessel, Sourabaya harbour, Java. In this the lower section has developed at the expense of the upper and has actually become the functional stem.

A Contribution to the Study of the Vegetation of Mpwapwa

By *H. E. Hornby and Robina M. Hornby*

PREFACE

FOR MORE than ten years the authors—who have now left the Territory—have studied the vegetation in the neighbourhood of the Veterinary Headquarters and Research Station, Mpwapwa, and during this time they have made a collection of local plants. This now numbers more than nine hundred species, the determinations of which have all been made by Mr. P. J. Greenway of Amani, whose unfailing help and interest are gratefully acknowledged. They desire the collection to be of real use, not only to research workers stationed at Mpwapwa, but to all who are interested in the rich flora of Tanganyika Territory. As an aid to those who wish to consult the collection, a catalogue has been compiled and is available at Mpwapwa, and in the following pages a brief description is given of the more important plant communities, with notes on their significance.

INTRODUCTION

To nearly all newcomers to Central Africa, including many with scientific training, the vegetation of the more densely wooded parts of the continent is a meaningless jumble; and such it remains to all but a fortunate few. These, through inherent love of Nature or because their work makes the effort necessary, learn to see order where the uninformed see only chaos, to perceive differences in the groupings of plants, and to realize that these differences have a meaning. Gradually the discerning student appreciates that certain plant communities are essentially stable; observation year after year shows minor changes only. Other communities are as clearly unstable: certain plants found one year have been replaced by other species a year or two later; sometimes obviously through the action of man or his domestic animals, but sometimes without this influence. This division of plant communities into those which are stable or *climax*, and those unstable or *seral* is very important and the basis of ecological study. But it is not easy to divide vegetation into definite communities. As Tansley & Chipp (1926, page 6) say: "When we try to fit too rigid a framework on the facts of nature we always come to grief because nature refuses to be bound by our conceptions. The wanderings and combinations of plants are so manifold and conditioned in so many different ways that it is not easy to frame a really natural classification of the multiform communities they produce. It is probably impossible to frame one that will fit *all* the facts, but meanwhile we must do the best we can, for we cannot get on without some sort of naming and classification of plant communities."

We have found the system of F. E. Clements, the distinguished American ecologist, to be the most useful one to follow. This system is already used

by many in East and South Africa; notably by Dr. John Phillips who, as Professor of Botany in the University of the Witwatersrand and by his writings, exercises great influence on the rising generation of botanists in Africa. But one can follow a system without being a slave to it, and if on occasion we wish to diverge slightly from the lines laid down by Clements we shall do so; stating at the time our reasons for this action.

LOCALITY

For the purpose of this article, "Mpwapwa" is anywhere within twenty miles of Veterinary Headquarters. It consists of the great mass of the Kiboriani Mountain block and the country immediately around. According to Gillman (1933) this block is the western continuation beyond the almost certainly tectonic "gap" at Mlali, of the ESE.-WNW. striking and highly SWS. dipping, ancient metamorphosed sediments and volcanics which build up northernmost Usagara or North Rubeho, anciently folded and recently upraised. Thus there is no plain, but as it were a southward draining valley through which runs the road to Kilosa, between the comparatively gentle slopes of the east side of the block and the Mlali Mountains; the altitude of this gap being about 3,600 feet. Kiboriani is thus a great range terminal, standing above a peneplain that it studded irregularly with inselbergs. The main slope of the peneplain is from north to south—in which direction the Kinyasungwe River traverses part of the area before turning south-east near Msagali—so that, at the same distance of a few miles from the main block, the plain north of Kiboriani is higher than that lying west or south of the mountain. The country to the north of Kiboriani is the somewhat featureless, flat, Masai steppe. To the west of the mountain is an inselberg-studded plain. To its south, beyond the foothills that enclose the Veterinary Headquarters at Kikombo, and overlook Mpwapwa village, is a quickly dropping foreland intersected by low ridges of hills, as far as the Kinyasungwe and railway; further south is Gulwe Mountain, and further south-west is the "great tectonic line of the Mbonda-Matonga scarp". Obviously Mpwapwa shows great diversity of country, measured by altitude alone. Added to this is the diversity derived from rain-shadows, soils and rocks.

GEOLOGY

A very detailed description of the geology of the west half of "Mpwapwa" has been given by Temperley (1938). He amplifies the earlier brief but comprehensive account of the salient features of the Kiboriani massif by Gillman (1933). It appears that the rocks of Mpwapwa are those of the Lower Basement Complex, and that the principal ones arranged in order of decreasing resistance to weathering are—

Meta-dolerite.	Plagioclase amphibolite.
Quartz-granulite.	Acidic gneiss and granite.
Quartz-mica-schist.	

The order is important, as there is "a direct relationship between the elevation and the proportion of hard to soft rock. As the amount of hard rock diminishes outwards to the north and south of the range, so the heights of the foothills and inselbergs lessen". Also the partitioning off of pervious rocks by hard bands of quartz favours water conservation and its subsequent delivery by streams.

Quoting Temperley (pages 14 and 15): "The forms of the massifs are dependent on their geological structures. The marked east-west alignment of the crest of Kiboriani and of its foothills and ridges is due to the prevailing east-west strike of the stratiform metamorphic rocks. The sinuous form of the actual crest-line follows strictly the course of the thickest belt of hard rocks, namely the psammitic schists and granulites. The foot-ridges and salients on the slopes are formed of long, narrow beds of amphibolite and quartz-granulite, the hardness of which is superior to that of the acidic gneisses in which they lie. Among the psammitic schists in the higher parts of the range the massive quartz-granulites stand up like reefs and have been mistaken for such by prospectors. A number of these are to be seen above Kongwa Mission Station. Still more wall-like are those quartz-granulites that stand up in the even softer gneisses of the foothills. These are conspicuous in the northern foothills Munyakongo, Tunhilla and Makongu. Meta-dolerites, though of very small areal extent, are the hardest rocks of all. They occur as cores in many of the amphibolite sheets and nearly always form conspicuous features. The remarkable conical hills of Mghulhatambulwa and Sanghanga, at the western end of the Kiboriani range, owe their existence and steepness to outcrops of this rock. Two small but high peaks above Kongwa Mission Station are formed of meta-dolerite; so also are some of the small, abrupt foot-ridges on the south side of the range close to the Dodoma road.

"Amphibolites without meta-dolerite cores are rather less resistant to erosion than the psammitic schists and granulites and form slight depressions among them following the prevailing strike. When, however, they occur in the acidic gneiss, they form conspicuous features, an example of which is well illustrated in the long, narrow ridge at the western foot of Mghulhatambulwa. The meta-calcareous rocks do not form conspicuous features unless they contain much quartz in addition to the calcic minerals.

"The same rules of differential weathering hold in the Gulwe massif. The western, steep salients owe their existence to numerous meta-dolerite cores in amphibolite sheets: the summit is formed of a band of quartz-granulite, while the lower slopes on the north side are buttressed by layers of quartz-granulite and amphibolite".

West of the Kinyasungwe River, that is, after about twenty miles along the Dodoma road, going from Mpwapwa, the rocks change from Lower Basement Complex, and gneisses give way to granites, conspicuous as inselbergs.

As the peneplain itself is extensively and often deeply covered with superficial deposits, Temperley's remarks on its geology may be dealt with under the next heading.

SOILS

Once more we must quote from Temperley, as we are unable to improve on the brief description, incorporating the work of Milne, given on pages 9 and 10 of his paper.

"The soil within three or four miles of the Kiboriani massif is bright red : it belongs to Milne's group of 'non-laterized red earths' of the sub-type that has been transported (Milne, 1936). Milne points out that these soils are not accumulating at the present time but formed during climatic conditions, more humid than now, from material washed down from the highlands. They are leached sandy soils, the clay fraction having been transported further from the hills and accumulated in the bottom lands on which the present alluvial deposits rest.

"The red earths attain a considerable thickness, particularly in the neighbourhood of Kongwa, where their transport outwards from the range has been impeded by some foothills. Here, in the Mlanga stream bed, a fine section is exposed for several miles, the soil in places reaching a thickness of over thirty feet. This red earth is the most fertile soil of the district, a fact attributed by Milne to the number of times in its history that it has occupied the position of topsoil, and therefore to the number of opportunities it has had to develop towards maturity. It is a stratified deposit built up of a number of washes, part of the material of each having existed first as a skeletal soil on the slopes of the range. Each wash must then have lain exposed on the peneplain for some time before being covered by the next. Finally, the soil in cultivation does not become completely exhausted, for each wet season the uppermost layer is washed away by the rain so that the succeeding underlying one is exposed for use. As Milne remarks : 'Truly this is a form of mining, not of agriculture.' By proper methods of cultivation soil erosion can be greatly reduced, but as the natives are slow to adopt them, vast quantities of this valuable soil are lost irretrievably every year.

"Beyond the vicinity of the hills, the peneplain is covered by a soil that is in general paler. This soil is a greyish-sandy-yellow but contains many red areas from a few hundred yards up to a mile or two in diameter. The formation of this soil must be due chiefly to the weathering of the underlying rock under climatic conditions much more humid than those at present. The underlying rock is dominantly granite or acidic gneiss with only an occasional inclusion of basic rock. It is not known whether the red patches are due to underlying basic rock or to some former or present difference in moisture conditions.

“Extensive areas of still lighter-coloured soils occur on the level areas of peneplain north of Kongwa and north of Msagali. The second of these is crossed by the Dodoma road near the Kinyasungwe and has been described by Milne. He believes that it is hard-pan developed over a lake-bed soil.

“Milne (1935-36) has recorded brown clay on the Dodoma road close to the lake-bed soil. It occurs downhill from some calcareous crustal deposits developed on amphibolite. It may be derived as a residual deposit after the weathering of the limestone, or directly from the basic rock.

“Calcareous crustal deposits are common in the area. In the Kiboriani range they occur wherever springs issue close to marble or meta-calcareous outcrops. The most considerable are at Kongwa Maji, two miles west of Kongwa Mission Station, and between Chunyu Hill and the Kiboriani massif. These deposits are not forming at the present time but are undergoing erosion. On the peneplain they are found attached to the sides of stream gullies and projecting from the soil at the surface. They also occur on the hillsides up to several hundred feet above the peneplain, particularly overlying quartzite and quartz-granulite outcrops. A belt of such deposits lies on the eastern flanks of the north-south Chiegea chain of hills, where they are evidently due to the presence of thin bands of marble associated with the quartzites.

“On the hills the character of the soil depends upon the kind of rock from which it has been derived. On and immediately below exposures of quartz-granulite and quartz-mica-schist, it is pale, sandy and micaceous, but in the hollows, where acidic gneiss and amphibolite are weathering, it is much darker in colour. The blackest soils occur on and below thick bands of amphibolite with meta-dolerite cores.

“The soil on the hillside is never deep, except in some of the stream beds no longer functioning as watercourses, for it slips downwards during the wet seasons. The number of stream beds now occupied by deep deposits of soil is a further indication of the decrease in humidity that has been taking place since geologically recent periods.”

CLIMATES AND CLIMAXES

It is very difficult to describe or even define a “climate”, since this is a complex of so many factors: rainfall, effective rather than total; humidity of the air, including mist; maximum, minimum and mean temperatures; evaporation; wind; sunshine, etc., and the seasonal changes of all these. Cyclical changes have also to be considered. These difficulties, but not how to overcome them, are well set forth in a review of the subject by Moreau (1938).

Consequent to these difficulties, the biologist finds it more satisfactory to express climate in terms of vegetation than in terms of physics, and particularly in terms of a vegetation community that is a true resultant of these manifold and complex physical forces.

None can deny that every locality has a climate. Further, the majority of botanists agree that in every locality there is a *tendency* for plant life to settle down to some exceedingly stable form. This trend towards stability, known as succession, is frequently frustrated; nevertheless in areas not too much disturbed by man, this stability is also frequently achieved, and the locality then, as it were, sleeps under an unchanging *form* of vegetative life. Such a stabilized community, in a state of dynamic equilibrium that cannot be upset by seasonal or cyclical extremes of the climate to which it is adapted, is known as a *climax*. The concept of the climax as a complex organism inseparably connected with its climate, and often continental in its extent, was introduced by Clements in 1916, and the following extract from a later paper (Clements, 1936) expresses the concept clearly :

“It can still be confidently affirmed that stabilization is the universal tendency of all vegetation under the ruling climate, and that climaxes are characterized by a high degree of stability when reckoned in thousands or even millions of years. No one realizes more clearly than the devotee of succession that change is constantly and universally at work, but in the absence of civilized man this is within the fabric of the climax and not destructive of it. Even in a country as intensively developed as the Middle West, the prairie relicts exhibit almost complete stability of dominants and sub-dominants in spite of being surrounded by cultivation (cf. Weaver and Flory, 1934). It is obvious that climaxes display superficial changes with the season, year or cycle, as in aspection and annuation, but these modify the matrix little or not at all. The annuals of the desert may be present in millions one year and absent the next, or one dominant grass may seem prevailing one season and a different one the following year, but these changes are merely recurrent or indeed only apparent. While the modifications represented by bare areas and by seres in every stage are more striking, these are all in the irresistible process of being stabilized as rapidly as the controlling climate and the interference of man permit.

“In brief, the changes due to aspection, annuation or natural coaction are superficial, fleeting or periodic and leave no permanent impress, while those of succession are an intrinsic part of the stabilizing process. Man alone can destroy the stability of the climax during the long period of control by its climate, and he accomplishes this by fragments in consequence of a destruction that is selective, partial or complete, and continually renewed.”

To the reader of this quotation of Clements the meaning of the word *aspection* may be novel. It means “due to aspect”, and *aspect* in ecology means “a seasonal phase of vegetation”. Everyone knows the difference between the spring (*vernal*), summer (*aestival*) autumnal and winter (*hiemal*) aspects of an English wood.

How does this Clementsian concept apply to Mpwapwa? We should say without hesitation that the climate of the Mpwapwa peneplain, of which only one factor is a rainfall of twenty to thirty inches compressed into less than six months, must produce a climax of *Deciduous Bushland*.^{*} On the other hand, on top of Kiboriani Mountain one feels in a different climate; a cooler, moister, less exacting climate than that of the plains, and the reality of the difference is confirmed by the presence of small areas of *Upland Dry Evergreen Forest*; a community that could neither evolve nor survive two thousand feet lower down. This is the climax associated with the climate of the extreme mountain-top, and wherever in East Africa this climate occurs, there the vegetation will tend towards the same climax. Concerning the reality of these two climaxes there is little difference of informed opinion, but the existence of a third is debatable.

Leaving Gulwe station (2,500 feet) and going upwards and northwards, it is clear to the trained observer that as far as about the 4,000 feet contour he is passing through vegetation having a single (Bushland) climax. He notices that beyond Mpwapwa village the species are not quite the same as those nearer Gulwe, but the differences can only be seen by close inspection; the formation of the "untouched" bush remains the same. Above the 4,000 feet contour, however, he enters Woodland, as opposed to Bushland, and this type of vegetation persists until Evergreen Forest is sighted near the summit of the mountain. This kind of woodland, known botanically as *Brachystegia-Isoberlinia*-Other Species Woodland, because of the constant presence of trees belonging to the genera *Brachystegia* and *Isoberlinia*, but more conveniently referred to by the native name of miombo, is a community of very great importance that covers hundreds of thousands of square miles between Uganda and Sudan in the north and Transvaal in the south. Travellers on the Great North Road have every chance of becoming familiar with this woodland since they pass through it most of the way from Iringa, in Tanganyika Territory, to the Limpopo River.

Now a remarkable thing about miombo is that it appears to be *always* subject to the fires that are everlastingly sweeping through the drier parts of Central Africa; in other words, all woodlands dominated by trees of the genera *Brachystegia* and *Isoberlinia* appear to have sufficient inflammable ground cover (not necessarily grass) to permit recurrent fires. These have been going on for so long that they may *almost* be looked upon as a natural feature of many environments. Certainly many species of plants and insects have become so well adapted to periodic exposure to fire or the effects of fire that they would suffer and might die out if fires were for ever excluded from their environment.

^{*}Called *Deciduous Thicket* by other writers.

With the advent of the white man such a change in environment becomes possible; so now arises the question: Although grass fires have occurred during countless centuries, yet as they are usually started by man and therefore need not be started, are they to be considered natural? This is no academic quibble, but vital to the decision whether miombo, continually exposed to fires as it has been, and undoubtedly in equilibrium with this periodically scorched environment, is a climax community. Where fires are inevitable in the future as they have been in the past, then they would be natural, and miombo would be a climax.

We ourselves, who have had unburnt miombo under general observation for fifteen years, are convinced that with fire-exclusion the more-or-less grassy woodland of clean-boled, well-spaced trees, often forty or more feet in height, that constitutes miombo, is definitely, though often very slowly, replaced by vegetation communities of which the woody species are set much closer together. This thickening-up is due in part to increase in the number of immature *Brachystegia* and *Isoberlinia* trees, but also in part to smaller trees and shrubs. Phillips (1930) believed that persistent fire exclusion would lead to greater and greater replacement of *Brachystegia* and *Isoberlinia* by thicket elements until—in the case of Mpwapwa—the miombo was replaced by Deciduous Bushland, except towards the top of the mountain where the thicket elements would be derived from Upland Dry Evergreen Forest and so belong to this climax. We consider, then, that since fires can and may be excluded, they should *not* be considered a natural feature of any environment, and the various sub-types of miombo are therefore seral communities tending towards climaxes different from themselves.

But what are the climaxes to which miombo tends if undisturbed by fire? As stated above, Phillips believed them to be what we call Deciduous Bushland and Upland Dry Evergreen Forest, and there is considerable evidence in support of this. For example: Gulwe Mountain is nearly as high as Kiboriani, and on its summit are traces of Evergreen Forest. But the ascent of its northern slopes takes the traveller *through Deciduous Bushland all the way to the summit*; he passes through no miombo at all. This difference from the ascent of Kiboriani can be explained in two ways: (1) It may be because the northern slopes of Gulwe Mountain are in a rain shadow, so that the climate does not permit miombo. (2) Owing to the absence of streams, these slopes have always been uninhabited by man; it may be, therefore, that, sandwiched between bushland below and forest above (neither of which permits the passage of fire) the slopes have never experienced the fires that are essential to miombo.

At the present time, all we can say with conviction is that whatever may be the final outcome of excluding fire from miombo, the resulting climax or climaxes would not be miombo of the form known so widely to-day through-

out south-central Africa, and that, therefore, this miombo is not a true climax. Clements has a term for communities that are not true climaxes but, on account of the persistence of the factors preventing development, are exceedingly stable. He calls these *serclimaxes* (pronounced sere-climaxes) and that is what miombo communities are.

In the section on Locality we referred to Gillman's opinion that the Kiboriani massif was (geologically) recently uplifted. In his view, too, when we talk of climaxes in the great East African "shatter-belts" we should not forget that the recent crustal movements have carried parts of the land from the drier lowland climate into a markedly more humid upland climate (or vice versa); and that these movements may well have taken place within a period of time shorter than that required for the establishment of a vegetation climax. Certainly Milne considered that Mpwapwa soils were derived from the weathering of rocks under conditions more humid than those at present. However, in the end, climaxes are (as Phillips says) determined through "the master control of climate over-riding such local differences as physiography, geological formation and soil type". Therefore, the recognition of climaxes is the key to understanding climates. At Mpwapwa we can recognize: (1) a Deciduous Bushland Climax; (2) an Upland Dry Evergreen Forest Climax; and (3) a *Brachystegia-Isoberlinia*-Other Species Woodland (miombo) serclimax that may be successional to one or both of the true climaxes, but in the present state of our knowledge is more conveniently treated as independent of both.

At this point we should like to make a suggestion regarding the use of the word *formation*. Clements (1936, page 254) says: "... the term climax has come more and more to replace the word formation, which is regarded as an exact synonym". We consider the word climax can now bear alone the unchallenged meaning of a stable community, that is, one in dynamic equilibrium with its environment, and release the word formation to signify "a climax and all communities that belong to it developmentally". In this way, when we speak of passing through Bushland Formation we do not mean we are in obvious bush all the way (as we should be if we passed through Bushland Climax); we may at times be passing through fields of grain or through scrubby grazing—seral communities which, if allowed, would give way eventually to stable bush. This special use of the word does not, of course, interfere with its general use as defined by dictionaries.

NOTES ON SOME OF THE MORE IMPORTANT VEGETATION COMMUNITIES

A.—UPLAND DRY EVERGREEN FOREST FORMATION

(1) *The Climax*.—There are only two small patches of true forest; and by *forest* we mean closed evergreen tree communities, with practically no grasses on the forest floor. Although mere relicts, both patches are easily

recognized. We can imagine that in a former wetter period this type of forest was widespread on the mountain, though probably even then the edges were assailed by fires which, as we have pointed out, must have been in existence for countless centuries. Then the climate became drier, and the effects of fire and other forms of man-engendered disturbance swept away all but these two relicts; the upper persisting where altitude still gives a climate not far removed from the more general earlier wetter one, while the lower persists by reason of especially favourable soil (edaphic) conditions (see Milne, quoted by Staples, 1938) and through the protection from fire afforded by its position on a leeward slope.

Both blocks are being used by the Veterinary Department for studies in water conservation and the effects of excluding fire from the forest edge. The two studies go together; for it is desired to know not only what type of vegetation on the mountain top best favours rain percolation and subsequent spring flow, but how this type can be obtained and extended.

We have no intention of detailing the constituents of any vegetation community. The serious student must make his own collection and compare specimens with those in the Mpwapa Herbarium, and, when necessary, appeal to Amani. The forest is called *dry* because it exists in a climate with several rainless months each year, during which the surface soil dries out and ground herbage shrivels. There are few noble trees; the most imposing are the feathery-leaved *Albizia maraguensis*. Most of the trees are only thirty to forty feet high; mainly small-leaved, for example *Euclea divinorum*, *Apodytes dimidiata* and *Olea chrysophylla*, but with one beautiful broader-leaved flowering species, *Calodendrum capense* or African Chestnut. Occasional but nevertheless conspicuous in the higher block is *Dracaena steudneri*, a liliaceous plant that achieves tree dimensions. Interweaving among the trees and upon themselves are scandent thorny bushes and trees with long lax branches, for example *Rhus natalensis*, *Gymnosporia* sp. (Hornby No. 493) and the very thorny *Toddalia asiatica*. Many of the trees carry ferns and most are more or less moss-covered. A common undershrub is a wild coffee, *Coffea* sp. (Hornby No. 734). Ground flora is very scanty, though in the glades there are some large-leaved herbs and good stands of the grass *Ehrharta abyssinica*.

(2) *Forest-Margin Communities*.—The great enemy of forest is fire. Throughout Africa every natural forest is menaced by fire, and trees tend to be replaced by grasses. Wherever forest trees are cut down to make fields, grasses grow up and usually the fields become linked with neighbouring recurrently burnt areas. From that time natural regeneration of the forest in the clearing becomes unlikely. Forest seedlings are destroyed by fires that favour many species of tall grasses, and so nearly all forests and forest relicts are neighboured by grassland. Often, of course, the relicts disappear, and then only grassland remains.

But the relicts do not always go. At the forest margin large leafy shrubs and woody herbs, many of them scandent and some of them with conspicuous flowers, find congenial environment. We need only mention *Canthium gueinzii*; *Tecomaria rupium*, with orange flowers; *Vernonia brachycalyx* and *V. zanzibarensis*, both with mauve flowers; *Myrsine africana*; *Lippia asperifolia*, with leaves strongly scented when crushed; *Pavonia schimperiana*, with pink hibiscus-like flowers; the cream-flowered *Leonotis mollissima*; the "everlasting"-flowered *Helichrysum schimperii* and *H. kirkii*; the leguminous plants, *Rhynchosia resinosa* and *Mucuna* sp. (Buffalo bean); the thorny *Acacia pennata* and *Rubus* sp. (Bramble). These do not support fire, but neither are they easily killed by it, and the tangle formed by them acts as a protecting buffer to the forest. It is essentially grasses that support fire, and fierceness of fires is proportional to the predominance of tall grasses. Because of this fact the action of grazing animals is detrimental to fires, and there are worse ways of protecting forest than by deliberately overgrazing forest margins with cattle, to encourage woody herbs and shrubs which not only have a buffer action but may form a first stage in forest regeneration. One experiment at Mpwapwa is to graze the margin of the upper forest block and study the subsequent plant succession.

(3) *Mountain Grasslands*.—Evergreen Forest Formation at Mpwapwa is so restricted in area that the amount of Mountain Grassland derived from forest destruction is correspondingly small; at most a few hundred acres. Also, being at the lowest limit of the formation's climate it is extensively invaded by woody species from the adjacent miombo as well as from the forest margin. The two factors that most favour the formation of grassland are seasonal inundation, which drowns tree roots, and recurrent fires which destroy young trees. A third factor, namely shallow soil above impervious rock, acts as much by causing seasonal inundation as by restricting the root range of tree seedlings.

There is little pure grassland on the Kiboriani block, except the area that is so conspicuous on the upper south-west slopes of Mount Wilkins. Here the soil is very shallow, and the dominant grass is *Sacciolepis barbiglandularis*. Elsewhere the grassland community is *Grassland with Scattered Trees*; obviously fire-maintained, since there is marked increase in the number of woody species after only three years' protection from fire. The dominant grass genera appear to be *Hyparrhenia*, *Cymbopogon*, *Andropogon*, *Themeda*, *Panicum*, *Loudetia* and *Setaria*, but many others are represented. The commonest tree is probably *Dombeya quinqueseta*; certainly this is the most striking when it is covered with white or pale-pink papery flowers in early spring. Other trees include *Acacia abyssinica*, *Rhus incana*, *Combretum gueinzii* and *Vangueria tomentosa*. Conspicuous among the many shrubs and woody herbs are *Sphacophyllum africanum*, a bushy composite with yellow flowers; *Crotalaria lachnocarpoides* and *Argyrolobium leucophyllum*, both with

silvery-grey leaves, and the thorny trailing *Asparagus racemosus*. Locally common, too, is the Bracken fern, *Pteridium aquilinum*.

B.—BRACHYSTEGIA-ISOBERLINIA-OTHER SPECIES WOODLAND (MIOMBO)

From a little below the top of Kiboriani, that is, from about 5,500 feet altitude, to approximately the 4,000 feet contour, the mountain side is clothed by woodlands of a fairly uniform type: smooth, clean-boled trees, thirty to fifty feet high, standing well apart from one another but with their crowns touching and so making a closed canopy, and generally with a fair ground cover of grass and herbs. This type is well shown in photo No. I of an article by Greenway (1933) on "The Vegetation of Mpwapwa". It gets its name from the two allied genera that dominate it. There is only one local species of *Isoberlinia*, *I. globiflora*, but there are at least five local species of *Brachystegia*. The different species have a strong resemblance to one another: clean-boled, thornless, with soft pinnate leaves that are often beautifully tinted in spring. An easy way of distinguishing the two genera is by deeply slashing the bark: all *Brachystegias* slash red, while *Isoberlinia globiflora* slashes orange. But although species of one or both genera occur everywhere throughout the woodlands, the species differ from place to place and notably with altitude. To show this, we may quote from some field notes we made while descending from near Kiboriani Mission Station:—

"Above 5,600 feet: *B. spiciformis* by far the commonest tree, with *Faurea speciosa* next.

"About 5,500 feet: Mixed wooding of *B. spiciformis*; *Faurea speciosa*; *Uapaca kirkiana*, with tough leaves and edible fruits; *Combretum gueinzii*; *Protea uhehensis*, with creamy-white flowers, and the pinkish-yellow flowered *P. abyssinica*.

"About 5,000 feet: *B. utilis* forming a consocieties (a consocieties is a seral community with a single dominant), together with a few *Combretum gueinzii*.

"About 4,800 feet: *B. utilis*-*B. spiciformis* associates. (An associates is a seral community with two or more dominants).

"About 4,700 feet: A consocieties of *B. microphylla* on some steep slopes, and a consocieties of *B. bussei* on a less steep hill-side.

"About 4,600 feet: A consocieties of *Isoberlinia globiflora*.

"Below 4,500 feet: *B. microphylla* is the only species of *Brachystegia* or *Isoberlinia*, but there are many other kinds of trees, notably *Albizia tanganyikensis*, with flaking bark; the milky-sapped *Diplorhynchus mossambicensis*, and *Combretum spp.*"

Generally speaking, *B. spiciformis* is found in the highest zones; to be joined a little lower down by *B. utilis*. Then *Isoberlinia globiflora* joins *B. utilis*, and *B. spiciformis* tends to fall out. *B. microphylla* favours certain

kinds of rocky ridges and also comes lower than any other species though *B. bussei* and *B. boehmii* come nearly as low.

Notable among associated genera of trees and shrubs are *Uapaca* and *Protea*, found only in the higher zones, and *Phillipia benguelensis*, found only in the very highest zone. The most important genera of grasses found throughout miombo are *Hyparrhenia*, *Andropogon*, *Themeda*, *Panicum*, *Setaria* and *Rhynchelytrum*.

C.—UPLAND BRACHYSTEGLIA SPICIFORMIS-OTHER SPECIES

WOODLAND (MIOMBO)

This is the uppermost zone of Mpwapwa miombo, but as it contains no *Isoberlinia*, it cannot be included in the communities just described under heading "B". Where, as just below the mountain huts, the *B. spiciformis* trees reach a normal height of about thirty feet, the community can be considered an ordinary miombo consocieties, but higher up, as one approaches Upland Dry Evergreen Forest, intermediate conditions between those favouring this formation and those of typical miombo are encountered, and *B. spiciformis* then becomes a mere constituent of an *ecotone*, or transitional belt, between the two formations. Small consocieties of dwarfed moss-covered *B. spiciformis* form *alternans* with little forest blocks, where *Brachystegia* mingle with small evergreen trees, as *Myrica salicifolia*, and shade a dense under-storey of shrubs, as *Myrsine africana* and *Tecomaria rupium*, and with patches of grassland dotted with scorched *Protea uhehensis* and *Aeschynomene burtii*.

D.—COMBRETUM-OTHER SPECIES WOODLAND

This, too, is an *ecotone*. It contains a few *Brachystegia microphylla*, but these are not dominant, and therefore the woodland cannot be considered as the lowest zone of miombo. Nor can it be definitely identified as the highest zone of Deciduous Bushland, though it is not sharply defined from this formation. Therefore it is conveniently described as an *ecotone* that is often though not invariably found between Miombo and Deciduous Bushland. The belt is of varying width, depending a good deal on the degree of slope in the neighbourhood of the 4,000 feet contour.

Tree combretums, twenty to twenty-five feet high, are the obvious dominants. The local species are *C. binderianum*, with reddish-brown fruits; *C. zeyheri*, with particularly large, straw-coloured fruits; *C. guenzii* sub-sp. *splendens*, with somewhat felty leaves, and *C. apiculatum* sub-sp. *boreale*, with smallish brown fruits. There are, however, many other species of trees, of which *Sclerocarya birrea*, *Azelia quanzensis* (a lucky-bean tree), *Sterculia quinqueloba*, *Albizzia harveyi*, *Lonchocarpus capassa* and *Terminalia stuhlmannii* are among the largest, while among the smaller trees, the yellow-

flowered *Markhamia obtusifolia*; *Commiphora fischeri*, with reddish-brown peeling bark and trifoliate leaves, and *Vitex hildebrandtii* are perhaps the most common. There are varying amounts of lower shrubs, and where these do not form dense shade there may be a good grass cover, affording useful grazing.

E.—DECIDUOUS BUSHLAND

(1) *Climax Communities*.—Throughout this climax the prevailing life forms are short-boled trees to about twenty-five feet in height, often with wide-spreading branches, and many-stemmed bushes, fifteen to twenty feet high. The crowns of these are usually touching or interlaced, and scandent shrubs reach up into them. The next stratum, formed of smaller shrubs and woody herbs from two to five feet high, is evident in inverse proportion to the density of the canopy above, whilst herbs and grasses, forming the lowest stratum, are sparse except along game paths and in the occasional glades. Above the general canopy emerge the crowns of scattered larger trees, to about thirty or forty feet in height, but it is the low trees and the bushes which give the characteristic appearance to the Bushland; one of shady leafiness during the rainy season, and of grey-stemmed leaflessness throughout the dry season.

“Dry Thornbush” was the name given to this deciduous vegetation as a whole by some earlier writers. Actually, besides the Acacias, comparatively few species carry true thorns; it is the spikey branches of some of the *Albizzias*, and the soft spines of most of the *Commiphoras* that give the thorny impression, while the papery peeling bark of the *Commiphoras* accentuates the general appearance of desiccation during the dry season, when the earth of “red Ugogo” reflects the heat of the midday sun. Below and among the bushes a carpet of dry leaves forms to the limited extent permitted by termite activity, but there is no fuel for fire in the sap-filled bushes and shrubs themselves; fires sweeping down from the open woodlands die out as soon as they reach the bushland. Occasional tall candelabra *Euphorbias* are the only noticeable evergreen trees.

The bushland vegetation is most complex and varied, and the selection of dominants is not easy. When attempting to divide a climax into divisions, one looks first for perdominants—species dominant throughout the climax; then for the natural large groupings of dominants that form associations; then for the smaller groupings of the same dominants that comprise the faciations and lociations of which all major associations are composed. *Eudominant* is the name given to a dominant occurring throughout all the faciations of an association. *Sub-dominant* is a species that prevails in a stratum below the highest.

There are few species perdominants in our Bushland Climax. *Acacia kinionje*, with thorns in threes and yellow-brown peeling bark, is one. *Acacia spirocarpa* might be considered another, though it never reaches its full stature in these communities of crowded trees and shrubs. The exceedingly prevalent

genus *Commiphora* furnishes only two species—*Commiphora* sp. nr. *C. lindensis* and *C. boiviniana*—of which the occurrence is so common and widespread that they may be considered perdominants. Unless one is making a detailed analysis of the climax, it is probably justifiable to think of *Acacias*, *Commiphoras* and *Albizzias* in terms of genera rather than of species, and these genera are found throughout the climax.

However, not all dominants of the bushland belong to genera rich in species. Three notable dominants are the only local representatives of their genera: they are the baobab (*Adansonia digitata*), *Delonix elata*, relative of the "Flamboyant" but with yellow flowers, and *Cordyla densiflora*, with shiny green edible fruits. Of these, *Delonix elata* is a perdominant, but the other two fail to achieve this status.

It is the comparative rarity of the baobab and *Cordyla densiflora* in the higher zones of our bushland climax that made us decide we were dealing with *two associations*: (1) An upper, *Acacia-Albizzia-Commiphora-Other Species Association*; and (2) A lower, *Adansonia-Commiphora-Cordyla-Other Species Association*.

(1) *Acacia-Albizzia-Commiphora-Other Species Association*

This community is found upon the lower slopes and foot-hills of Kiboriani Mountain. It merges above with the *Combretum-Other Species Woodland*, or directly with the miombo by forming alternates with the lowermost con-sociations of *Brachystegia microphylla*.

None of the three acacia dominants grows to a large size; the species *A. subalata* and *A. kinionje* are naturally only twenty to twenty-five feet high, while the third, *A. spirocarpa*, is kept to the same size by competition. *Albizzias*, which at first sight resemble acacias but are not thorny, are represented by *Albizzia anthelmintica*, *A. brachycalyx*, *A. harveyi*, and *A. gracilifolia* which resembles *A. harveyi* but is usually multiple-stemmed and has a smoother bark. *Commiphoras* are not as important here as in the lower association. The commonest are *Commiphora* sp. nr. *C. lindensis*, *C. rubrifolia*, *C. boiviniana* and *C. puguensis*. The last-named is often conspicuous during the summer; first by reason of its bareness when caterpillars strip it of leaves, then later, by the freshness of the succeeding foliage. Trees of less importance are *Delonix elata*; *Zizyphus mucronata* and *Fagara* sp. nr. *F. chalybea*, both very thorny; *Lannea stuhlmannii*; the dioecious *Sclerocarya caffra*; the holly-like *Elaeodendron stuhlmannii*, and many other species.

There can be few large trees in a bushland association because, as Staples (1938) has shown, the dense community is avid for water after each long dry season and does not permit penetration of rain-water below a very few feet; therefore large trees can maintain themselves only where such accidental features as rock faces, termite tunnels, etc., permit local areas of deeper moisture penetration.

Sub-dominant trees and shrubs which give much of its characteristic life-form to the association include *Grewia platyclada*; *G. dumicola*; *G. bicolor*; *Vitex* sp. (Hornby No. 153), a white-flowered bush with fruits the size and colour of brown boot-buttons; *Ehretia coerulea*, with pale violet flowers after the first rains, and *Premna holstii*, whose leaves emit a pungent odour when crushed.

Shrubs include *Marsdenia umbellifera*, *Croton scheffleri*, *C. menyharti*, *Ormocarpum kirkii*, *Clerodendron scheffleri*, and *Ochna longipes*, which is a mass of yellow bloom for two or three days only during the early rains. Among sub-shrubs are an *Ecboium* and *Lantana*, the blue-flowered *Blepharis hornbyae*, and *Disperma crenatum*, which may form large dense pure stands.

Of evergreen trees and bushes, the candelabra tree *Euphorbia* sp. nr. *E. bilocularis* is the most striking. Others occasional throughout the association are *Thylachium africanum*, *Maerua cylindricarpa*, *M. angolensis*, *Boscia grandiflora* and *Courbonia edulis*.

Scandent shrubs and lianes are numerous and include *Cadaba adenotricha*; *Acacia pennata*; *Dalbergia fischeri*; *Cissus oliveri*; *Secamone floribunda*; *Marsdenia zambesiaca*, of which the large fruits contain long silky fibres; *Bauhinia fassoglensis*, with pale yellow flowers; *Combretum purpureiflorum*, the crimson tooth-brush-like flowers of which appear before the leaves about September; *Momordica trifoliata*; *Helinus ovatus*, and *Vigna nilotica*.

The characteristic grasses are annuals of weak growth found along paths and in glades. They include *Brachiaria deflexa*, *B. serrifolia*, *Gilgichloa indurata*, *Leptochloa uniflora*, *Oplismenus burmannii*, *Panicum brevifolium* and *Setaria homonyma*.

(2) *Adansonia-Commiphora-Cordyla*-Other Species Association

This replaces the upper association just described, from about the 3,000 feet contour. The two merge to form an ecotone, which should be avoided when one wants to get a clear picture of either association. The one now under consideration can be studied to advantage near Gulwe or on the Nsue road.

The claim of the baobab (*Adansonia digitata*) to dominate is clear to all, nor is there any doubt about the importance of the *Commiphoras*. Most noticeable of these are *Commiphora caerulea* and *C. hornbyii*, each with bark flaking off in large pieces to reveal a bluish-green stem; *C. stuhlmannii*, a short-boled tree, with long spreading, four-sided branches, and *C. merkeri*, with large lozenge-shaped lenticils on its straw-coloured, roughly-peeling bark. *Commiphora stolonifera*, propagating by stolons, and forming utterly impenetrable thickets, is an important sub-dominant.

The other dominant that gives its name to the association is *Cordyla densiflora*. This tree, to thirty feet high, and well known for its hard wood and edible fruits, is conspicuous in autumn when its pinnate leaves turn bright

yellow. About the same time and later, another eudominant, *Acacia kinionje*, stands out by reason of its clustered spikes of flowers. Other eudominants are *Albizia gracifolia* and *Delonix elata*. The tallest tree of the association is probably *Entandrophragma bussei*, with fruits shaped like peeling bananas; but for reasons given when we described the other association, its very size precludes it from being more than a local dominant.

The association is very rich in small trees and shrubs; many of them very beautiful for brief periods. It is not only botanists who will have noticed the peculiar flowers of *Strophanthus eminii*, with their thin, ribbon-like petals, and the crimson and white flowers of *Quisqualis indica*. Other conspicuous flowering shrubs are *Gardenia* sp. nov. (Burt No. 3912) and *Peterodendron ovatum*, with masses of flowers like pear blossom. The fruits of *Sapium bussei*, apple-like in appearance but quite inedible, often attract attention. These grow with the shrubs *Vitex*, *Marsdenia*, *Croton*, *Ehretia* and *Premna*, of which the species have already been mentioned in the description of the upper association. Grewias, also, are common, especially *G. similis*. More local in their distribution are *Talinum* sp. aff. *T. taitense* and *Gyrocarpus asiaticus*. Evergreen trees and shrubs are those of the upper association, with the addition of a large *Balanites* sp. and, particularly near Lake Nsue, the fleshy-leaved *Salvadora persica*.

Sub-shrubs beneath the shady canopy include *Hibiscus canescens*; *Ecbolium* sp. (Hornby No. 77) and *Barleria* sp. (Burt No. 3928), both with blue flowers and growing to four feet in height. Among the scandent shrubs are *Ipomoea shirambensis*, with mauve flowers appearing when the bushland is leafless; "tooth-brush" combretums; *Fockea schinzii*, with its stem like a great snake; mauve-flowered vignas, and the yellow-flowered *Bauhinia fassoglensis*. Annual creepers which are very lovely at the end of the rainy season include *Ipomoea odontosepala*, with large mauve and maize-coloured flowers, and another convolvulus with large all-mauve flowers.

This association provides many species of euphorbias, monadeniums and other succulent plants, forming part of a ground herbage which though scanty is rich in families.

It is hoped that even this brief description of the association will give some idea of its richness and varied interest. Anyone who gives it careful study will find it fascinating even in the grey leaflessness of winter.

(2) *Some Seral Communities*.—Although much climax bushland is to be found in the Mpwapwa District, it is fragmented; the fragments forming alternates with seral communities. Some of these belong to *priseres*, or natural successions, where development to climax is held up by continuous or seasonal waterlogging, or by persisting unfavourable edaphic (soil) conditions; others belong to *subseres* engendered by man, and the communities of these seres so overlap that they are best dealt with as a whole under the title of *Cultivation Steppe*.

(1) *Hydroseral Communities of Lake Nsue*

Lake Nsue is a dilatation of the Kinyasungwe River. During the rainy season it fills to its maximum size of about two miles by a half mile, and twelve feet deep. At the end of the dry season the area has shrunk to half the full size, and the depth to two or three feet. The lake was much smaller when we first knew it, that is, it has increased to its present size within the last twenty years, presumably through the formation of a barrier of silt in the river bed below the lake. For several years after the somewhat sudden rise of the high-water mark, many *Acacia albida* and *A. campylacantha* persisted below this level, but they are now drowned and gone. Above the lake level there is a thin fringe of these acacias with fig trees and *Tamarindus indicus*, involved in the extensive cultivated areas of the lake-shore.

Growing actually in the water when this is high are such herbs as *Achyranthes robusta*, with thick inflated stems; *Ipomoea aquatica*, with mauve flowers; the red-stemmed *Polygonum lanigerum*, and another, *Polygonum sp.*, with white stems and grey leaves; *Sesbania pubescens*, with pale yellow flowers, and *Aeschynomene indica*, with very small yellow flowers. Among the aquatic cyperaceae are *Cyperus alternifolius* sub-sp. *flabelliformis* and *C. articulatus*.

Plants growing in water-logged soil include the sedges *Cyperus esculentis*, *C. tenax*, *Mariscus sp.* and *Scirpus sp.* nr. *S. maritimus*. With them are bulrushes (*Typhia spp.*) and such herbs as *Lippia nodiflora* and *Heliotropium indicum*.

As the water recedes in the dry season and the ground dries, prostrate herbs with grey-green woolly leaves appear. They include *Heliotropium supinum*, *Molluso lotoides* and *Indigofera microcarpa*. With them is *Hygrophila sp.* (Hornby No. 275), an aromatic blue-flowered acanthaceous herb, and the grasses *Dinebru arabica*, *Sporobolus glaucifolium*, *Echinochloa colona* and *Heleochoa schoenoides* (a saline-soil indicator), this latter forming, in places, a lawn-like pasture.

If through cutting-back of its outlet channel the lake were to disappear, then these pioneer herbs and annual grasses would probably be succeeded by more advanced grass communities, then by acacia woodlands and, finally, by the bushland climax. Such a succession constitutes a *hydrosere* (hence the title of this section) as opposed to a *xerosere* which develops from a habitat drier than that of the climax, and examples of which in the form of well-marked communities appear to be lacking in the Mpwapwa District.

(2) *Seasonal-swamp Communities*

The edge of Lake Nsue, dealt with in the last section, is seasonal swamp, but this section deals in a more general way with the low-lying lands of heavy clay known as *mbugas*. These become so water-logged in the rains that

only a specialized vegetation, different from climax bushland, can grow on them; such vegetation communities are therefore hydrosereal ones. The fact that seasonal flooding is favourable to many species of grasses, while it is inimical to tree growth, is taken advantage of by stock-owners ever on the look-out for natural pasturage. The result is that all local *mbugas*—except those at Matamonda, which until recently were tsetse infested—have been continually overgrazed and their natural grass cover largely replaced by unpalatable herbs and annual grasses. At Matamonda there are associates and consociates constituted by such tall grasses as *Panicum maximum*, *P. deustum*, *Pennisetum purpureum* (Elephant grass), *Phragmites communis* (Spear grass or Cane grass) and *Sorghum verticilliflorum*; together with dense stands of shorter, often recumbent grasses that include *Cynodon plectostachyum*, *Brachiaria* spp., *Panicum* spp. and *Digitaria* spp. This *mbuga*, however, has a much better soil and is much less grazed than the majority, and its grasses must not be considered typical of *mbugas* generally.

More typical are the *mbugas* situated along the Dodoma road, for example, the one at mile eighteen from Mpwapwa, just beyond the Msagali-Kongwe cross road. The soil is brown cracking clay. Here, overgrazing is so severe that it is difficult to say to what extent the present grass cover represents the dominants determined by *mbuga* conditions alone. The many species of grasses present include *Pennisetum mezianum*, *Cenchrus ciliaris*, *Bothriochloa insculpta*, *Gilgichloa indurata*, *Panicum maximum*, and species of *Digitaria*, *Setaria*, *Echinochloa* and *Chloris*. Encouraged by the overgrazing, low-growing woody plants are much in evidence; notably *Disperma* sp. (Hornby No. 2140), with mauve, brown-tinged flowers and lax trailing stem; *Disperma* sp. (Hornby No. 2141), two to three feet in height, with mauve-marked white flowers, and *Cyathula erinacea*. In the depressions are more hygrophilous herbs, as *Asteracantha longifolia*, *Celosia argentea* and *Aspilia* sp.

Where large channels cut deeply across these *mbugas*, the banks are drained and the vegetation approaches nearer to the climax; it may reach a proclimax (that is, near climax) stage represented by a dense fringe of *Kigelia*, *Zizyphus*, *Terminalia*, *Dalbergia*, *Grewia*, *Randia*, etc., with undergrowth of *Pycnostachys*, *Hygrophila*, *Centema*, *Cephalacroton*, etc. Colonizing the drying floor of such channels are the prostrate grey-leaved herbs *Heliotropium supinum* and *Glinus lotoides*.

(3) *Acacia* Woodlands

Mbugas which are less water-logged during the rainy season than those just described tend to carry heavy stands of acacias. Soil conditions no doubt determine the species of acacia that occur, for the prevailing communities are frequently consociates; one meets extensive, almost pure stands of *Acacia kirkii*, *A. mellifera*, and *A. stuhlmannii*; the last easily distinguished by its very hairy

squat pods. Along the Dodoma road and throughout much of the country near Gulwe Station are areas where these communities prevail.

Acacia spirocarpa woodland is best seen between Matamonda and Tubugwe, and near Mlali. The species itself is almost everywhere throughout the bushland formation but, as mentioned above, it does not thrive in close competition with other trees. It is seen at its best in transition belts between climax bushland and *mbugas*; well-grassed sites through which fires sweep periodically to keep down woody competitors. The same improvement in the growth of these acacias is seen in the farm pastures when individual trees are left dotted about after the rest have been cleared away. Palatability of the pods, and resistance of the seeds to digestion by ruminants result in widespread scattering of *A. spirocarpa* seeds by domestic animals. The resultant seedlings are among the worst weeds of pastures on the veterinary farms.

(4) *Hygrophilous Acacia Communities*

Streams coming from Kiboriani pass underground near the base of the mountain, but their channels continue to be recognizable for some miles by the more luxuriant vegetation, particularly fig trees and acacias, which they engender. In these belts, *Acacia usambarensis* (stinkbark) is found where the soil retains most moisture. *Acacia campylacantha*, characterized by thorns on the trunk and main branches, and *A. albida*, with large "apple-ring" seeds, come next, and finally comes *A. spirocarpa*, furthest away from the underground channel, though all species intermingle to some extent.

(5) *Short grass-Low shrub Alternes*

On the north side of Kiboriani Mountain are large stretches of mixed grassland and bushland on a plain that shows limestone outcrops, and has a yellow-grey soil differing in colour and structure from that of the *mbugas* referred to as seasonal swamps. One effect of calcareous rock lying close to the surface must be the production of excessive wetness after heavy rain, and this may be the factor that inhibits tree growth. On the other hand, the absence of trees may be directly due to shallowness of soil, and for this reason we consider the vegetation of these Kongwe and Bwaga plains to be different communities from those found in the *mbugas* of heavy clay already described.

The grass alternes are heavily grazed by native cattle, and the result is an extremely varied grass flora: within an area of a few acres are *Aristida*, *Eragrostis*, *Chloris*, *Digitaria*, *Setaria*, *Cenchrus*, *Bothriochloa*, *Pennisetum*, *Themeda*, *Heteropogon*, *Andropogon*, *Hyparrhenia* and other genera. Mixed with these grasses are some herbs and low woody shrubs, for example, the purple-flowered *Monechma* sp. nr. *M. bracteatum*, *Vernonia aemulans*, *V. pauciflora* and *Heliotropium undulatifolium*; nevertheless the grassiness of these areas contrasts sharply with the paucity of grasses in the adjacent low bush alternes.

One of these low bush communities consists of a thick cover of shrubs of dwarfed appearance growing to a height of three or four feet. Well-known constituents are *Disperma crenatum*, *Croton menyhartii*, *C. scheffleri* and *Indigofera retroflexa*, but other equally common constituents still await identification. They include *Lantana* sp. (Hornby No. 574), the blue-flowered *Ecbolium* sp. (Hornby No. 77) and an acanthaceous shrub with white flowers (Hornby No. 2065).

On ground which is slightly higher but with similar soil, the uniform low bush is replaced by another bush community of less even height: A lower layer, to about ten feet high—in Clementsian terms, a *lamies* (or *lamiation*, if the community were climax)—consists of many bushland climax elements, notably *Corlia* sp. (Hornby No. 717), *Anisotes bracteatus*, *Maerua endlichii*, *Opilia campestris* and *Commiphora stolonifera*, while above it, to about twenty feet, is a more broken lamies of *Commiphora* sp. nr. *C. lindensis*, *Commiphora* sp. nr. *C. schimperi*, *Fagara chalybea*, *Maerua cylindricarpa*, dwarfed *Acacia spirocarpa*, and other small trees. There is also a herb layer which comprises among others, the yellow-flowered *Justicia zanzibarensis*, the white-flowered *Neuracanthus* sp. (Hornby No. 2067) and the purple-flowered *Monechma bracteatum*.

(6) "Cultivation Steppe"

This is not a good term for all the subseral communities that represent or follow man's use or, more often, abuse of land; but we know of no better one.

The usual native procedure with regard to land usage is somewhat as follows: He selects a piece of land under climax or proclimax bushland; cuts down all woody vegetation with the exception of baobabs and some other fairly large trees, such as *Entandrophragma bussei* and *Ostryoderris stuhlmannii*; spreads the cut material evenly and sets it on fire when it is dry. The resulting seed bed is excellent for grain crops, and the same land can be used under various crops for three or four years without the addition of manure—which the local native rarely applies; instead he prefers to abandon the land when it is exhausted. It is then that nature steps in and strives to get it back to climax bushland once more. In the absence of stock, and if the land is fairly flat so that erosion is slight, the whole sere consisting of stages in which herbs, grasses, shrubs and finally trees dominate in turn, can be completed within a man's lifetime, though usually the land is again called upon to yield crops before the climax stage is fully reached. Around Mpwapwa the presence of many stock retard succession. Herbs and annual grasses are eaten, and although coppicing, suckering and seedling shrubs and trees gradually occupy the land and eventually exclude cattle, this takes a long time and meanwhile cattle tracks become gullies; so that even if the bush does succeed eventually in covering the soil, it conceals gullies, and the fertility status is lower than

it was originally. Often the bush is so long delayed in closing that open "secondary" thicket on seriously eroded land is a persistent stage—the stage of man-made desert.

Different from this deplorable system of *laissez faire* is man's deliberate intervention to check succession at a stage most suitable to his needs, and to hold it there. This is the business of the skilled pastoralist who when he requires a certain grass stage, encourages its formation and then maintains it, by controlled grazing, by planting and by manuring. The results of successful efforts in this direction can be seen on the government farms at Mpwapwa, and less well on the nearby native-occupied areas where rotational grazing is insisted upon through the application of Native Authority rules.

We shall not attempt to describe the vegetation of any of the subseral stages that comprise cultivation steppe. Their study must be the continual occupation of those workers who desire to see ever improved agricultural and animal husbandry methods replace the current ruinous ones. Such workers must take into consideration seasonal *aspects*, which may make statements regarding dominants rather complicated. For example, the grass *Urochloa trichopus* which seems to be everywhere in January may have disappeared by May, and its place taken by *Aristida* spp., *Eragrostis* spp. and the beautiful red-topped *Rhynchelytrum repens*. Such aspect communities are called *sociés* by Clements; to correspond with *sociations* in climax vegetation.

F.—RIVERINE FRINGING FOREST

This community is found along the banks of the few permanent streams which flow down the sides of Kiboriani. From near the mountain's base their water disappears underground except after heavy rain, and the vegetation associated with this lower seasonal flow has been mentioned briefly above under the title of "Hygrophilous Acacia Communities". The streams may originate in the Upland Dry Evergreen Forest Formation, but the greater part of their course is through miombo and the upper association of Deciduous Bushland. A fringing forest is thus composed of hydrosereal communities of the formations through which the stream flows, but it is conveniently studied as a whole.

The constituents of Fringing Forest are much the same as those of Upland Dry Evergreen Forest; in many respects the one is a mere extension of the other. But there is this difference: Whereas Upland Forest enjoys a cooler climate than Fringing Forest, this has a more abundant water supply. But while this abundant water cannot make up altogether for the enormous continuous transpiration at low altitudes—for which reason some species fall out as the stream reaches the foot of the mountain—it affords, at higher altitudes, more reliable conditions than are found away from it, and so certain trees are found by the stream side that are not found in the mountain forest itself; these include the most massive of local trees, *Khaya nyasica*.

We have not attempted to follow the streams through their courses, so we have no accurate knowledge of the transitions which occur as one passes from springhead groves of *Pygeum africanum* and *Syzigium guineense* to the acacia associates of the lower reaches. We give, however, a list of the more important large trees, besides the three mentioned, which occur throughout most of the fringing forest: *Albizzia glabrescens*, *A. zimmermannii*, *Garcinia livingstonei*, *Ekebergia arborea*, *Sorindeia obtusifolia*, *Polysphaeria schweinfurthii*, *Parkia filicoides*, *Trichilia emetica*, *Diospyros mespiliformis* and *Grumilea buchananii*. In addition there are the fig trees: *Ficus vallis-choudae*; *F. mucoso*, with powdery yellow-green bark, and fruits along the large branches; *F. stuhlmannii*, and *F. wakefieldii*, of which the growing points are covered by fine brown hairs.

Smaller trees include *Cordia abyssinica*, *Royena usambarensis*, *Crabia burttii*, *Commiphora zimmermannii*, *Treema guineensis*, *Cussonia arborea*, *Euclea divinorum* and, occasionally, *Ferdinandia magnifica* with its handsome orange flowers. Of the other kinds of woody plants we need only mention a few lianes, as these are characteristic and troublesome hindrances to forest exploration: *Marsdenia spissa*, *Dovyalis macrocalyx*, *Strychnos* sp. (Hornby No. 696). *Tricalysia* sp. (Hornby No. 624), *Secamone floribunda*, *Fagara* sp. (Hornby No. 905), *Landolphia buchananii*, *Adenia cissampeloides*, *Acacia pennata*, and another thorny plant, *Pterolobium erosum*, that looks and hurts like a scandent acacia, but has the redeeming feature of showy fruits that glint crimson in the sunlight.

Some of the many herbs have attractive flowers, for example, *Eranthemum seticalyx*, with salmon-pink flowers like those of a garden phlox, *Mellera submutica*, with mauve-blue flowers; the blue-flowered *Ageratum conyzoides*, *Gnaphalium luteo-album* and *Justicia flava*; the pink-flowered balsam-like *Impatiens hochstetteri*, and *Thunbergia alata*, well known to gardeners as "Black-eyed Susan". There is also a troublesome stinging nettle, *Girardinia condensata*.

There is always a belt of vegetation of varying width on each side of the evergreen fringing forest just described, that probably owes its existence more to rich transported soil than to free moisture. It is best seen on the lower, less steep slopes, where it may be hundreds of yards wide. The characteristic trees include the hygrophilous acacias—*Acacia usambarensis*, *A. campylacantha* and *A. albida*—together with *Kigelia pinnata*, with its huge sausage-shaped fruits; *Tamarindus indicus*; *Lonchocarpus capassa*; *Thespesia garckeana*, of which the light-orange flowers resemble those of the cotton plant; the thorny *Zizyphus jujuba*, and the more xerophytic fig trees, *Ficus thoningii* and *F. exasperata*.

EPILOGUE

All but a few—and these include some of the commonest plants, for example, bracken and bramble—of the plants mentioned in this article are

in the Mpwapwa Herbarium, but many specimens are imperfect, and of most the field notes could be amplified with advantage. The collection is therefore by no means complete, and it is the hope of the authors that others will enlarge and in every way improve the collection. The main object of this article, however, is to encourage newcomers to Mpwapwa to take up the study of the local flora; either for its own sake, as a fascinating occupation, or through realization of the economic importance of such work.

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Religious Practices of the Pagan Wazigua : The Story of a Dying Creed

By H. C. Baxter

[This article was begun at Lushoto in June 1925 and
completed at Pangani in June 1942.]

ANIMISM, the theory which regards the belief in separate spiritual existences as the germ of all religious ideas, was adopted by Sir E. B. Taylor in his book *Primitive Culture* as the minimum definition of religion "arising from the evidence of the senses as interpreted by the crude and child-like science of the savage". The Wazigua from earliest times have believed in one god; they have also believed in the existence of spirits or souls each of which has had or will have at some future date a habitat in an earthly body. But the pagan conception of God was of an awful, unapproachable Power, contact with whom must be maintained through a medium. Like the Pare, they chose the spirits of their ancestors to act as mediators and like the Pare they chose the spirits only of elder males as efficient to act.

It is well known that male elders of the Pare were buried head-less, that the dried skulls were kept in the roofs of family leaders and that these heads were brought down to floor level, placed on ceremonial stones and approached in prayer during any time of stress: it was believed by the Wapare that the spirits of their ancestors re-entered the skulls for the period of prayer and took messages to God on behalf of their families.

The term "ancestor-worship", given to this form of religion, is somewhat misleading unless one knows how to put the correct interpretation upon it—to wit, worship of God through the medium of the souls of ancestors.

For purposes of classification and comparison, this article is begun with a definition of Animism and with the briefest possible description of a religion kindred to the Zigua creed. This subsequent study of Zigua religious observance will be as comprehensive as possible and will show what interpretation was put by the Wazigua upon the evidence of their senses and how they evolved as a result of that interpretation a method of communication with the deity peculiar to themselves. The study will be divided into three sections: the Miviko (or acts of worship), the Miviga (obligations) or Ngasu (ritual necessities), and thirdly, the Kuvinila which can be described as the celebrations held at the close of the Miviga.

Miviko.—Native authorities on the subject describe five separate forms of prayer, of which the first, the Kisasa, is the most common.

Kisasa is the most common because it is performed for the benefit of individuals or of individual families. Each village chooses a permanent site for all *Kisasa*; the site must be outside the village precincts in a clearing screened by bush. The village elders organize the ceremony and call in the village doctor as a preliminary (the *Zigua* name for this doctor means by the closest interpretation "Diviner"). The doctor decides how many hymns will be sung at the ceremony; the number is commonly either seven or five and it is intriguing to note that an even number is never chosen. One example of this ceremony will suffice :—

A family is in trouble and decides to perform the *Kisasa*. They consult the elders who (after themselves consulting the doctor) proceed to organize the meeting. The family prepare meat and drink, after the elders have named the day and hour arranged. At the appointed time the family arrive at the praying ground, each with head and shoulders veiled in cloth, and are seated in the centre. They are immediately surrounded by a choir of elders, of whom two senior members carry and employ long, special horns. The horn-blowers and their choir of voices move slowly clockwise in a circle round the veiled figures with their faces to the centre and sing the hymns selected, clapping their hands to the rhythm of the tune. The number of times they repeat any one song depends upon the singers themselves: if it is a favourite it will of course be oft repeated. As a signal that one song is done, the voices shout in concert "*Hatiyo! OO Hoi Maiyo. OO Hoi!*" (the meaning of which is lost in the maze of time). Samples of the more common songs (or hymns) are :—

1. *Kingoi-ngoi—Ee—ka—ampa ka tungo*
Kaagololwa ni mwenye i nkonde.
2. *Mkwazu—Ee—kale na kale ni weye mganga.*
3. *Mzimu nkundeke—ee—waniwandaila*
Mzimu kagona mbona ntongo—Lukweli
mwana manda kawandawanda kumwagila.
4. *Songa—eee—dya mkale kona dimile dyenga matambwe.*

Once the songs are completed, a fowl's throat is cut ceremonially by the senior elder and the principals are unveiled. The fowl is grilled whole over the fire (it must never be cooked in any other way) and the company sit down to a meal of thick porridge, chicken and beer. Before they set to, the senior elder offers up a prayer to the spirits mentioning the special request for which the *Kisasa* has been called.

Ukungwi is a village rather than a family worship and is the most interesting ceremony of all. The site reserved, a clearing situate a little more distant from the village than is *Kisasa*, and called *Mpungi*, is entered through two breaks in the thicket facing the village. All males must enter by the right, and females by the left entrance. Within the clearing there are to be

found two clay figures side by side, one male to the right as one enters and the female on the left. There are no organs upon the figures to show male or female but it is a common belief that hidden in the belly of each figure there is a slice of flesh stripped from the hands of an elder recently dead and noted for his longevity. The strip from his right hand is in the right hand figure and from the left hand in the figure on the left, who is thus termed the female. (It is to be noted that no female flesh is used.) The figures used in this ceremony are of short stature and weigh about ten pounds each. As they enter each person must salute the figures; the male stretches first his right hand out before him straight from the shoulder with the fingers pointing to the clay figures, and as he calls the salutation "*Mgozi wa mbizi*" he moves his outstretched arm across the body from right to left; thereafter similarly he stretches out his left hand and moves it from left to right saying "*Mnala a mbizi*". He then sits down with other worshippers before the figures. The women entering on the left perform the same greeting in the opposite order: that is, left hand moved left to right first with the Mnala salutation and then the right hand. Mgozi is the male and Mnala the female of the Greater Hornbill. Any person failing to give the correct greeting to the figures is made to pay compensation for disrespect, the compensation being placed beside the figures.

Again, once the company is assembled, the throat of a fowl is ceremonially severed and prayers are offered or requests made. In all these prayers the clay figures are addressed as "Wazimi" (departed spirits). After the prayers there is a meal and at the end of it the leading elder of the village grasps a bush of leaves in his hands, dips it in a vessel of water and sprinkles the heads of the company with the water, praying over them as he goes. When all have been sprinkled the elder leaves the *Mpungi* by the correct exit (through which he came in) and as he reaches the open he breaks into a dance. As he gains distance from the clearing the company follow him out (each using the appropriate exit) and the village drummer strikes up his drum. And with their leader dancing before them, the company returns singing to the village.

Ukungwi means "passing the bar" or "being conversant with" and the very name given to the ceremony shows the working of the Zigua mind. A bar has to be passed so that conversation or a line of conversation can be established with the deity. And it must be emphasized that, in the opinion of the writer, this type of conversation was never believed to be direct from man to God but from man, by the agency of the medium, indirectly to God. As the Pare believed that the spirits of their ancestors entered the skulls, so did the Wazigua believe that the departed spirits entered into the clay figures after exhortation, and remained for the period of prayer only.

Wazimu is the family form of private worship, performed by the head of a family at the door of the hut of that member of the family who has called for prayer. The spirits involved on this occasion are those of the more elderly

of the deceased of that family and the ceremony is evidence of two separate beliefs: one, that misfortune of a minor character may come upon the family as a result of the anger or unrest of the spirits themselves, and secondly, that dire misfortune or death comes only from God and, if out of season, is due to his anger.

The elders were questioned very carefully in this matter for there is no doubt (and the elders agree) that in this family service, prayer was made direct to God. It is hard to reconcile this fact with the normal train of thought as illustrated in the more public ceremonial above described, but it is believed the explanation is that on these occasions (as will be seen) no direct request of a special nature is made to the deity.

In the ceremony the family head supported by available members stands before the doorway of the troubled house and calls upon the spirits by name; he begs of them that they be content and rest quiet in the place of departed spirits (*Kuzimu*); and in a grand finale he approaches the deity himself with a similar request and with the prayer that he "look to the good of this family" (a mere generality).

As this ceremony only takes place in case of minor misfortune, it can be seen that it is the spirits who are the main target. There are certain interesting terms used in this ceremony: the word for "sleep" is used when asking the spirits to rest. *Chohile*, a term connected with justice, is used for God. In invoking the spirits the names of male descendants on the father's side are first pronounced and then the names of male descendants on the mother's side. Finally, the ceremony is begun in the morning; the repast consumed thereafter, generally about midday, is called *Lumotwa* and consists of gruel and beer, and when it is completed all the beer left over is distributed for consumption by the neighbours.

Uganga is the ceremony performed in honour of a person recently dead and is meant to establish contact with his spirit, since, until *Uganga* has been performed in his honour, no spirit can be involved in prayer. Great trouble is taken to attract the attention of this spirit. Not only do all able-bodied members of his own family attend, nor is the ceremony confined to the village wherein he resides; but also as many guests from neighbouring villages as can be accommodated are invited. All male worshippers are required to strap bells to their legs and every available drum is commandeered. Singing is universal and, beginning in the evening, will continue all night (*Uganga wa Ncheleza*) in the case of an important spirit. At the end of various songs or at any moment when excitement has reached the appropriate pitch and the dancing is at a climax, the whole company will shout "*Mzimu naagone*"—"Let the departed spirit sleep (that is be at rest)". After a few rounds of general song a male chorus breaks out into a battle song generally sung by returning warriors in honour of their fallen companions, and during this the women burst into weeping. One interesting point is to be mentioned:

throughout the ceremony no name is spoken (other than that of the spirit for whom the ceremony is performed) except a mysterious *Centa*. No elder can be found now who knows who *Centa* was and he is presumably a most important member of the tribe long dead.

Mviko wa Mlungu (the worship of God) is the Zigua Harvest Festival. Throughout the festival no mention of departed spirits is made. The Wazigua believe that though they can make no direct request to God for assistance, the nostril of the deity may be tickled by the savour of a feast and pleasure may be his at the distant sound of mortal praise for his beneficence. As a preliminary every single householder must prepare millet beer, and must invite guests from neighbouring villages. On the day appointed a procession is formed as soon as all the guests have arrived (generally about ten a.m.), each person carrying a sample of his harvest and a gourd of beer, and the company is led by the elders to a chosen *Mkongo* (mahogany or lucky bean tree) outside the village where the senior elder offers up thanks to God for the harvest just gathered and a prayer for further assistance next year. After prayer each villager pours his ale at the foot of the tree as a libation and the samples of produce are stacked round the bole. Everyone then repairs to the village where the rest of the day is spent in feasting.

At this point it would be well to sum up the conclusions made which are as follows :—

- (1) God is a very distant and terrible Power in Zigua eyes.
- (2) To obtain certain special benefits, the only sure method of access to him is through the medium of the spirits of the departed.
- (3) Prayers of a general nature may be offered direct to God but there is no guarantee that they reach him; but he is susceptible to praise loudly expressed by representative bodies.
- (4) The spirits, who mediate between man and God, have their own feelings and, if they are alienated, lines of communication might be endangered. Moreover the spirits themselves in anger have power to cause minor disorders.

The observances termed *Miviga* by the Wazigua refer entirely to stages in the upbringing of a new generation. They are circumcision or initiation ceremonies each of which is followed by its celebration *Kuvinila*.

Ngasu (Mwaliko wa kava).—This circumcision is performed between the ages of four and ten years by a native doctor with whose family the deity has always been associated. No relative of the boy and no female is present. The operation is performed in a private place not far from the boy's home and the doctor, after completing it, declaims in a ceremonial whine a warning against self-abuse, sodomy and unnatural offences. His voice is pitched to reach the boy's home so that, as he ends, the relatives dash forward as pre-arranged—after giving the doctor time to put a drying powder on the wound

and cover the patient's nakedness. These near relatives shout and beat the roof with sticks asking aloud "Who has harmed our son", and so on, and when they have discovered the doctor and patient they become silent while the former gives advice as to the care of the patient. The boy is then carried home and the doctor is paid in part (his fee is a cock).

The *Kuvinila* of a Ngasu is performed as soon as the patient is fully cured. Food and drink is prepared by the family or families (for often several neighbours will have their sons circumcised on the same day) and the boys are smeared with castor oil and clad in new clothing. A feast is held and if the boys are many the fathers exchange favours with their fellows, the one father making a gift to the son of his neighbour and the other reciprocating. The ceremony is called *Kwaluka* (to pay off a debt) since at the end of the day the circumcision doctor is paid off his second and final fee.

Mwaliko.—This is the initiation stage entered upon some time after Ngasu and generally by boys just showing pubic hairs. A *Mwaliko* camp is held every year after harvest during the slack period before the rains and all eligible boys attend it. The instructors are chosen elders and the course lasts from three to four months. The boys are instructed in their duties and responsibilities on attaining to manhood. One fire was lit at the beginning of the sessions by an officer called Msangi (his trade was Usangi) and the camp must be broken up and the fire quenched before the first thunder-clap of the short rains. Any boy begetting a child before initiation was outcast with the child and mother concerned. Tests of manliness played an important part in the curriculum and the nature of these tests was kept secret under pain of cursing, so that no certain proof that indecencies were practised (as is alleged by certain persons) could be obtained from any of the elders questioned. All that is known is that throughout the course the pupils abandoned normal clothing and were dressed in bark; they slept on straw spread on the ground and not on raised beds; they also smeared their skin with white clay called Ngombe or Lukowa in a zebra-like pattern. They carried short, thick sticks. No women could enter the camp with the exception of the women of the Wasangi who were given special passes, valid for from three days to a week, that they might practise the fire-making art. All men passing by the camp were challenged by the putting to them of certain questions the replies to which would prove they had already been initiated. Having proved their rank these men could set the boys tasks which must be completed without question. The name for an initiate was *Kungwi* or *Mwalami*. Any passer-by proved uninitiate would be mulcted in a small fine to be enjoyed by his challengers. Women interlopers were assaulted with sticks except in cases of advanced old age. At various stages different salutations were due to the boys as between each other, between them and the initiate and between them and the uninitiate. They could not talk to women or talk so as to be overheard by women. An uninitiate was termed *Mdongwe*. In the *Kuvinila* celebration

(Kwaluka Mwaliko) the Msangi played an important part. After a wash and shave and a change from bark to new cloth the boys, now initiate, proceed to the village. There there is much feasting, singing and dancing, in all of which the Msangi is the leader, the verses of his songs being couched in cryptic language whilst his acrobatics in the dance are supposed to be peculiar to himself and his clan. He and his Sangi supporters are made the principal guests and are laden with gifts by the villagers—goats, oxen, fowls, etc. The first beer to be drunk by each initiate is contained in a small jar and offered to him, if possible by his intended sweetheart dressed in her Sunday best.

Mnkinda is the girls' circumcision ceremony which may be held for one or for many of the same village. Beer drinking starts the night before and goes on till seven a.m. the next morning when the operation is performed in secret. The girls, before the operation, appear publicly dressed in their best, covered with beads and smeared in castor oil. Their ages range from five to ten years. The real ceremonial lies in the dividing of the ale. Male elders in turn distribute first one gourd of beer to the company and then another, saying "This jar is for such and such a stage in the ceremony". Solid food is consumed in the form of dried meats. There is a drum accompaniment throughout.

Kisazi, the girls' puberty ceremony, is held after the first menstruation. The girl, modestly dressed, is escorted to the house of an elder female relative and there she is kept until the end of *Kisazi*. The relative reports to the village women that the girl has broken cloth, "*Kavuna suke*", and these latter indulge in a small celebration together—some ten minutes' dancing with much use of the *Kigelele*, a shrill pipe trilled by quick movement of the tongue on the teeth, and much shouting of traditional phrases couched in parable to describe this natural phenomenon (menstruation).

Now for a certain period the girl retires from public existence just as with the Wazaramu and other coastal tribes to the south. She is called a *Mwali* until she publicly reappears as a full adult. During her retirement she may only be approached by uninitiate boys or aged male relatives. An instructress is appointed, styled a *Kungwi*, and the girl is instructed in her duties as a woman and a wife (she will probably be already betrothed or even married though her marriage will not have been consummated) for a period not less than four months and not exceeding one year. Her instruction is divided into three stages and during the third and last stage other women beside the *Kungwi* attend the course to give advice. The *Kungwi* must be treated by the pupil with the deepest reverence for the rest of her life. The Kwaluka *Kisazi* takes place once the *Kungwi* declares the course complete. On an appointed day the girl, dressed in her best and covered in oil, is carried from the house of retirement on the back of a close female relative. Her husband

or suitor accosts her with presents on her way and at her mother's house a public celebration is held.

Nyinka, the wedding.—Once a day is appointed, in Zigua the ceremony must take place on that day, and there is a common saying "A wedding day cannot pass" (that is without completion of the ceremony). Early in the evening there are preparations in the villages of both bride and bridegroom. The bride's family produce a new bed, and sweep and garnish a special room in the hut of one of the bride's grandfathers or great-uncles. The bridegroom meanwhile chooses his best man and with him is led into the bush by two or three old men; he carries bow and arrow. A tree of the species *Msasa* is chosen into which he must drive the arrow, and he then collects and takes home a few leaves and parasite creepers from the tree. At about seven p.m. a cock's throat is cut and the bird grilled, the head being given to the bridegroom to carry with him to the bride. The food is eaten with representative male relatives and then after a short prayer by the father, or the maternal uncle of the groom, the procession starts towards the bride's village carrying gifts of fowls, etc. As they proceed, every event on the road is noted and whether it occurred on the right or left of the groom, and each event is interpreted as a sign of good or bad fortune during marriage. On arrival at the village the party halts while a spokesman of the bride's family who has waited at the entrance to challenge them runs home to tell of their arrival and of the gifts brought. The bridegroom and his best man are then escorted to the room specially prepared, where a grandmother of the bride receives them and seats the bridegroom within upon a pestle and mortar (*kinu* and *mche* in Swahili—used for grinding corn). There the groom will sit until two or three a.m. whilst outside in the hut of his future father-in-law his escort and the bride's representatives have a challenging match. The bride's party name one after the other the troubles the girl may have to bear in union with this boy, and as each trouble is analysed and accepted a gift passes from the boy's party to the girl's house. When all is done the girl is led by female relatives to the wedding room and is deposited on the lap of the best man. The grandmother then with the assistance of one other old woman of her degree leads the couple into the backyard where they are set upon stools close to and facing each other. The pair are invited to undress and the legs of the bride and groom are then intertwined as they sit bowing their heads to one another. The grandmother then cups her hands and takes water in them from a bowl set ready for the purpose. Two or three times she pours water on the head of each, and while the boy and girl wash their bodies in the falling water the old woman exhorts her grand-daughter always to maintain this cleanliness both in herself and in her husband. After the washing, it is the second or assistant woman who pronounces the couple man and wife and they are left alone to re-enter the bridal chamber. For two nights and a day the pair are left undisturbed, and on the afternoon of the second day the

best man leads the bride and groom before the bride's parents, "*kufundwa*" (to be instructed). The husband is warned to report at once any disobedience on the bride's part. The husband is then led back by his best man to his own village to receive instructions from his parents, and when they have finished, his belongings are collected, porters are supplied by the bride's people, and the boy returns to live in his bride's village.

During the payment of the preliminary instalments of dowry, the maternal uncle of the bride claims a considerable share and the final instalment of all, which releases the groom from all further obligation, is itself paid to this maternal uncle who, on receipt thereof, must call down a blessing upon the pair and invoke the assistance of departed spirits who will watch over their union.

NOTE.—All the above ceremonial, except *Mwaliko* and *Mnkinda* and the celebrations thereafter (*Kuvinila*), is practised in the same degree by the *Wanguu*.

Lake Manyara

By A. M. Watermeyer and H. F. I. Elliott

SCOPE

CONSIDERING its comparative accessibility, Lake Manyara, the smallest of the three great Rift Valley lakes of northern Tanganyika, has had, at least in literature, less attention than it deserves. This is remarkable in that from every scenic and scientific view it would be difficult to find a place of greater interest both intrinsically and in its environs. Little apology therefore, it is hoped, is needed for a brief descriptive study which aims at bringing an introduction to some of the lines of research which might be followed, rather than at an exhaustive treatment of each or any of them. Our observations are based on the experience over some fourteen years on the part of the first-named writer, and on some dozen visits to its shores by the second. Needless to say a far longer time than has been at our disposal in the intervals of other work would be necessary for the completion of a really full study.

PREVIOUS DESCRIPTIONS

Three German accounts of Lake Manyara by Baumann 1894, Werther 1898, and Jaeger 1907 (the first and last of which we were able to consult through the kindness of Mr. R. E. Moreau, Librarian at Amani), are all that we have been able to trace in previous literature, all written from an "Umbugwe" angle. This is to be expected seeing that at the time of the authors' journeys only the southern, Mbugwe, end of the lake was fully inhabited. Baumann did indeed make his way along the western shore and finally up the escarpment by the old cattle and caravan track a few miles north of the lake, but although he makes a few observant remarks about the then little known shores along which he passed, his attention was rather distracted by an encounter with Masai raiders.

The lake is generally referred to by earlier authors under its Kimbugwe name of "Lawe ya Mweri", said to mean western lake as opposed to the smaller pan to the south-east, "Lawa ya Seri". Viewed thus from the south much that is interesting was missed. To take one instance, the references to game: Jaeger mentions only large herds of wildebeeste and numerous water-fowl "among them pink flamingoes"; Baumann remarks on the numerous rhinoceros but does not seem to have seen the elephant. Indeed it was not till about 1910 that the game of the lake shores aroused the interest of hunters, resulting finally in the blazing of motor trails. Although with the war these have now almost disappeared, Manyara remains far more accessible than either Natron or Eyasi.

SITUATION

Lake Manyara lies in a depression in the eastern Rift Valley, some sixty miles south-west of railhead at Arusha. The main Arusha-Dodoma road skirts the lake at places within three miles of its eastern shore. The branch road to Oldeani passes within three miles to the north and a track to the Mbugwe trading centre of Madukani a similar distance to the south. From the Oldeani road rough tracks make it possible in the dry season to take a car along the whole length of the lake on its eastern side and about half way on the western side.

A dozen streams and water-courses are constantly adding to and altering the great alluvial bed which contains the lake so that it is rather difficult to define its bounds. As most recently mapped, however, the lake proper, that is the area liable to be submerged at the end of the rains, is one hundred and sixty-seven square miles in area with a maximum length of nearly twenty-nine miles, a maximum breadth of eight and a half miles and an average depth of between two and three feet. For some months after the exceptional rains of 1942 it is probable that this area was considerably exceeded and the depth of the water certainly reached five feet over wide stretches near the river mouths.

GEOLOGY

The contemporary geological formation to which this "vast puddle" owes its existence can be easily observed. Volcanic upheavals have made the floor of the Rift a switchback and both north and south of Manyara volcanic belts raise the valley floor to an altitude of 4,000 feet, the intervening depression lying at a bare 3,150 feet.

The more recent volcanic activity, and therefore the operative factor in enclosing the depression, took place in the northern of the two volcanic belts referred to, which stretches in a solid block from the Ngorongoro highlands in the west through the lesser hills of Essimangor, Kitumbeine, Burko and Monduli to the great peaks of Meru and Kilimanjaro in the east. The single cone of Oldonyo-Lengai still pierces this dead volcanic mantle with intermittent activity some forty miles north of Manyara. The apex of the belt in the Rift Valley floor is only fourteen miles to the north, and this barrier prevents the lake draining away to the still lower depression of Lake Natron lying at only 2,000 feet. Actually, this northern volcanic belt abuts on Manyara itself and the abrupt transition between it and the older gneiss formation can be clearly distinguished about a third of the way down the lake and can also be seen on the Oldeani road. On the lake-shore under the Rift wall the junction is marked by the hot sulphur springs of Maji-Moto.

Thus Manyara came into being, a hollow with no exit between two volcanic masses, the older Hanang and the newer Ngorongoro mass. As volcanic activity died and the peaks became moist and finally forest clothed, numerous streams found their way into the hollow, a narrow belt of the intervening

gneiss to the west and a broad belt to the Masai steppe to the east also sloped towards the lake, and it finally became the drainage sump for an area of about four thousand square miles of country. Possibly the original catchment area was greater, certainly the rainfall must have been heavier, for the existence of the lake is now barely maintained by the in-flow.

There are plenty of indications of other geological and climatic changes affecting the lake, probably an aftermath of the main volcanic activity.

Thus on a small terrace immediately above the north extremity of the lake and some three hundred feet above its level, when a site was being cleared for a rest-camp, quantities of potsherds, bones and drilled discs of ostrich egg shell, confirmed by some archaeologist visitors as being of early origin, were uncovered. It was found that this shelf or terrace, which lies immediately above a particularly attractive torrent, consists of river shingle, showing plainly that some earth movement of the past had caused the stream to alter its course and run fifty or sixty feet lower down the escarpment and two hundred feet further out. The settlement of which the remains were found near the rest-camp seems to have existed prior to this movement—its antiquity may be judged by the fact that the archaeologists, when the side cut for the Oldeani road was being excavated, found potsherds and bones in alluvial rubble and shingle beds several feet below the surface of the ground.

The whole length of several hundred yards of alluvial terrace thus exposed contained, jammed between pebbles and small boulders up to twelve inches in diameter, remains the fragmentary condition of which indicated a sudden catastrophe rather than a natural accumulation such as would occur under seasonal floods. An exploration of the gorge from which the present river flows provides abundant evidence of sudden and local terrestrial movement in the form of vast piles of rock and boulders fallen from the faces of the gorge. But the angular fracture faces of the rocks and the absence of earth, decomposed rock and vegetation, except for a few giant fig trees, give the appearance of a movement which occurred in fairly recent, perhaps historical times. Further evidence of flood is seen in the lateral moraines of the stream, ridges of boulders, many of several tons in weight, piled up on the inner side of each bend in the stream, the round corners of the rocks, where they were chased over and over in their passage down the gorge, bearing witness to the force of the raging flood of water with which anything to be observed nowadays even in the heaviest rain is quite incommensurate.

In short most of the streams which flow into the lake from the west show signs of having been considerably larger in the past and support the hypothesis that the lake itself at one time covered an area many times that covered now. This is confirmed by observation in the country lying to the south-east and north of the lake which is comparatively flat but displays large areas of concretionary limestone beds. In places these form a system of terraces, for example those rising to the foot of Essimangor Mountain. These concretions are mixed

with igneous and lava pebbles which are smoothly water worn. Due east, again, the Makuyuni water-course, which drains a large area of the Masai steppe into the lake but is now dry from June to December, gives further evidence. At the point where it crosses the Great North road near the junction of the Oldeani road, it runs in a fairly deeply eroded bed fed by numerous "Korongos". Nearly all the erosion in this area exposes alluvial deposits and soft conglomerates. Below the road bridge abundant deposits of fossilized bones have been discovered. In one case these included in an area of a few square yards, quantities of petrified hippopotamus bones, the tusks rendering these unmistakable. A queer feature of these deposits was that while the tusks and some of the bones, although completely petrified, had no covering of mineral deposit and showed clearly the texture and grain of their original structure, other fragments were entirely encased in an inch or more of stony cement. Possibly this is an indication that an earlier fossil bed was broken up by a later flood and the subsequent deposit formed the concretions which now encase the fragments.

A hundred yards away an anthep-like mound eight feet high and fifty yards in circumference, covered with fragments of quartz, lava and other rock, some angular and others well water-worn, contained thickly scattered fragments of petrified bones, a stony blue in colour, a few teeth having the glassy lustre of complete petrification. These teeth seemed to be molars of large ungulates.

And to proceed from the east to the south end of the lake, we have heard that the presence of fossilized fish and shells was noticed when the stone for the foundations of a rest-house, some distance from the present shore, was collected.

Enough has been said to indicate that Lake Manyara formerly covered a very much greater area, its hippo ranging ten or fifteen miles from the places where the remnants of this species are now to be found. Terrestrial movement, possibly even a further upthrust of the Rift Valley walls, may have played a part in this shrinkage, but seeing that the land level on all sides is still sufficiently elevated to contain a much vaster expanse of water, it is difficult not to think that climatic changes resulting in a sharp falling off in the volume of in-flowing water have had something to do with bringing Lake Manyara to its present impoverished and unstable state.

HYDROLOGY AND CLIMATE

This brings us to the matter of the present water level of the lake. This, of course, is subject to great fluctuations almost entirely dependent on seasonal rainfall. The early rains, October to January, have little effect as it takes some time for the stream beds leading into the lake to become saturated, though the Kinyozi and other rivers of Umbugwe sometimes flood quite soon. By the time, however, the big rains of March/May are fully established, the rise in

lake level may be sudden and spectacular—in April 1939, for instance, a rise of eighteen inches being observed within a single week. In 1942 the lake again reached an almost unprecedented level within three months.

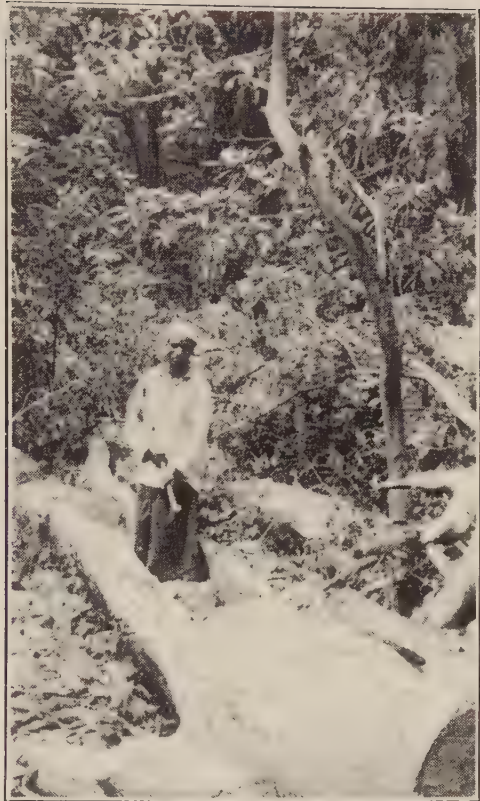
The annual precipitation over and around the lake itself is probably not large, though the only records which are available to throw light on this are those of Mbugwe (Madukani). The annual rainfall recorded here is 18·14 inches, of which all but ·13 is recorded in the seven months, November to May, little clear break being indicated between "short" and "long" rains. At Engaruka, thirty miles north of the lake, the yearly average appears to be only some fifteen inches with a sharper break between the rains. Probably then the average rainfall over the lake may be put at sixteen inches per annum. This gives a figure of nearly forty thousand million gallons distributed over the lake by direct rainfall annually. At the lowest estimate some six times this amount would be lost by evaporation annually. Some two hundred thousand million gallons of water must therefore be carried into the lake to maintain it in existence, but on a rough estimate only about one-tenth of this amount is supplied by perennial streams, the remainder being brought in by run-off, water-courses and perhaps underground seepage.

With only fifteen or sixteen inches of annual rainfall, the chief feature of the Manyara climate is its low humidity. The only temperature records available are those given by Jaeger, who at the height of the dry season, September 1906, at 2 p.m., recorded a shade temperature of 28°C. (82°F.) and a wet-bulb temperature of 17°C. (63°F.). The wind direction is constantly east or south-east, a very occasional westerly breeze being the precursor of heavy rain. A common phenomenon is a cloud layer at about 7,000 feet, persisting throughout the morning and considerably reducing a degree of heat which would be trying but for its aridity.

The escarpment streams on the western shore are nearly all perennial and show far less variation in volume than would be expected. This appears to be due to the fact that the greater portion of their flow is supplied by springs occurring at different levels up the gorges where water-tables lie between successive layers of lava. Indeed, even after the streams have issued from the gorges and are running on a more gentle slope, only a hundred feet or so above the lake, the increase of volume is very remarkable. In a recent survey it was found that one of the three streams running through Mto-wa-Mbu towards the lake, the Lugoto River, increased from two to seven cusecs in volume in a space of not more than a mile and a fall of perhaps fifty feet as it passed through the forest which bounds the northern end of the lake. Similarly when exploring the Garurum stream the first writer found that quite four-fifths of its water as it passes below the road bridge is fed into it from numerous strong springs below the top of the escarpment. Confirmation of these facts is given by the observation that these streams show comparatively little



Perennial stream from Rift Wall into Lake Manyara.



Fisherman hewing canoe out of a log of wild fig in the forest north of Lake Manyara.



Oldeani Road approaching Rift Wall near Lake Manyara showing four main gorges, sources of perennial streams flowing into the lake.

increase in sediment after heavy rains on the plateau in spite of the fine red soil of that area.

PHYSIOLOGY

These permanent streams as stated above are not sufficient to balance the loss from the lake by evaporation. Two sub-normal seasons or seasons of well distributed rainfall, during which there is little flood water from the great eastern catchment area, generally result in the main body of the lake drying up leaving a lagoon at each end fed by the permanent mountain streams. In 1941 these lagoons themselves were little more than ooze stinking with rotten algae, at least four-fifths of the lake being a blinding white sheet of alkali and salt. In March 1929 it was possible to drive right across from the main road on the east at Kwakuchinja to the hot sulphurous springs Maji-ya-Moto on the western shore of the lake and half way along it. The surface covered with a two-inch crust of alkaline crystals and dried algae was rather soft. Below this the bottom was remarkably firm. There was no danger of sinking in and once a fair speed was attained, it was like driving over a well-kept football field a hundred square miles in area.

It is under these conditions that the mirage effects, which particularly impressed Jaeger, are most apparent. In the early morning the surface clearly shows the natural curvature of the earth, but as the sun warms visibility is strongly affected and by midday the shore line and escarpment may be blotted right out by the heat haze. This gives the impression that the lake floor is literally boundless. Coupled with the entire lack of definition of the sky line and of any individual object, apart from oneself, the effect is strongly impressive. Standing in the centre of a circular sea of grey-white earth that fades to invisibility at three or four miles and merges imperceptibly into a purple sky and so into a lifeless blue where it draws into the focus of a scorching sun, the whole firmament might be a colossal burning glass and oneself and one's vehicle a solitary black-out.

But such conditions are really somewhat exceptional and the mirage effects depend on a slightly clearer atmosphere. On such days a bleached wildebeest skull at a few hundred yards may be mistaken for a large white boulder a mile away. Sheets of illusory water may be seen clearly reflecting game that appears to be wading in them. A man setting off to approach some wildebeeste seems to wade knee deep into a pool, his inverted reflection making the absence of water seem incredible, but the lack of a ripple or perhaps a puff of salty dust as the gnus gallop away destroys the illusion. A solitary wildebeest when first seen will resemble an elephant a mile away and the crowd of vultures which soon swoop upon a carcass will, as a hunter moves a few hundred yards away, appear to double their size and finally resemble dusky giants dancing in some ceremony of black magic.

The dry conditions which produce these phenomena are not as common as supposed by the German writers and only in 1929, 1934 and 1941 of recent years were they really marked. It is only in such years too that the "dust devils" really come into their own. In 1941 there were armies of these dust spouts to be seen, literally scores of them large and small, gyrating in couples and threesomes over the length and breadth of the lake. Sweeping up the fine white alkaline dust into their tapering tubes they were very conspicuous against the deep purple of the Rift wall. Some were of great diameter and comparatively little height, and from these ranged through all sizes and shapes to attenuated poles of one thousand feet or more in height. Their slow but quite perceptible movement and changing shapes give them an appearance of sentient activity—more than enough to convince the superstitious of spirit influences.

A few showers of rain, however, may lay these soda ghosts for another four or five years.

VEGETATION

As might be expected from the contrasting topography of the lake surroundings, the towering abrupt escarpment facing gently rising plain, clear perennial streams and muddy seasonal water-courses, the vegetation around the lake exhibits considerable variety. The northern and southern ends resemble one another in being bordered by swampy areas of bulrush and sedges. The general aspect is extraordinarily reminiscent of Dutch "polder". But while the Ubugwe swamps are backed by a densely-settled area of millet and maize plantations, those to the north are shut in by a dense belt of ten to twelve square miles of forest, the damper part of which is of a true evergreen nature, the remainder being a close stand of acacia. This forest is bounded to the north by the plantations of Mto-wa-Mbu, sugar, maize, peppers and sorghums predominating, which in turn fade into dry open grassland sprinkled with balanites and acacia and interrupted only by an isolated stand of *miwale* or raffia palm in a swampy depression.

The eastern shore of the lake is bounded by a billiard-table-smooth stretch of short turf giving place as the ground gradually rises to a variety of dry steppe vegetation intersected by dense riverine thicket on the Makuyuni and Kwakuchinja rivers. This vegetation has been divided into some seven communities (H. M. Lloyd of the Tsetse Research Department in his survey of the "fly" position), including "mbuga" with scattered doum-palms and balanites, doum-palm forest (*Hyphaene crinata*), *Commiphora* scrub with *C. schimperi*, *A. mellifera* and *Euphorbia matabelenis* dominating, and more or less distinct communities of *Acacia campylacantha*, *A. spirocarpa* and *A. senegal*.

To the west the rift wall is clothed with remarkably dry vegetation, chiefly aloes and euphorbia but cleft by frequent gorges and running streams, pushing

little spits of forest on to the lake shore. The gorges themselves, several of them one thousand two hundred to one thousand five hundred feet deep, where they break through the face of the escarpment are densely clothed in thicket except where huge bare rock faces have been worn. Within their depths there is an atmosphere totally different from the outside world, a cathedral-like peacefulness echoing with the sounds of the dashing stream. It would be interesting to discover whether any peculiar form of life has adapted itself to these strange conditions. The first writer who has had the opportunity of exploring some of them obtained the impression that there were varieties of both bird and plant life quite different from those of the plain.

BIG GAME

The animate life of the lake itself is abundant in the extreme. To the passer-by the striking feature in this respect is, of course, the flamingos, which at certain seasons of the year deck the lake as far as the eye can see with delicate pink clouds. A more observant traveller who pauses on one of the escarpment view-points and scans the grassy margins and forest glades far below him on the lake shore, will be unlucky not to see at least one species of big game whether elephant, buffalo or rhinoceros, as well as the plebeian gnu. Big game is in fact numerous wherever fresh water tempers the alkalinity of the lake and the plains' game, wildebeest, Thomson's gazelle, Grant's gazelle, oryx, zebra and giraffe wander in their hundreds and in the case of the first-named often in thousands along the comparatively dry and salty eastern shore. Only at the extreme southern end of the lake does the greater human population make it possible for game of some sort or other to be invisible.

Elephant are seasonal visitors to the north-western corner of the lake and have well-marked tracks through the forest and up the escarpment to the uplands where they make their dry season home. They become extremely bold and enter the banana groves of the Mto-wa-Mbu villagers well before dusk. The second writer recently met a fine tusker as late as eleven o'clock in the morning standing almost in the open near the small fishing encampment on the lake. It showed neither alarm nor anger. Rhinoceros are very common in the thicket that covers the face of the escarpment but are no longer as numerous as thirty years ago when they first drew the attention of hunters. According to Baumann, writing twenty years earlier, the area now covered by the Mto-wa-Mbu village and plantations was their favourite stamping ground. Hippopotamus, whose fossil remains have been mentioned above, are no longer numerous but several families live in bulrush swamps at the southern end of the lake, under the escarpment at the northern end and in an isolated patch a further half a dozen miles to the north. In the dry season their tracks are to be found wandering well out into the muddy borders of the lake. Their habitat is shared by large numbers of reed buck but the latter differ in

that they are often to be seen pottering round the marginal pools in the heat of the day. In the glades of the forest, giraffe, waterbuck, bushbuck and impala are to be found, the latter often in large herds, and buffalo are common in swampy patches and particularly in the region of the sulphur springs of Maji-ya-Moto, which can be excelled by few places in the opportunity it offers for viewing buffalo in the open. At times a lone buffalo will take up his quarters in a thick patch of sugar cane or derelict land in Mto-wa-Mbu village itself and emerge every evening to make a succulent meal of the young maize and onions, much to the chagrin of the inhabitants.

Finally, among the smaller fry, baboons, vervet and black-faced monkeys and pig are all common and troublesome to cultivators and big game watchers alike, and a word must be added about the carnivores; for in the region of Manyara are the haunts of some of the finest black maned lions one could ever hope to see. One day in particular stands out in memory when two of these beasts and a lioness were watched playing cat and mouse with a small herd of oryx in a little valley where the early rains had just greened the grass.

BIRDS

To return to the flamingos and the bird life of the lake which is, and we hope will always remain, perhaps its most entrancing feature. No more will be attempted than to give an outline picture and it must be remembered that this is based on notes made along a two- or three-mile stretch of the northern shore which, out of the one hundred miles or so of the lake circumference, is perhaps the most attractive of all to birds, combining salt lake with fresh water pools, reeds, rushes, short springy turf and mudbanks, and deeper pools where two perennial rivers flow into the lake.

First then the flamingos. Both the African species are always present, but the numbers of Greater Flamingo dwindle at certain times of the year until only a few score may be seen. There are fluctuations too in the number of the Lesser species, but these seem to depend rather on water levels and feeding conditions, and there is a daily movement at certain times of the year of vast numbers of these birds to and from the crater lake of Embagai, twenty miles away in the summit of a ten-thousand-foot mountain. It is a weird experience to be camped at full moon on the slopes of that mountain and hear the murmur of the passing flights and see their shadows passing over the moon. The peak of the year seems to be reached about October-November; our estimates are in fact conservative when we say that on the 26th November 1940 we estimated over four million Lesser Flamingo and one hundred thousand Greater Flamingo. This estimate received some corroboration on a visit to Embagai crater on the 5th October 1941, when the estimated number of Lesser Flamingo, spread evenly over the whole surface of the crater lake where, after being disturbed from a dense conglomeration near the shore, they floated and



Miwale or raffia palm grove, Lake Manyara.



Pelicans and Flamingos on Lake Manyara.

preened preparatory to their night feeding flight to Manyara, was over three million. From these huge figures numbers appear to fall to between half and one million in March-April and to begin increasing again at the end of the rains. The breeding of these hordes of Lesser Flamingo remains something of a mystery, though the local inhabitants claim to have found eggs at both Embagai and Manyara in certain seasons and young birds in dull plumage are common on Embagai in October, approaching the figure of several thousands.

Second to the flamingo in numbers, but only when the water level suits their taste, come the pelicans. In November 1940 tens of thousands were present, but in the following May not a single one was seen. After the 1942 rains the birds returned in their thousands. This bird is, of course, chiefly dependent on fish conditions which as will be seen later are very variable, whereas the flamingo can always pick a living among the vast store of algae and crustaceans, even when the lake is at its driest. It is an odd experience to be walking in the sweltering heat of the bush a few miles from the lake and out of sight of it, and to see the beautifully drilled flights of pelicans wheeling overhead. The majority appear to be the white pelican (*P. onocrotalus*), but a few showed the dark tail of the pink-backed (*P. rufescens*).

Finally we come to the balance of the waterbirds in their three groups, waders, herons and gulls, and no inconsiderable influence do they have on the scene. Their nodal point, so to speak, is the pool dotted meadow at the north-eastern corner of the lake which bears so strong a resemblance to wet Dutch "polder" and a remarkably close resemblance in its bird life.

The vast majority of all three groups are visitors from far afield, though some of the species are present throughout the year owing to the overlap of their arrival and departure dates and the presence of non-breeding individuals in whom for some reason or other the migration instinct has failed to operate. A list of the species observed is given in an Appendix but it will give a better idea of this ornithologist's paradise to record here that of the forty-two "wader" species ("*Limicolae*") known to occur in the Territory, twenty-five have been seen on Lake Manyara, while of the heron-stork-ibis tribe twenty-one species have been noted, and five species of gulls and terns. Two particular occurrences may be described. On the 26th November 1940 flocks totalling not less than fifty thousand avocets were seen in the shallow water, feeding with the graceful sweep of their bills and when disturbed covering the sky with an intricate beautiful black-and-white pattern which would be suitable for a futuristic wallpaper. This species is usually described as rare in East Africa. On the 11th March 1942, when the road was water-logged by rain and the lake had to be approached on foot, the first flock of waders contained the bird, typical *par excellence* of the Dutch countryside, but recorded not more than half a dozen times south of the equator, a Blacktailed Godwit. Altogether, including

ducks, raptors and other birds of the lake and its shore, over ninety species have been recorded.

But with all this variety and spice of rarity, what will for ever be remembered of the bird life of Manyara is the sound, like the sea lapping on a pebbly shore, of a myriad gobbling beaks and guttural voices, a sound which every now and again surges into the roar of Atlantic surfs, as the sky is fretted with pink and scarlet wings bearing a million alarmed flamingos to safety.

FISH, ETC.

And so finally we come to the smaller life which supports these multitudes of birds. Most important probably because most lasting are the algae and crustaceans, of the latter of which Baumann found numerous species and named several novelties. The fresh water streams and lagoons abound with barbel, weighing up to fifteen pounds; a little minnow-like fish is common and also a small fish of six ounces average weight alleged to be a species of tilapia but even tastier than the ordinary representative of that genus of Lake Victoria and Lake Babati and, though rather small, very free from bones. This species had been ignored by local fishermen who had been catching barbel for years, but two or three years ago some Nyasaland strangers set up the fishing encampment which has been mentioned, began netting the smaller fish and did a lucrative trade for a while till the 1940/41 failure of the rains, drying the lake, reduced the small fish to vanishing point and brought about the total disappearance of pelicans mentioned above as occurring in May 1941. However, even at its most flourishing the fishing industry, if it can be so described, did little more than suffice for local needs. But although fishing plays a comparatively minor part in the human economy dependent on the lake a few words about its methods may be of interest.

FISHING

The canoes used are dugouts cut from a wild fig tree growing abundantly in the forest. After felling, the canoe is shaped, *in situ*, taking two men about a fortnight. Some are very large and heavy, unnecessarily so considering their requirements, and have to be provided with wooden wheels and axles before moving. Communal man power is then used to drag the canoe laboriously along the twisting jungle paths, sometimes several days being taken to cover as many miles to the lake shore or nearest streams. In this operation more than one canoe has had to be abandoned through it being impossible to move it further. Once the canoe is afloat, however, fishing is proceeded with in a very leisurely manner, amply compensating the initial labours. Stakes are driven into the mud in the deepish water around the stream mouths and lines are stretched horizontally between them. From these lines droppers are hung with baited hooks. Catches are removed each morning and the lines rebaited. A dozen fish is a very good total catch.

The unwieldy size of the vessels, compared with the shallow water, absence of crocodiles, small catches and short distances covered, indicates a considerable lack of inventiveness. A light raft of the local raffia palm poles would probably have been tried by less conservative folk.

THE HUMAN ELEMENT

Agricultural.—But it is perhaps less a question of conservatism than of the normally slow adaptation to environment of recently settled peoples. In other ways for instance full use has been made of the raffia palm. The source of this material is a swampy hippo- and buffalo-infested depression a few miles north of the lake under the escarpment. The palms grow in a solid forest and many reach sixty feet in height. The bole is only six to eight feet high however even in an old tree, the leaves with their stout mid-ribs forming the main growth. These ribs are invaluable for walls and roofs, being both ant- and borer-proof, the former at least if not buried in the ground. These ribs have a very soft core with an outer shell of remarkable hardness and a fine glazed surface. They can be split easily and uniformly. One man can carry ten poles of an average length of eighteen feet and a diameter of four inches. They can be used only if they are removed after drying naturally and being shed by the tree—an important natural safeguard against over exploitation.

A fair proportion of the buildings in the Mto-wa-Mbu settlement are now made of this material. This settlement is one of the two agricultural communities dependent on Lake Manyara and is of much more recent development than the other, the densely-settled Mbugwe plain with its low flat-roofed and turf-covered huts sprinkled as thickly as anthills. Both communities are similar in reaping the benefit of alluvial soils and irrigation from the streams which feed the lake, and again in the nature of their crops, though millets are more typical of the southern settlement and maize of the northern. In both cases cotton is the main economic standby and in both cases food crops can be raised at almost any time of year. Since the first agriculturists camped at Mto-wa-Mbu in the year 1920, the settlement has steadily grown and now comprises well over five hundred inhabitants, representing a large proportion of the tribes of northern Tanganyika, Wasukuma predominating. It is the only place in present-day Masailand where there is no restriction on settlement, attaining this position by its situation in a tsetse fly belt. On the other hand Mbugwe is settled by a homogeneous tribe with more or less distinctive physical characteristics. It may be that they are the descendants of the early inhabitants whose remains have been remarked upon when discussing the geology of the area. The most marked remains of these ancient agriculturists are to be found under the Rift wall about three miles north of Mto-wa-Mbu. The site as a whole closely resembles that of Engaruka of which the ruins have been described in this journal (March 1936, December 1938) in that it is contained in a pocket formed by an L-shaped break in the Rift wall and

enclosed in front by a low foothill, thus forming a sheltered and naturally fortified valley. Mr. Fosbrooke who has examined this site also found clear indications of a system of irrigation, but came to the conclusion that the piles of stones were not built up like those of Engaruka, but merely collected together possibly to clear the ground for cultivation.

Pastoral.—Agricultural settlement at the north end of the lake disappeared possibly from some natural catastrophe and was not revived until the Mto-wa-Mbu settlement came into being in comparatively recent years on the site of a camp on the old caravan route to the west. It was however apparently replaced by some form of pastoral settlement.

The evidence for this lies in the Masai legends of their drive to the south. According to these, to quote Mr. Fosbrooke in his *Sociological Survey of the Tanganyika Masai*, the Lake Manyara area was in the old days inhabited by a pastoral tribe known to the Masai as the Il Adoru. There is an amusing story of a battle between the warriors in the vanguard of the oncoming Masai and these earlier tribesmen. One-half of the latter were defeated, but the remainder retired behind a lake and taunted the Masai to attack. The Masai waded in up to their necks in water and were left foundering while the Il Adoru made good their escape. This event can be dated, by the Masai age grade concerned, to 1806. The Adoru left nothing behind but the name Manyara of which the meaning has been lost or forgotten.

For the next hundred years the Masai remained in sole occupation of the northern shore of the lake, where on the alluvial plains they found abundant pasture and in the streams leading to the lake perennial water supplies for their herds. Only in recent years has their hold gradually weakened not from human agency but by the insidious spread of the tsetse fly. No less than three species of this malevolent insect now occupy land which was formerly the home of thousands of head of cattle, and to-day only three Masai "bomas" remain. Unless the fly can be eradicated it seems likely that once again four-fifths of the shores of Lake Manyara will be tenanted only by waterfowl and big game.

APPENDIX

WATER BIRDS OF LAKE MANYARA AND THEIR STATUS

Grebes

1. Great-crested Grebe (irregular).
2. Dabchick (resident).

Cormorants

3. Reed Duiker (irregular).

Pelicans

4. White Pelican (regular).
5. Pink-backed Pelican (occasional).

Hérons

6. Grey Heron (irregular).
7. Black-headed Heron (resident).
8. Goliath Heron (occasional).
9. Purple Heron (regular visitor).
10. Great White Heron (resident).
11. Yellow-billed Egret (resident).
12. Black Heron (resident).
13. Little Egret (regular visitor).
14. Buff-backed Heron (resident).
15. Squacco Heron (resident).
16. Green-backed Heron (occasional).

Storks and Ibises

17. Saddle-bill (occasional).
18. Marabou (regular visitor).
19. Wood Ibis (regular visitor).
20. Sacred Ibis (regular visitor).
21. Hadada (resident).
22. Glossy Ibis (regular visitor).
23. African Spoonbill (regular visitor).

Flamingos

24. Greater Flamingo (regular visitor).
25. Lesser Flamingo (perhaps resident).

Duck and Geese

26. White-backed Duck (occasional).
27. African Pochard (resident).
28. European Shoveller (regular visitor).
29. Yellow-bill (occasional).
30. Cape Widgeon (irregular).
31. Hottentot Teal (regular).
32. Red-bill Teal (resident).
33. Garganey (regular visitor).
34. Knob-bill (occasional).
35. Egyptian Goose (resident).
36. Spurwing Goose (irregular).

Birds of Prey

37. Sea Eagle (irregular).
38. European Marsh Harrier (occasional).
39. African Marsh Harrier (possibly resident).

Rails

40. Black Crake (resident).
41. King Reed-hen (occasional).
42. African Moorhen (resident).
43. Red-knobbed Coot (resident).

Cranes

44. Crowned Crane (resident).
45. Wattled Crane (once recorded).

Plovers

46. Ringed Plover (regular visitor).
47. White-fronted Sand Plover (once seen).
48. Kentish Plover (doubtful single record).
49. Chestnut-banded Sand Plover (resident).
50. Kittlitz Sand Plover (resident).
51. Three-banded Plover (probably resident).
52. Caspian Plover (regular visitor).
53. Crowned Lapwing (resident).
54. Blacksmith Plover (resident).

Waders

55. Avocet (possibly resident).
56. Black-winged Stilt (possibly resident).
57. Common Snipe (regular visitor).
58. Painted Snipe (possibly resident).
59. Curlew Sandpiper (regular visitor).
60. Little Stint (regular visitor).
61. Sanderling (occasional visitor).
62. Ruff (regular visitor).
63. Common Sandpiper (regular visitor).
64. Green Sandpiper (irregular visitor).
65. Redshank (one doubtful record).
66. Marsh Sandpiper (regular visitor).
67. Greenshank (regular visitor).
68. Wood Sandpiper (regular visitor).
69. Black-tailed Godwit (one record).

Pratincoles, etc.

70. East African Pratincole (regular visitor).
71. Large Lily Trotter (occasional).

Gulls and Terns

72. Lesser Black-back Gull (regular visitor).
73. Grey-headed Gull (regular visitor).
74. Gull-billed Tern (regular visitor).
75. White-winged Black Tern (regular visitor).
76. Black Tern (doubtfully recorded).

Kingfishers

77. Pied Kingfisher (irregular).
78. Giant Kingfisher (resident).
79. Pigmy Kingfisher (resident).
80. Grey-headed Kingfisher (resident).

[Further references to literature are :

E. OBST. "Das Abflusslose Rumpfschollen Land," etc., Vol. II, pp. 143-44, 1923.

JOHANNES (who visited the Lake in 1896 and 1897) in *Mitt. D. Sch.*, Vol. XI, 1898, pp. 171-72.

C. GILLMAN. "Water Consultant's Report, No. 1, 1938" (Government Printer, Dar es Salaam), App. III, paragraphs 13 and 101-4, wherein a tectonic rather than a volcanic origin of the basin is emphasized.—C.G.]

The Legend of Nkanda

As told by Ntemi Ikombe of Mwadui in Shinyanga

[Written down by Clerk Waza Shimula and translated from the Swahili by C. M. Coke, the language being kept as close as possible to the simplicity of the original.]

NKANDA was the son of the sister of the *Ntemi* of Ubinza in Uganda, and was born at the village of Utunga. The name of his mother was Minza the daughter of Shokala, the custom of old being that a daughter of the royal house be given this name Minza; and his uncle was *Ntemi* Wajamwiguru the son of Shokala who ruled the country of Ubinza. After a space they went to live at Lugaka; and at this time Nkanda was yet a babe. And now came the time for his teeth to grow; and his upper teeth were the first to show. Now if a child grows first his upper teeth, this is an evil sign for his brethren, so that they fear lest death come to them. For this reason the mother and father of Nkanda spoke together, and they sent and called all the brethren of their house to come and take counsel to slay Nkanda. And when they were gathered they were all agreed that he must die. So they took the child Nkanda, and bound to him a stone of great weight and cast him into the deep waters of the lake, and they returned and went home. And in the morning when they awoke they saw the child Nkanda at the door of the house alive and well, having come forth from the waters. Then they called together once more all the brethren of their house; and they seized Nkanda and slew him for the second time, and his body they burnt with fire, and the ashes thereof they cast upon the waters; and so they returned home. And behold, in the morning they saw the child Nkanda swimming on the waters of the lake; and now he had changed and become as a boy of some six years.

Then his uncle *Ntemi* Wajamwiguru saw that this child was one who had great magic, and he was afraid, and he said to Nkanda, "I send to you this black ox; go with it into the south where there are lands that have no people; go and rule there". And he gave him food for the journey. And Nkanda set forth upon his journey, and came to Usuma and lodged there. And in the morning he went his way and came to Wilegi and lodged there that night. And from Wilegi he came to the *Ntemi* of Ukara near to the country of Ukerewe and abode with him. But in the night they found that the house of the *Ntemi* had caught fire; and Nkanda was driven away. So he went from Ukara and came to Sukuma to the village Uchambi and lodged there. And when it was morning he went his way and came to Ntusu.

And when he came to Ntusu he sojourned with a wise man whose name was Gombanida. Now always he had taken with him that ox which he had been given by his uncle Wajamwiguru in Ubinza; and when he drew near to that place Nkanda hid his ox on a hill. And he stayed with Gombanida and helped him to herd his cattle for eight days. Then came the Masai on

their wars, and came upon Nkanda and Gombanida herding in the pastures. And Gombanida cried to Nkanda "Run", but he said, "I will not run". Then Gombanida changed himself into the likeness of the bird called *Ng'ung'hwani*, the crested crane, and flew up and rested on a tree; and Nkanda too changed himself into a rock and the cattle into stones; so the Masai passed by. Then Gombanida loosed his spells and became a man again; and Nkanda did likewise and became a man, and he changed the cattle from stones to be cattle again; and they went their way home.

Now when Gombanida came home he told his wife all that had happened in the pastures and how Nkanda had changed himself into a rock. So the wife of Gombanida set herself to make trial of Nkanda when he went to herd in the morning. And when morning came Nkanda unloosed the goats to go and herd them; and the wife of Gombanida changed herself into a snake and followed Nkanda swiftly before he had gone far. But Nkanda had already seen that it was the wife of Gombanida behind him changed into a snake. And he turned round and lifted his finger at her and said, "Thou snake, come not near, but die there". And the snake died. Now when Gombanida saw that the skill of Nkanda exceeded his own and that his wife was dead, he drove Nkanda away.

So Nkanda went forth from Ntusu and went his way towards Mwagala, and he slept at Nunghu at the village Kitala at the house of a man named Kilala. And in the morning he went his way and came to Mwagala. And his ox he drove up into a hill there and hid him. And he came to Ndoma, a man of Nyashimba in Mwagala, and served as herd boy of the sheep of Ndoma and herded these sheep for ten days. Now in his herding he tarried long and did not drive home the sheep early; then Ndoma said to his wives, "Do ye cook the porridge quickly so that we eat before he comes; when he sees we stint him of his food he will cease to tarry thus". And behold, as they spoke thus, Nkanda was listening. So he made to tarry yet longer in the pastures. And they set to their cooking early; but it befell otherwise than they had thought. When they set the pot of porridge on the fire, it would not boil until Nkanda returned from his herding; for he had cast his spells, and though they blew upon the fire it was in vain, until Nkanda's sheep were heard bleating as they returned. And it was the ninth or tenth hour of the day when Nkanda returned; then the pot boiled and in a short space the porridge was ready and they all ate together. For they had all gone since morning without eating. And so it was each day for three days, he tarried thus in the pastures. And on the fourth day Ndoma grew angry and drove Nkanda forth. And behold being skilled in spells, Nkanda came and stayed by the door and when they ate he drew near and ate also, yet they did not see him. And when they finished eating he went and set himself again by the door. And on the next day when they would go forth from the house, birds set upon them and belaboured them, savage crows and kites, so that they could do naught but

return into the house. Then they called to a neighbour and prayed him, "Go call a wise man, one Kilalage, to help us with his skill that we may know what it is that brings this plague of birds upon us now". And the neighbour agreed and went to call Kilalage, and left them with their door tight closed for fear of those birds.

Now when the neighbour came to Kilalage the wise man, he told his tale; and the wise man said to him, "Go tell Ndoma thus: that man whom he drove away is a mighty man; then let them call his name 'Nkanda' and they will see him appear there at their door". So the neighbour returned and made clear to Ndoma all that he was told by the wise man; and Ndoma cried out "Nkanda", and behold Nkanda answered "Yes" and appeared before him. Now by this time Nkanda was a full grown man for he was wise in spells. And on that day his name was called "Nkanda", for until that time his name had been known as "Mwisuge". And when Nkanda came forth, the birds were seen no more.

Now that part of Mwagala was known as Walyongo. And on that day the people of Mwagala said, "Here is a mighty man; go call the chief *Ntemi* Mwigulu-wa-ngoma". So men went to call *Ntemi* Mwigulu, and he came to Nkanda; and when *Ntemi* Mwigulu came his people told him how they had seen the power of Nkanda, and said, "This man is the ruler of this land; all of us here have chosen him to be our ruler". And *Ntemi* Mwigulu-wa-ngoma agreed and said "It is well".

Now the reason that they agreed upon Nkanda ruling that part of Mwagala was that they were troubled by wars with the Masai. For in former times before Nkanda had come to Mwagala, a daughter of the chief, *Ntemi* Dula, was to be married to one of his clan. And when the time of the marriage came her father would not give her the skin of a wild gazelle as was the custom. Now this daughter's name was Wali. And she grew angry and would not marry the man who had betrothed her. And Wali departed from her father's house and was carried away by the Masai. And after many days she wished to take her vengeance upon Mwagala the land of her father, because he had refused her the skin of the gazelle at her marriage time. So she brought the fighting men of the Masai against Mwagala to harry her father and his people time and again; and they troubled the people of Mwagala greatly. This then was the reason that Mwigulu-wa-ngoma agreed that Nkanda should rule the land; for Nkanda was a man of power and they said, "When enemies come, Nkanda will cast his spells and they will go away".

Now Nkanda asked them "Truly do ye agree that I rule this land?" And they answered, "Indeed we do agree". And he bade them, "Go now and find an ox that is black all over without a spot, a bull. And after three days come hither again with all your oxen." So for three days they went to seek for such a bull, but could not find one; then they returned to Nkanda to tell him. And when they came they said to Nkanda, "A black bull we

cannot find". And he said "It is well"; and he bade them "Go now and call together all the people of Mwagala". And they went and did as Nkanda bade them; and they gathered all together and came to him, and he said, "Now I am ready; I have got me a black bull". And behold, it was that same one that he was given by his uncle Waja-mwigulu, Ntemi of Ubinza. And he said, "Let us go to that *Mlangale* tree with our oxen". And when they came to the tree Nkanda said to them, "Strangle that bull". And they tried to strangle it but could not. Then Nkanda smote it with his hand on its head and it died. And Nkanda bade the people, "Go home and stay five days and on the sixth come again". And on the sixth day they returned to the tree to look at the bull. And they found its body swollen greatly so that it was of the height of a man. Then Nkanda bade them, "Go home and stay eleven days and on the twelfth come again". And on the twelfth day all the people came and they saw the body of the bull was filled with maggots. And Nkanda said to them, "Go home again and stay twenty-one days and on the twenty-second come again". And on the twenty-second day they all came, and they saw that the maggots had all become men busy making spears and swords.

Then Nkanda bade the people of Mwagala, "Now bring five hundred oxen as food for these my men". And they brought the cattle as he said. And he sent his men into the hills named Igilali and Gidamwandu and Ikelenge; and the people of Mwagala brought their cattle to these hills. Then Nkanda bade them, "Go home and stay six days; on the seventh come here and let not one man fail". And on the seventh day the people came but not all. Then Nkanda led forth his men from the hills to do battle and he warred in the land of Mwagala with all those people who had not come before him and conquered them. Now he had already sent to call his eight sisters from Ubinza; and when he had conquered the land of Mwagala he set his sister's son Mbuke to rule over them. And from the dead he took their skins to make him a drum.

And Nkanda warred with the people in many lands. Some he did not conquer, and others he conquered and set his sisters' sons to rule over them. And he lived in Mwagala fifty-six years until he died. And when his time came to die he said to the people, "A brown sheep will come forth from the waste lands and when I see it I shall die; and when I am dead ye shall place my body in the hide of a black ox". And so indeed it came to pass; there came forth that sheep and Nkanda bade the people, "Now dig my grave; I am dying". And when they had dug the grave, ere one minute had passed he died. And when he died Nkanda was an old man of some seventy years.

NOTE.—Nkanda is said by Ntemi Ikombe to have been the founder of the Binza clan of the Sukuma; probably however other sections of the clan tell of other legendary founders. Nkanda, in this legend, reaches Sukumaland from the north. The correlation of such folk-lore would probably be of interest in throwing light on the early movements and origins of the tribe and their royal houses. The incident in this legend of the armed men arising from the dead bull's body is an interesting parallel with the Greek myth of Cadmos of Thebes and the dragon's teeth.

Biological Brevities

By W. Victor Harris

INTRODUCTION

THESE NOTES are about those numberless beasts which wriggle and run, blister and bite, interest and horrify, and which are such a feature of daily life in Tanganyika. They are the living things larger than a malaria parasite and smaller than a bush pig for which the Swahili uses the portmanteau word *dudu*. In temperate countries books are available on natural history, museums are seldom far away and those who want to know more about the smaller living things can do so with little trouble. This does not apply to the much more numerous tropical beasts and bugs about which the books, when available, are decidedly "scientific" and very expensive. For this reason I have written and illustrated these brief notes on some of the *dudus* about which I have been asked questions. They might have been entitled "Contributions to the Biology of Daily Life in Tanganyika" but they are not intended to be so ponderous as to warrant that.

1.—THE AEROPLANE MANTIS

One of the more spectacular insects to be found in our gardens is the praying mantis known scientifically as *Pseudocreobothra wahlbergi*. From the coloured rings on its wings it has got the common name of the aeroplane mantis (Fig. 1). It is bright green and pale yellow in colour with dark, almost black, markings on the two front wings. The body has many irregular projections, and the legs have flap-like knee caps. Like all mantids it feeds on other insects.

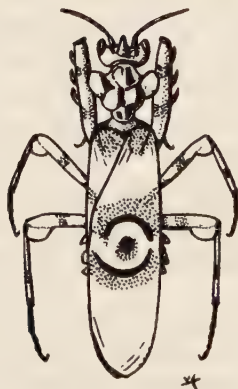


Fig. 1. The Aeroplane Mantis (natural size).

The young, wingless mantis is equally spectacular. The abdomen is furnished with more conspicuous projections and is carried bent up and over the back. When the body is straightened out a conspicuous yellow and dark green eye-spot is visible on the back. This young mantis is frequently found on roses, and the peculiarity of its general appearance is increased by a pink colour diffused throughout the body, just as if it has got it through eating red rose petals.

The aeroplane mantis offers an interesting example of modern camouflage for offensive purposes. Its colouring and shape break up an outline which would act as a warning to its victims, while the "aeroplane markings" make an un-insect-like point of interest among the flowers to catch the attention of passing butterflies and other insects and lead them within range of the powerful front legs.

2.—MAMBAS

Snake stories are usually about pythons, puff adders, spitting cobras or mambas, and the most hair-raising of them all concern the mambas. Before we go any further let it be said that green mambas and black mambas are colour variations of the same snake, the green colour being a sign of youth and darkening with age, only getting really black in sub-tropical southern Africa. Mamba is a South African name for the snake and is used by Europeans in Tanganyika. Its use is liable to some confusion since "mamba" is the Swahili word for crocodile.

The scientific name for the common mamba is *Dendroaspis angusticeps*. It belongs to the family Colubridae (with the cobras) and its venom is a nerve poison which particularly affects the lungs and heart. The mamba ranges from Natal and the Transvaal to Abyssinia. It grows to a length of ten to twelve feet. Most specimens seen in East Africa vary in colour from emerald green to a dull olive or even brownish shade, looking brighter and more spectacular when in movement than when dead. Mambas are tree dwellers and inhabit both forest and dry bush areas, feeding on birds. Their most notable character is their speed of movement, whether on trees or on the ground.



Fig. 2. Head of a Mamba (natural size; redrawn from Pitman).

A dead mamba is recognizable by the number and shape of the head plates (Fig. 2) and by the two large poison fangs set particularly far forward in the jaw and not followed by other teeth. The head is rather long and narrow and the eyes noticeably large. Live mambas should not be inspected so closely. Full details can be obtained from that excellent book *A Guide to the Snakes of Uganda*, by Captain C. R. S. Pitman (Uganda Society, 1938).

3.—THE JIGGER FLEA

Instead of feeding for an hour or two and then passing on as do most fleas which attack man, the jigger flea arrives and, unless forcibly ejected, stays until it dies. Jiggers are very like any other flea to start with. They are small, brown and active (Fig. 3). The female jigger, when she finds a suitable place, does not puncture the skin to suck blood and then move on leaving behind a swelling or "flea bite"; no, she goes right in head first and disappears from view in all but the palest skins. She feeds within the skin of the host and her eggs develop. To meet the need for expansion, the jigger's body is elastic between the hard plates of the thorax, where the legs are attached, and the abdomen. This area stretches until the flea becomes a ball with the head and thorax attached at one end and the segments of the abdomen at the other. (Fig. 4). The posterior is on a level with the surface of the skin, and the mature eggs are ejected at intervals. The female jigger dies where she is when her egg production is complete.

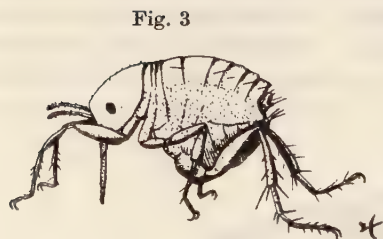


Fig. 3. Female Jigger Flea before entering the skin (greatly enlarged).

Fig. 4. Female Jigger Flea distended with eggs (greatly enlarged).

The eggs of the jigger hatch out into small grubs which feed on organic matter in crevices and cracks, in dust beneath mats and furniture in houses, and especially in pigstyes. They do not turn straight into fleas, as many people imagine, inside the host. The grubs eventually spin cocoons and pupate before changing into adult fleas. So far as we know only the females suck

blood. In addition to man, they attack all domestic animals and many wild ones.

The scientific name of the jigger is *Tunga penetrans*. It is a native of South America, whence it has spread in historically recent times to the west coast of Africa, across the continent to the east coast and so over to India. Its common name in South America is "chigoe". In the United States the name "chigger" is used more frequently for a different insect.

[To be continued.]

NOTES

A Vanilla as a Plantation Protector

By R. E. Moreau

ATTENTION has recently been drawn to a very fine *Vanilla* trained over *Jatropha curcas* trees alongside the Sigi River at the lower end of the Amani Research Station grounds. The plant has not been authoritatively identified but the large showy flowers—with sepals and petals cream and lip purple, each nearly three inches long—agree very well with the description of *Vanilla imperialis* Kraenzlin, and are quite unlike those of any *Vanilla* recorded east of the Great Lakes. Since *V. imperialis* is typically West African, and has not been recorded from nearer the Indian Ocean than Uganda, it was at first assumed that the Sigi plants must have been derived from an importation. The plantation records contained, however, no references to the species. On the other hand Mr. F. M. Rogers, the late Superintendent, remembered a cutting being brought in by a local African who said he had found it *porini*, “in the bush”. Through the plantation foreman, Mwindadi Simba, the name of the original finder was traced. He had died but the place where the plant grew, on the Bulwa native lands, at an altitude of about two thousand feet on the steep slope rising from the west bank of the middle Sigi River, was remembered in his family and a piece has just been produced by a relative.

The climate of this locality is comparable with that of the West African range of *V. imperialis*, but on such evidence as the above alone one would naturally hesitate to accept so great an extension of geographical range. Powerful confirmation that the plant is a native of low altitudes in Usambara has, however, been afforded by the following facts:—

- (a) It has a Ki-Sambaa name, *njore* (or *njorwe*), which I have been able to check from several native sources.
- (b) It is distinguished by my informants from the much smaller *Vanilla zanzibarica* Rolfe, which is well-known in coastal areas of Tanganyika, and it is reported to be found at Daluni and Hemagoma as well as in the Sigi valley.
- (c) It has among the Wasambaa a special magical use, for which *V. zanzibarica* will not serve.

Accounts of the usage obtained by Mwindadi Simba and by me independently agree well. It is noteworthy that, although he has been employed at

Amani for thirty years, he, a Bondei, had never before heard of the custom, which is exclusively Sambaa. The method is as follows :—

If a man has reason to fear that his crops will be robbed he cuts three lengths of *V. imperialis*—it has a tough juicy stem nearly an inch thick, with a pair of leathery leaves at intervals of about six inches. One piece he sticks into the ground on the edge of his *shamba*. With the other he perambulates his boundary, finally sticking it into the ground close to the first, so that they form, as it were, a gateway. The third piece he takes home to his hut. It does not matter whether the cuttings grow or die : their efficacy is the same : any trespasser entering upon the *shamba* will die. Some say that only a childless curmudgeon will use this charm because his own family may be smitten by it.

The fact that the charm (*kiapo*) has been used is made known and moreover the two “gateposts” are not concealed. An enemy may cause trouble to the *shamba*-owner by carrying them off, as he can, with impunity to himself. The result of their removal is not to give safe ingress to a thief but to interdict the owner himself from entering his *shamba*, under the same deadly penalty as he himself invoked, unless he can apply a remedy. This is the use of the third cutting, which was taken to the hut at the time the original charm was laid. By perambulating his boundaries with it, he can reopen his *shamba* to his own (but no one else’s) ingress. The third cutting must then be left at a point on the boundary, but it need not be obvious and a prudent man hides it so that this time there may be no hanky-panky.

San Rafael

Extract from a letter of December, 1942, from Lt.-Comdr. G. F. Cole to Mr. R. E. Moreau :

I HAVE just read the interesting article in *Tanganyika Notes and Records* on San Rafael. I have never heard the name mentioned on the coast; probably it is a name too hard for the Swahili language and has become lost. I favour Mr. Hatchell's theory and think Fungu Tongone is the site. The Admiralty may have some record as Captain Owen was down this way in the 1820's. In a bay north of Tanga I have again noticed the encroachment of the sea which I mentioned to you before. Also while surveying on Kwale Bank I noticed that the reefs there had altered a great deal. I found small pinnacles of coral rock in places shown on the chart in twenty fathoms. In fact, the main Kwale patch seems to have shifted about two thousand feet! The north end of Yambe was in 1894 eighteen hundred feet from east to west, while in 1939 it was only nine hundred feet across and the shape was entirely different.

* * * *

Mr. C. Gillman writes :

AS A STUDENT of East African coastal tectonics I think that Hatchell's suggestion on page 24 of the last number of *Tanganyika Notes and Records* is plausible, especially in view of Comdr. Cole's recent surveys which leave no doubt that the coastal strip between Tanga and Pangani is at present slowly subsiding. The sinkage of Maziwi Island off the Pangani mouth, described by Moreau in this Journal, No. 7, 1939, page 116, points in the same direction. Under the circumstances we may, for the time being, reasonably assume that the memory of the San Rafael bank and of its name has been lost owing to its disappearance below the surface probably at some time during the sixteenth or seventeenth century.

As regards the orange question, Dr. F. Stuhlmann, whose careful and penetrating researches into the origin of East African cultivated plants are generally accepted as correct, remarks as follows in his monumental "*Beitraege zur Kulturgeschichte von Ost Afrika*", 1909 : *Citrus Aurantium amara* (Bitter orange, *chungwa kali*) was brought to East Africa between the ninth and twelfth century by Persian settlers from Shiraz (page 70), while *C. Aurantium sinensis* (Sweet orange, *chungwa*) was "more than probably" brought by Arab traders from China to the Persian Gulf and the Red Sea towards the end of the thirteenth or at the beginning of the fourteenth century, and

somewhat later thence to northern India and East Africa (page 73). Stuhlmann (page 72) also mentions the story of the oranges which were taken to the Portuguese fleet near San Rafael, adding that "these shallows must have been situated near Tanga or Tangata", the latter being the name of the bay just west of Tongone Bank.

Philatelists may be interested to know that the vessel depicted on the triangular 85 centavos Mozambique stamp of 1940 is identical in shape and rigging with the picture of Vasco da Gama's fleet in Strandes's book.—C.G., *Dar es Salaam*, 30th April 1943.

CORRESPONDENCE

THE EDITOR, *Tanganyika Notes and Records*.

Dear Sir,—Readers of my note on "The distribution of the Chimpanzee in Tanganyika Territory" (*Notes and Records* No. 14) will have observed from my second paragraph that I had applied to both the Game Warden and to the Tsetse Research Department and had failed to get from them any definite and localized evidence of the occurrence of the animal in the Territory.

Mr. Teare now tells me that he had been told of Grant's specimen from north of Kigoma (quoted separately by me) by Swynnerton, who used it as the basis for including the animal in the protected list of the Game Ordinance.—Yours faithfully, R. E. MOREAU, Amani, 9th January 1943.



230-lb. Sea Perch caught in Ruvuma River.

Mrs. G. H. Dalton submits the accompanying photograph of a 230-lb. Sea Perch (*Njombo*) caught on a hand-line in the Ruvuma River (about three miles upstream from the mouth) in November 1942.

The record for an *Njombo* is believed to be 50 lb. (see *Notes and Records* No. 3 of April 1937).

The native fishermen were emphatic that the fish was an "*Njombo*" and not a "*Chewa*".

