Resource exploitation and population aggregation: the case of Kibiro

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Abstract
In 1894 Major Thruston, a British officer, described Kibiro on the south-eastern shore of Lake Albert, in Uganda, as 'the only manufacturing town in Unyoro', consisting 'of about a thousand grass huts closely huddled together'. The reason for this aggregation of population was that the women of Kibiro had developed a method of extracting salt, from alluvial deposits adjacent to hot springs at the bottom of the Western Rift Valley, that allowed sustainable exploitation of a renewable resource. This method involved leaching recycled earth that had absorbed saline moisture from exposed areas of the deposits, called 'salt-gardens'. These were very different from the salt-pans used at Lakes Katwe and Bunyampaka, also in the Western Rift. As well as being sustainable, the Kibiro technique raised the low salt content of the springs to a level where the resulting brine could be economically boiled and also reduced the magnesium content of the finished salt. The women of Kibiro still produce salt in this way and the considerable accumulation of domestic and industrial deposits at this place has been shown by archaeological excavation to have built up over a period of 700-800 years. Kibiro, therefore, represents a case where population concentrated at one point because of the continued successful exploitation of a particularly valuable resource. The material evidence excavated from this place suggests a Nilotic or Central Sudanic element in the basically Bantu population and suggests that in this instance small-scale industrial urbanization was taking place from early in the present millennium.

Introduction
Africa's Western Rift Valley is one of the continent's most impressive landscape features. In Uganda, for instance, its south-eastern side is defined for much of its length by an abrupt escarpment that drops over 300m, from the relatively lush plateau above, to the drier conditions of the valley below. Agricultural production and density of human settlement is less in the savannah conditions of the Rift, although the situation is complicated by the huge mass of the Ruwenzori Mountains that tower to over 5000m to the south-west and provide a range of environments of their own. The Rift Valley also contains a series of large, deep lakes, of which the Ugandan representatives are the north-eastern end of Lake Edward, Lake George, and Lake Albert (Fig. 1). These are rich in fish and at the time of first European contact, in the second half of the nineteenth century, the area also had substantial populations of game, remnants of which survive particularly in the Queen Elizabeth National Park in the area between Lakes Edward and George. In addition, the area had several major sources of that most prized of commodities in tropical Africa: sodium chloride, common salt.

It has long been appreciated that salt played a major role in the development of internal trading networks in tropical Africa (for example Fagan 1969). In turn, over the last millennium or so, such trading networks were amongst the factors that contributed to the growth of urbanization and the emergence of states in some parts of the continent (Connah 1987). It is probably significant, for instance, that by the nineteenth century the Ugandan section of the Western Rift Valley formed part of the Kingdom of Bunyoro (Dunbar 1969), to the north-east, and of its breakaway state Toro (Ingham 1975), to the south-west. Salt was clearly of major economic and political importance to these states (Tosh 1970; Kamuhangire 1975). Moreover, it seems that continued successful exploitation of this resource could lead to an aggregation of population at the point of production. This is what appears to have happened at Kibiro on the south-eastern shore of Lake Albert, in Uganda (Fig.1), where in 1894 a British officer, Major

Arthur Thruston, described the settlement as 'the only manufacturing town in Unyoro', consisting 'of about a thousand grass huts closely huddled together' (Thruston 1900, p. 143). The reasons for this particular instance of what amounted to small-scale industrial urbanization are worth examining.

Methods of salt-production

The variety of ways in which salt was obtained at one time or another in tropical Africa almost defies imagination. In the Sahara Desert it was quarried in slabs of rock salt, straight out of the ground (Garlake 1978, p. 13). In parts of the western Sahel zone it was obtained laboriously by leaching large quantities of ash, got by burning the leaves of salt-bush (Salvadora persica), and then boiling the resulting fluid (Connah 1981, p. 198). In East Central Africa it was even extracted by leaching goat dung and boiling the product of this operation (Baker 1866). One of the most obvious methods, however, was to extract the salt either from seawater or from natural saline springs (for example Nenquin 1961, p. 115-16; Sutton & Roberts 1968, pp. 61-2). Solar evaporation was the most efficient way of accomplishing this, particularly with seawater where the salt content of about 2.5 per cent could be relatively easily raised to the saturation level of approximately 24 per cent, at which point the salt begins to crystallize out of the solution. Some of the inland salt springs, however, had a much lower salt content, or were of such a configuration that the construction of salt-pans was difficult, or contained other minerals which it was desirable to get rid of. In such cases, it was the practice to extract the salt by leaching quantities of earth from deposits adjacent to the springs and impregnated by them (for example Fagan & Yellen 1968, pp. 4, 30-1; Morgan 1974). Having done this, it was then necessary to boil the brine that resulted, in order to evaporate all the water and recover the contained salt. The problem was that this could be a very laborious operation, involving not only the hot work of lengthy fire-tending but considerable expenditure of effort in cutting and carrying large volumes of firewood, that often had to be brought substantial distances. For this reason, salt-producers sometimes went to extraordinary lengths to raise the salt content of the brine before boiling and therefore to save on labour and fuel. In Western Europe, for instance, French and German salt-manufacturers in the eighteenth and nineteenth centuries constructed gigantic evaporation walls of bundles of blackthorn branches, several storeys high and hundreds of metres long, down which they trickled the salt solution and raised its concentration by what became known as the 'thorn-graduation' process (Rogers 1984). In Uganda, the people of the fishing settlement of Kibiro used another method, equally unusual in its own way and contrasting sharply with the solar evaporation techniques practised in other parts of the Western Rift Valley (Connah et al. 1990).

Remarkably, in a continent where the influences of Western culture have destroyed so many traditional practices in the last half century, it is still possible to observe salt-working in the Western Rift, as was done at both Kibiro and Lakes Katwe and Bunyampaka (Fig. 1) in 1989 and 1990. The political upheavals of the 1970s and early 1980s in Uganda created economic problems that tended to foster these local industries and to protect them from the competition of mass-produced imports, in this case sea-salt from the Kenyan coast. In addition, we are fortunate to possess a variety of accounts by European explorers, officials, soldiers, missionaries, and scientists, that stretch back for well over a hundred years (for example Baker 1866; Schweinfurth et al. 1888; Mounteney-Jephson 1890; Stanley 1890; Casati 1891; Colvile 1895; Ansorge 1899; Thruston 1900; Fisher n.d. [1911]; Roscoe 1923; Roscoe 1924; Baker 1954; Fawcett 1973). It is therefore possible to examine the salt-production of this area over the last century, and to see it as a specialized human response to the environmental conditions of this part of the Western Rift. Because salt-boiling and associated human occupation have led to the accumulation of substantial archaeological deposits in the case of Kibiro, it is also possible to suggest a considerably greater antiquity for this industry. These deposits at Kibiro, which are up to 3m deep, have produced a series of radiocarbon dates which indicate that they have been forming for the last 700-800 years (Connah 1991). Salt-making at this place, therefore, would appear to be a development of what has often been called the East African Later Iron Age and to have no clear association with the so-called Early Iron Age.

It is the unusual, if not unique, methodology of salt-extraction at Kibiro which is of most interest, however. Twentieth-century survey maps of this part of Uganda record Kibiro, wedged onto a narrow plain between the lake shore and the base of the escarpment, as possessing both 'Hot Springs' and 'Salt Pans' (Uganda 1962; Uganda 1966). The former it certainly has, the latter seem unlikely ever to have existed. Kibiro salt-production is based on the leaching of recycled earth, that is used to absorb the saline moisture from the deposits adjacent to the natural springs. This is carried out in flattened depressions known in Lunyoro as ebibuga, in English 'salt-gardens'. A closer examination of the technique involved demonstrates how different their operation is from the use of salt-pans. In order to appreciate this point fully it is worth considering the use of salt-pans at the salt lakes of Katwe and Bunyampaka, further to the south-west along the Rift Valley.

Salt-pans at Katwe and Bunyampaka

Kibiro, Katwe and Bunyampaka were not the only places in the Western Rift where salt was produced in the past but they are the only ones that are known to be still in production. Both Katwe and Bunyampaka are lakes within explosion craters in a formerly active volcanic area north-east of Lake Edward and south-west of Lake George. The area contains a large number of such craters, several with spring-fed lakes in them, of which some are saline. At both Katwe and Bunyampaka there is a relatively high salt content in the lake water, although this varies depending on rainfall and evaporation (Arad & Morton 1969). In February 1989 the Assistant Manager at the Katwe salt-works claimed a salt concentration of 13.5 per cent and it is Katwe that is the more important of the two places in terms of scale of production. Certainly, the salt content of Lake Katwe is such that it crystallizes continually into a stony deposit on the bottom of the shallow lake, from where it is quarried in slabs by men wielding iron bars who wade in the water. These slabs are then floated to the shore on trains of small rafts made of the very light ambatch wood. This provides a poor grade of salt which is, in fact, a very variable mixture of sodium chloride, sodium sulphate, and sodium carbonate (Fawcett 1973, p. 64) but it is marketed as raw slabs and used for cattle. In 1989 it was said that it was exported to Rwanda and Za‹re as well as being sold in various parts of Uganda and, indeed, it was observed on sale in the market at Mbarara (Fig. 1).

A far higher grade of salt is obtained by solar evaporation in mud-lined salt-pans, which are constructed in clusters around the margin of the lake (Pl. 1). The pans consist of low banks, up to about half a metre in height, made of mud, sticks and grass, and enclosing roughly rectangular areas of the lake water of about 10 x 10m in dimension (Pl. 2). The water remaining in these pans is from 15 to 30cm deep and the pan is so located that its floor is level. On sunny days during the drier periods of the year the bottom of the Western Rift is a hot place, especially within the confines of a crater, and the rate of evaporation is high. As this occurs, a filmy scum forms on the surface of the water in the salt-pan; this is the salt crystallizing out. The operators of the pans, who are both men and women, periodically disturb the surface of the water with their hands or by pouring salty water on it, in order to get the salt forming on the surface to sink to the bottom of the pan. The speed of the whole operation obviously depends on the temperature and on the amount of sunshine but it would seem that, in average dry season conditions, it is possible to harvest the salt that has collected at the base of the pan after between four and seven days. In 1989 this was commonly done with plastic washbowls that were used at an angle to scrape up the salt from beneath the water in the pan. To do this the operators had to wade in the pan as they worked. The resulting salt was coarse-grained and grey but by repeated washing in the plastic bowls with water from the pan, whilst kneading it with the hands or trampling it with the feet, it could be got to a remarkably clean and white condition. The quality of the end-product very much depended on the assiduity of the individual worker, both in keeping the pans clean and in washing the salt that was recovered (Pl. 3). Like the slabs quarried from the bed of the lake, however, the salt from the pans is not pure sodium chloride, being contaminated with both carbonate and sulphate. This may be good for cooking vegetables, easing sore stomachs and relieving constipation but it means that the composition of the final product must be regarded with some uncertainty (Fawcett 1973, p. 64). After all, people do like to be able to choose whether to take their medicine or not. Nevertheless, the Katwe salt-pans are clearly a very effective way of producing edible salt. In dry weather they can be used continually, and when the water level becomes too low in a particular salt-pan, it is an easy matter to open an inlet in the surrounding bank and allow more in from the lake, which is usually no more than 1m deep.

The highest grade of salt from Katwe actually results from natural evaporation of the surface of the lake itself but forms only late in the dry seasons and still contains some carbonate and sulphate (Fawcett 1973, pp. 63-4). Also it tends to be available in only limited quantities, which vary from year to year depending on weather conditions. All that the salt-workers have to do is collect the finished salt but there appears to be no way of controlling or increasing production.

Overall, however, salt production at Lake Katwe is on a fairly substantial scale, both of granulated salt from the pans and lake surface and slabs of rock salt from the lake bottom. Production is carried out by groups of independent workers, who pay a periodic fee to the Lake Katwe and Kasenyi Salt Industry, that is run by the local government. Salt-pans have to be reconstructed or at least repaired after each wet season, and so the number varies from dry season to dry season, it was about 2050 in July-September 1988, for example, but 1912 at the same time in 1989 (Syahuka-Muhindo 1989, p. 7). In 1969 Katwe was producing about 5000 tons of 'mixed salts' each year (Arad & Morton 1969, p. 1176) and it is not surprising, therefore, that in the 1970s an attempt was made to place the industry on a modern mechanized basis. A German group constructed a causeway of stones and earth to the centre of the lake, so that brine could be pumped from there to a large extraction and refinery building that was built a little distance away on the shore of Lake Edward. For one reason or another, the scheme failed and the causeway, its rusting equipment and the adjacent building are in the process of becoming industrial archaeology. Meanwhile, the traditional production methods at Lake Katwe continue to thrive, as they have probably done for some centuries.

At Lake Bunyampaka near Kasenyi, however, the scale of operation seems to be much smaller. No rock salt is extracted from this lake but numerous salt-pans cluster along parts of its shore. The lake is situated at the bottom of a crater, as at Katwe, but is not so big. When visited in 1989, it had rained earlier in the day and so work had come to a halt but the mode of operating the salt-pans seemed to be much the same as at Katwe. Heaps of finished salt on the lake shore had been carefully compacted, presumably to protect them from the rain (Pl. 4), and in some cases they had been neatly covered in grass for the same purpose.

The production of salt at Lake Katwe was mentioned by H.M. Stanley a century ago (Stanley 1890, vol. 2, pp. 312-15) and that at Lake Bunyampaka was described by J. Roscoe in 1924 (pp. 156-7). Indeed, it seems likely that salt-production at both places has an antiquity of some centuries, and yet a search in the vicinity of the salt-pans at both Katwe and Bunyampaka failed to reveal any substantial archaeological deposits, merely some thin scatters of potsherds. At Lake Bunyampaka, even a detailed search of an adjacent area where, according to Roscoe

(1924, p. 157), there had been a village that marketed the salt, produced only dispersed archaeological material (Connah 1989, p. 49). This is in sharp contrast to Kibiro, where fire plays such an important part in evaporation and where the operation of the salt-gardens (Connah et al. 1990) differs so much from that of the Katwe and Bunyampaka salt-pans.

Salt-gardens at Kibiro

Yet even at Kibiro the sun plays an important role and the pace of salt-production is much affected by weather conditions: the greatest activity being during hot, dry periods and the least activity during dull, rainy ones. Indeed, after heavy rain the salt-gardens are often too wet to work at all or, in some cases, even flooded by shallow surface water. These working areas known as salt-gardens are clustered in several groups in and around the Mukihanga Valley, an area of low-lying poorly drained alluvial and possibly lacustrine deposits that merges with the narrow coastal plain of Lake Albert. Through this valley flows a relatively small stream of hot water fed by several natural springs, the main one of which is situated in the ravine-like upper valley, where the latter has cut back into the face of the Western Rift escarpment. This spring has a temperature of approximately 84øC and a discharge rate of 400L per minute, although this may vary seasonally (Arad & Morton 1969, p. 1172).

Basically, the salt-gardens consist of irregular areas of anything from 5 to 50m2 of roughly level ground, from which the grass and topsoil have been removed (Pl. 5). These areas are carefully drained by little channels cut through or around them and their surfaces are scraped smooth and any stones removed. The turf and topsoil are heaped in low banks around each salt-garden to form a boundary, or sometimes the salt-garden is marked off from its neighbours by lines of stones. It is these areas that are the scene of the most distinctive part of the Kibiro method of salt-production. The deposits exposed by the salt-gardens are impregnated with water from the hot springs, that contains, amongst other things, sodium chloride. The trouble is that the water from the springs contains only 0.41 per cent of sodium chloride but also contains sufficient sulphate, some of which is in the form of magnesium sulphate (Epsom salts), for Emin Pasha to observe in 1885 that: 'when taken in large quantities, it acts as a moderate purgative' (Schweinfurth et al. 1888, p. ÿ177). Hence the laborious use of the salt-gardens: if salt was obtained directly by boiling the spring water, then an enormous amount of fuel would be required, and this in a savannah area where firewood has to be carried substantial distances. In addition, the finished product might well have an undesired effect upon the user. Equally, if solar evaporation was attempted in salt-pans, as at Katwe and Bunyampaka, the low salt content of the spring water would necessitate the evaporation of very large quantities of water and the magnesium sulphate would still be present in the salt that was produced. The solution of this double problem has been to boil brine extracted from the salt-garden deposits. This has a reduced magnesium content and a salt content 33 times higher than it was in the original spring water (Figs. 2 & 3). The lowering of the magnesium concentration is due either to magnesium exchange in the deposits or to the crystallization of a separate magnesium-rich mineral.

The method of operation would delight many environmentalists, interested as they are in the sustainable use of renewable resources. Loose dry earth, taken originally from the surface of the salt-bearing deposits, is spread over the surface of the salt-garden, being evenly broadcast from an elongated, shallow, wooden bowl. This is done each morning and, unless rain threatens, the loose earth is scraped up each evening, using a crescent-shaped iron scraper and the wooden bowl, and collected into heaps where it is left overnight (Pl. 6). Gathering the earth into these heaps, which are sometimes compacted, is to guard against salt-loss if it rains during the night, and for the same reason the earth will also be heaped up during the day if rain seems likely. This routine of spreading and scraping is repeated for a week or more and the loose earth, day by day, absorbs salty moisture drawn to the surface of the deposits by the capillary action brought about by the hot sun. As the earth absorbs this salty moisture, however, so it is continually dried by the sun, and as this happens, the salt content of the loose earth increases (Fig. 3). The number of days that spreading and scraping continue depends on the location of the salt-garden, the length of time that it has been in use, the weather, and the application of the salt-worker. The colour of the loose earth gradually changes from dark brown to greyish brown as the days go by and, at a time judged by the worker from experience, it is eventually packed into a large container with a small perforation in its base. Water from nearby drainage channels, and therefore also containing some salt, is then poured into the top of this container and, percolating through the earth, leaches the salt from it and trickles through the hole in the base of the container into a receptacle beneath. This operation, which is carried out at the edge of the salt-garden, used to be done using earthenware pots but during the last few decades handleless aluminium saucepans, known in Swahili as sufurias, have been adopted instead. When all the water has passed through the saline earth in the upper container and collected in the lower container, it is assumed that it may then be passed through the earth a second time or percolated through a fresh lot of earth, in order to raise the salt content of the final liquid to an acceptable level. After each batch of earth has been satisfactorily leached, the mud that is left in the upper container is dumped on the bank at the edge of the salt-garden, adjacent to the place where the leaching has taken place. Some time later, after it has dried and hardened, it is broken up and used once again on the surface of the salt-garden and eventually leached as before. Thus the earth from which the salt is actually extracted is recycled and used over and over again, and the salt content of the salt-bearing deposits is constantly renewed by the absorption of saline water from the hot springs and the stream that is fed by them. The obvious long-term advantage of the method is that the saline deposits are not actually mined or consumed in any way and, theoretically at least, salt-extraction by this method could continue indefinitely. In practice, however, the surfaces of the salt-gardens can suffer some attrition, so that too many stones become exposed and the garden is therefore abandoned. Also, constant use of a salt-garden for a long time eventually leads to a falling salt-yield and the garden will be fallowed for some years, during which it reverts to a grass-grown depression that can nevertheless in due course be brought back into production. The people of Kibiro call these working areas salt-gardens because it is from them that they derive much of their livelihood and because, unlike salt-pans, they are dry but to the outsider they are well-named for another reason: the salt-gardens literally grow salt.

The brown salty liquid that results from the leaching process is poured into other containers, nowadays usually aluminium saucepans or plastic washbowls, and carried to the house of the salt-worker in the adjacent settlement. This liquid, of which a random sample has been found to contain 13.7 per cent sodium chloride, is then boiled, usually in a special salt-boiling building, and this continues until almost all the water has evaporated and the steel boiling-pan contains only a porridge-like boiling salt. This is ladled from the pan and poured onto the surface of the mud hearth, where it solidifies. Continued pouring of this hot supersaturated brine onto the same place gradually builds up a cone of salt of around 3.5kg in weight (Pl. 7). The finished product is a slightly yellowish white but on analysis has been found to be remarkably pure, consisting of 97.6 per cent sodium chloride, 1.4 per cent potassium chloride, and 1.0 per cent calcium sulphate (N. Cook 1991: pers. comm.). This compares favourably with the salt from the Katwe salt-pans, which Fawcett (1973, p. 64) recorded as containing up to 85 per cent sodium chloride. Even the salt resulting from natural evaporation of the lake itself at Katwe, a commodity available only at certain times and in limited quantities, that vary with the weather, contains only 95 per cent sodium chloride at its best. Thus the salt of Kibiro is of high quality and is produced by a sustainable process capable of large-scale output.

In a society that is in other respects patrilineal, Kibiro salt-production is totally in the hands of women, who take the profits and own the salt-gardens, that are inheritable in the female line. Salt-gardens cannot be bought and sold, although in recent times it has become possible for them to be rented. The landscape around Kibiro shows considerable surface modification, resulting from the former existence of more extensive areas of salt-gardens than are at present in use. In addition, ethnohistorical sources indicate that the size of the finished units of salt is smaller than was previously the case, and their shape different (for example Schweinfurth et al. 1888, p. 180; Casati 1891, vol. 2, p. 137; Junker 1892, p. 524; Roscoe 1922, pp. 162-3). It seems probable, indeed, that overall production is less than it was in the late 1880s, at the time that European contact first began to be felt in Kibiro. It can be roughly estimated that at that time some 40-50 tonnes of salt was being produced per year, a very much smaller yield than that of Katwe in 1969 but a higher quality product. Although by 1931 the industry at Kibiro was described as 'close upon extinction' (Geological Survey of Uganda 1931, p. 29), there has been a recovery in recent times and in 1989 and 1990 salt-production was thriving. Probable salt-boiling hearths have been excavated from throughout the archaeological deposits at Kibiro which, as already indicated, date back from the present time to about 700-800 years ago. Those deposits consist of both occupation material and what might be called salt-boiling debris: burnt earth, very numerous potsherds, ash and charcoal (Connah 1991). Their depth, of up to 3m, is unusually great for later archaeological sites in western Uganda and part of the explanation for this must be that the archaeological deposits are integral with an alluvial fan prograding into the lake, with a high sedimentation rate. Nevertheless, the amount of cultural material in those deposits and their extent over an irregular area approximately 1km by 0.5km, would suggest the former existence of a substantial settlement, whose relative importance is indicated by its destruction by Emin Pasha in 1888 (Mounteney-Jephson 1890, pp. 35-7) and its occupation by the British in 1894 (Colvile 1895), on both occasions as a strategy designed to weaken the ruler of Bunyoro.

It seems clear that salt-extraction at Kibiro has gone on for a long time and, providing the springs still flow and the demand for locally produced salt remains, it could continue indefinitely because of the sustainable character of the production methods. Only one major threat to its future exists and that is firewood supply: in 1990 an average bundle of firewood weighed about 40kg and could produce five 3.5kg cones of salt from an estimated 100L of brine. However, rising populations in many parts of tropical Africa are putting heavier and heavier demands on firewood sources for ordinary domestic purposes. Kibiro provides a microcosm of this situation and, although salt-production is probably now less than it was a century ago, the firewood required for cooking purposes is clearly increasing as time goes on, with the result that it has to be cut and carried from distances further and further away from the settlement, usually high on the escarpment or on the plateau above it. Given the savannah environment of the area and the relatively few trees in that environment, which is mainly seasonally burnt grassland grazed by domestic stock, firewood resources would appear to be limited. It seems possible that a time could be reached, when the labour expended in carrying firewood on their heads for long distances will exceed the attraction of the profit that the women can obtain from their work.

Conclusion

For the time being, however, the salt-production of Kibiro remains an interesting example of a human response to a rather unusual environment. Other than the salt made by the women, the only resources Kibiro has are the fish caught by the men and some livestock including cattle, goats and pigs. Because the soil is either too stony or too salty and because Kibiro sits in a local rainshadow created by the escarpment, its inhabitants grow no vegetable food. For that, they must depend on the people of the plateau at the top of the escarpment, where they trade their salt and fish in exchange for cassava and maize flour, sweet potatoes, fresh cassava, beans, groundnuts and other foods, as well as a variety of other supplies. Without its salt, Kibiro would probably still exist as a small fishing settlement, like many others on the south-eastern shore of Lake Albert, but it would be smaller and of less importance than at present. The coastal plain at Kibiro is less than a kilometre at its widest and to the north-east and south-west it is much narrower, even non-existent in some places in the latter direction. Kibiro's salt industry has enabled a far more substantial population to live in this place than would otherwise have been possible and, judging from the ethnohistorical and archaeological evidence, this has been the case for some centuries.

Inevitably, the question arises of how such an unusual technique as that of the Kibiro salt-gardens came about. Did the ancestors of the women of Kibiro think of this particular method for themselves or was it learnt from some other group with whom they came into contact? East Central Africa remained unknown to the outside world until less than 150 years ago, yet there is evidence that extensive internal trading networks existed prior to the penetration of the area by Arabs or Europeans (Gray & Birmingham 1970). Thus the inhabitants of Kibiro could have borrowed their salt-extraction technique from somewhere else in the general region of the upper Nile and the Great Lakes. Indeed, the presence of pottery decorated with carved roulettes throughout the excavated sequence at Kibiro points to contacts to the north and north-west, and suggests a Nilotic or Central Sudanic element in the basically Bantu population of this part of Bunyoro. At present, however, no parallel is known for the Kibiro salt-gardens, although it is not impossible that one exists, hidden away in some forgotten corner of the copious ethnohistorical literature for Central and East Africa. Until such a case is discovered, it will remain most likely that the Kibiro technique was developed in Kibiro itself. By their ingenuity, the women of Kibiro were able to harvest the salt of the earth, and it is suggested that this harvest was so rich that small-scale industrial urbanization was stimulated from early in the present millennium. Kibiro, therefore, appears to have been a case where successful and prolonged resource exploitation became a major causative factor in the aggregation of population. It seems that here we have one of the roads to urbanism in Eastern Africa.

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Captions

Figure 1 Part of western Uganda showing the location of salt-making centres at Kibiro, Katwe, and Bunyampaka.

Figure 2 Weight per cent proportions of total solids in: 1: the main hot spring. 2: the brine after leaching. 3: the finished salt. Note that the relative proportions of elements analysed do not vary significantly, with the exception of magnesium, whose concentration decreases during the processing.

Figure 3 The increase in salt-content through the Kibiro process. Note that the earth from a new salt-garden has an unusually high salt content, even when sampled at the beginning of the process as here. This suggests considerable variability in salt concentrations at Kibiro. It should also be noted that because the process is a cyclical one, earth after leaching is back at the beginning of the process.

Plate 1 Lake Katwe, showing some of the numerous salt-pans around its margin. The causeway was constructed in the 1970s as part of a failed development scheme. Photograph by Andrew Piper, February 1989.

Plate 2 Salt-pans at Lake Katwe, constructed of mud, sticks and grass. In the centre foreground is an ambatch raft. Photograph by Andrew Piper, February 1989.

Plate 3 Salt from the Lake Katwe salt-pans: that on the left has been well washed, that on the right not so well. Photograph by Andrew Piper, February 1989.

Plate 4 A heap of finished salt at Lake Bunyampaka, compacted to protect it against rain. Photograph by Andrew Piper, February 1989.

Plate 5 Typical salt-gardens at Kibiro. Part of the settlement and the escarpment can be seen in the background. Photograph by Andrew Piper, February 1989.

Plate 6 Scraping up the scattered loose earth from the surface of a Kibiro salt-garden. Note the use of wooden bowl and scraper. Photograph by Andrew Piper, February 1989.

Plate 7 A cone of Kibiro salt, the form in which it is marketed. Scale indicated by camera lens cap. Photograph by Andrew Piper, February 1989.

Note on contributor
Graham Connah is Professor of Archaeology and Palaeoanthropology at the University of New England, Armidale, in New South Wales. He has researched and published on the archaeology of tropical Africa for the last three decades and has also contributed to the development of historical archaeology in Australia.

Fig 1

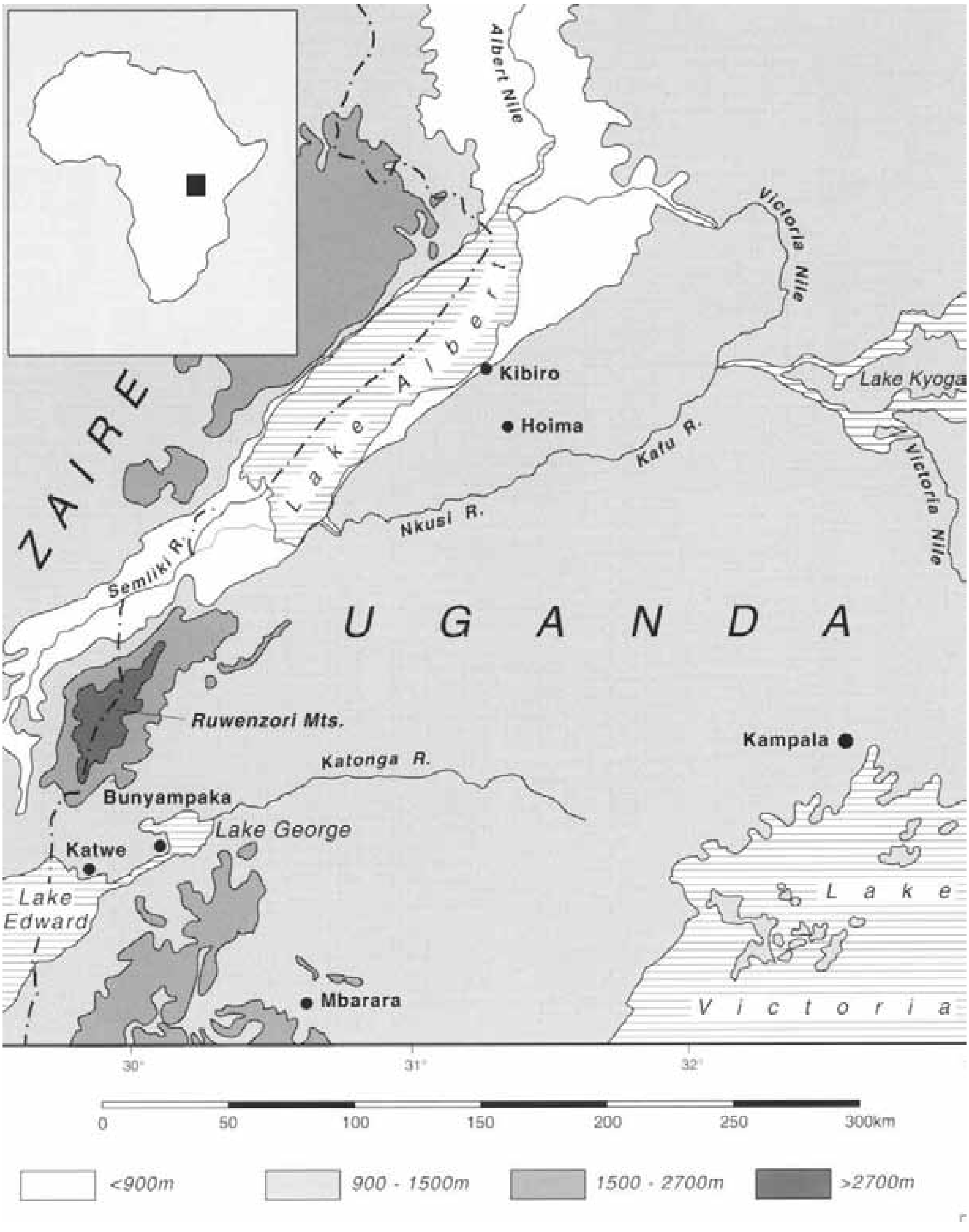


Fig. 1 Part of western Uganda showing the location of salt-making centres at Kibiro, Katwe and Bunyampaka

Fig. 2.

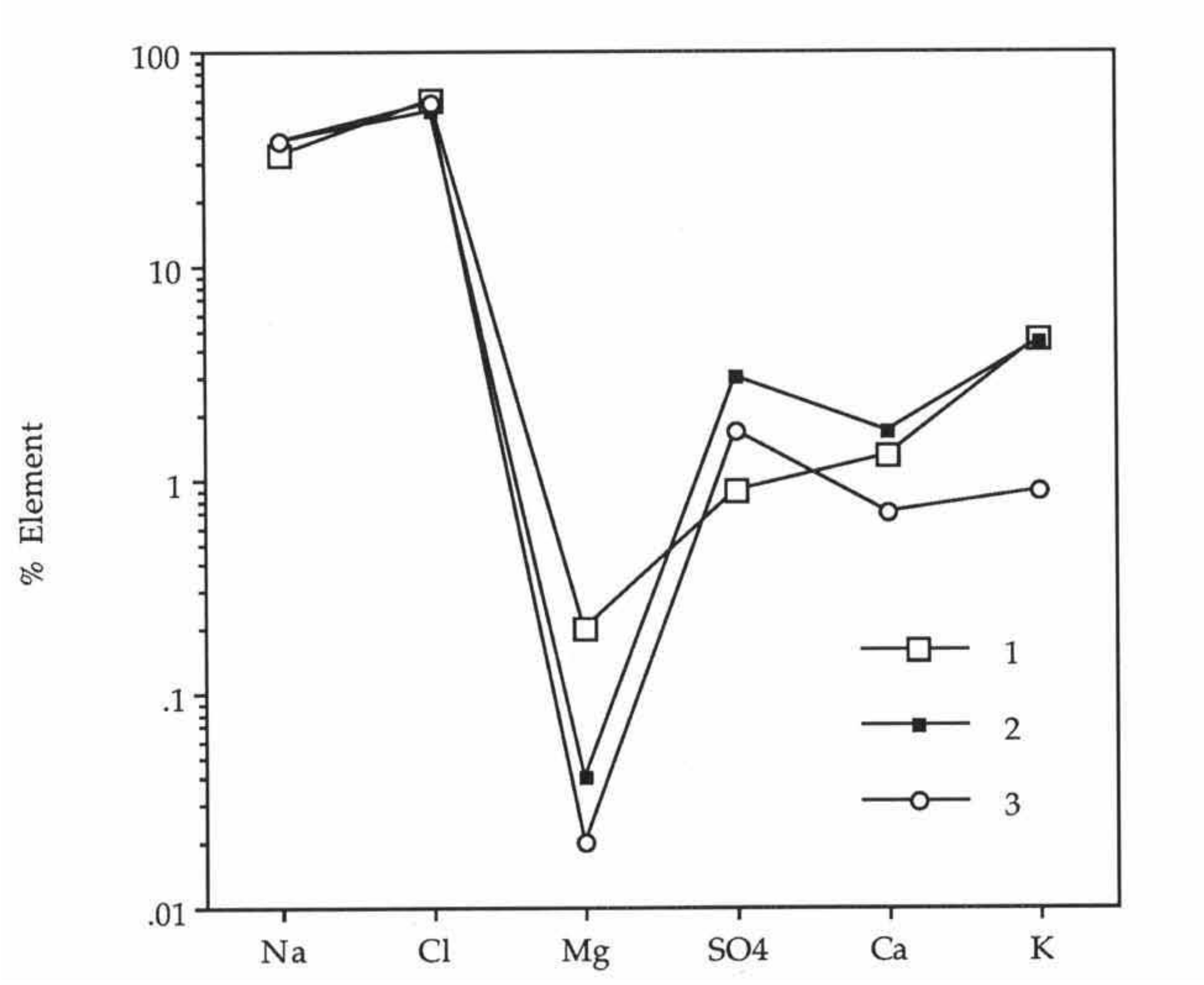
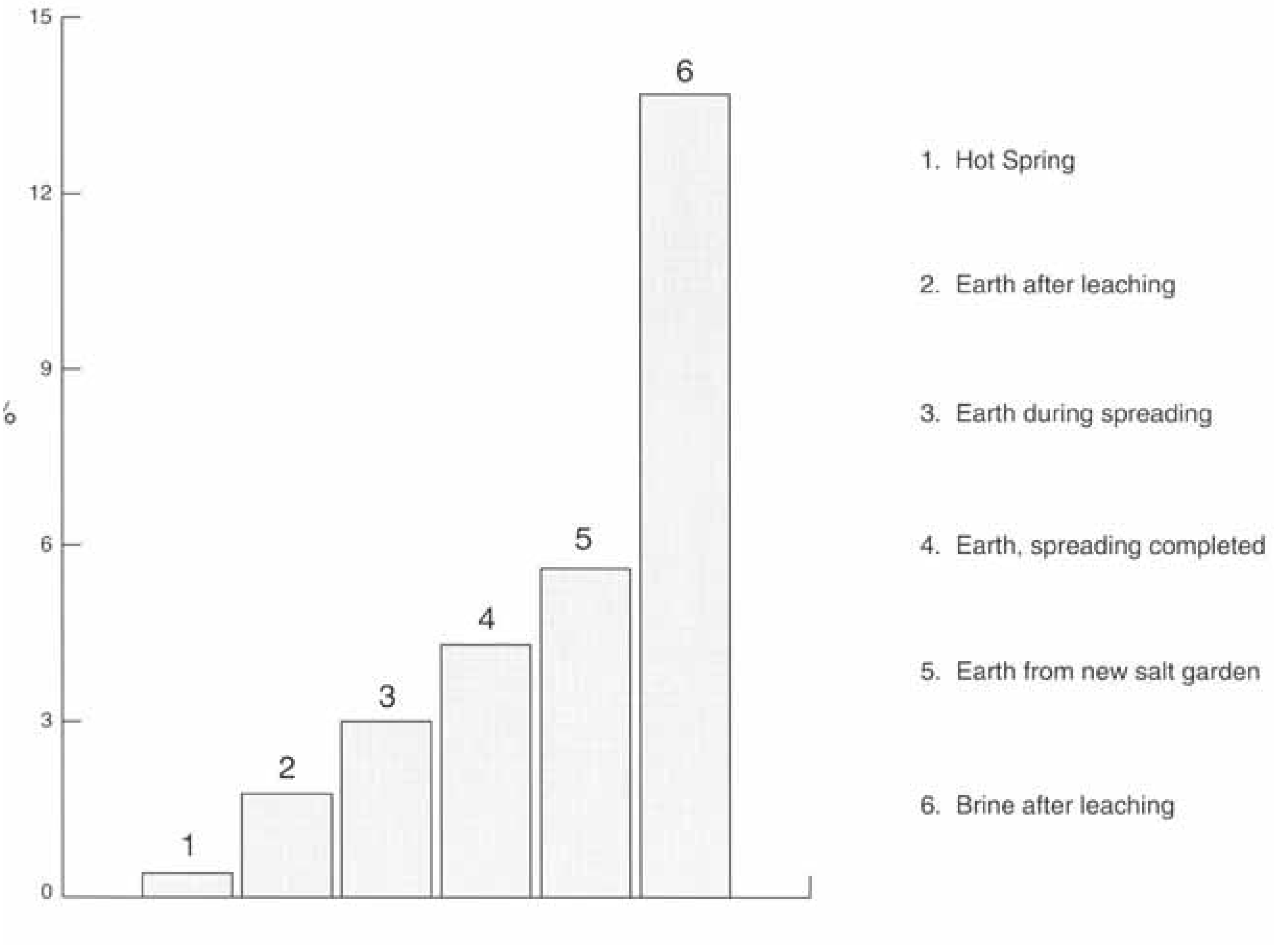


Fig. 2. Weight per cent proportions of total solids in 1: the main hot spring. 2: the brine after leaching. 3: the finished salt. Note that the relative proportions of elements analysed do not vary significantly, with the exception of magnesium, whose concentration decreases during the processing.

Fig. 3.



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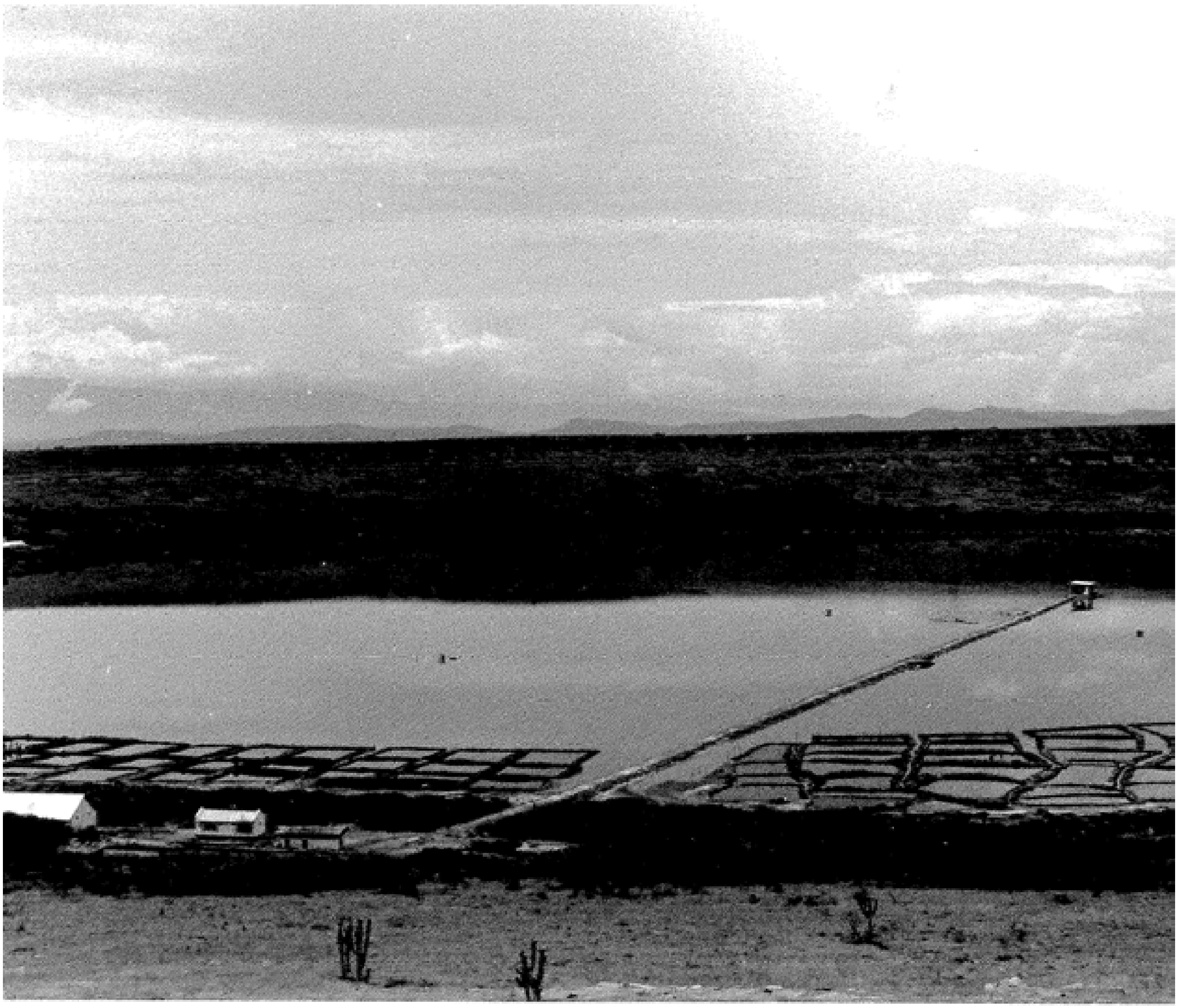

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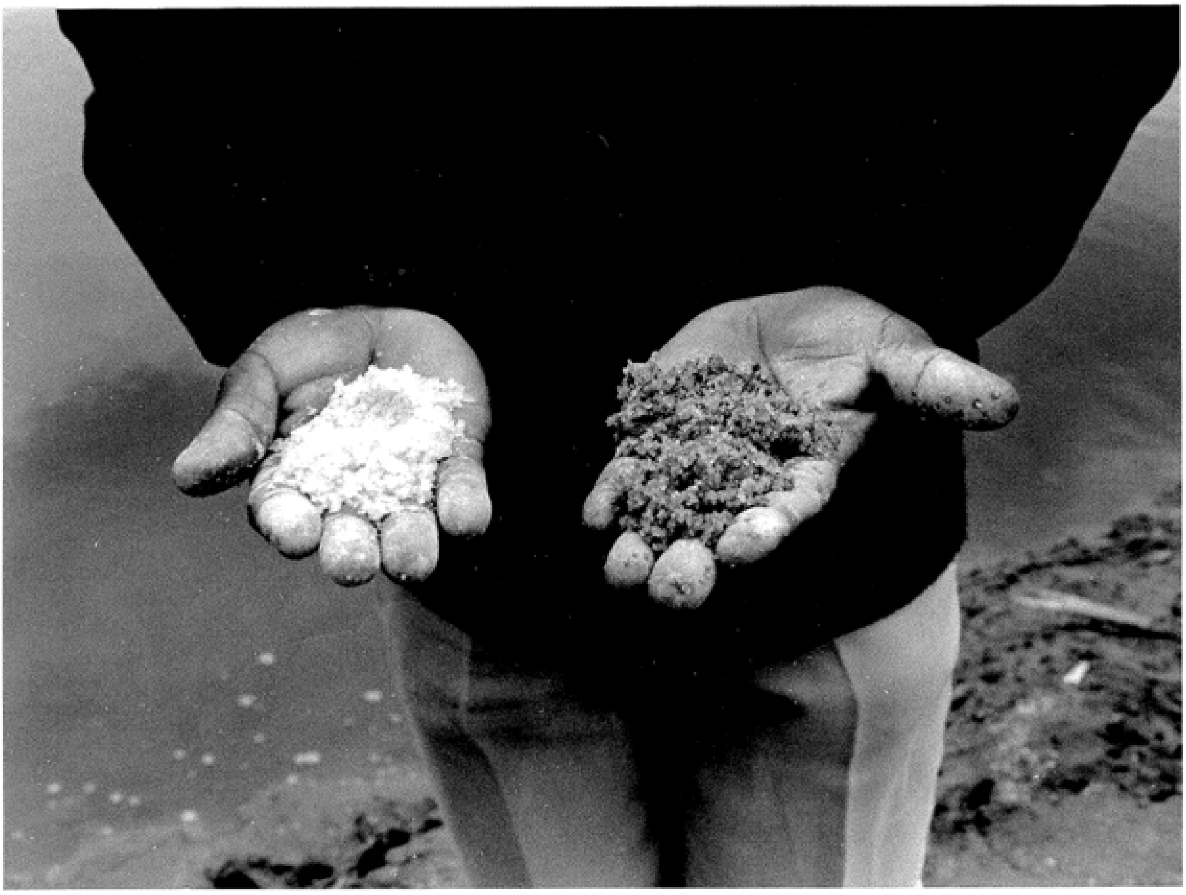

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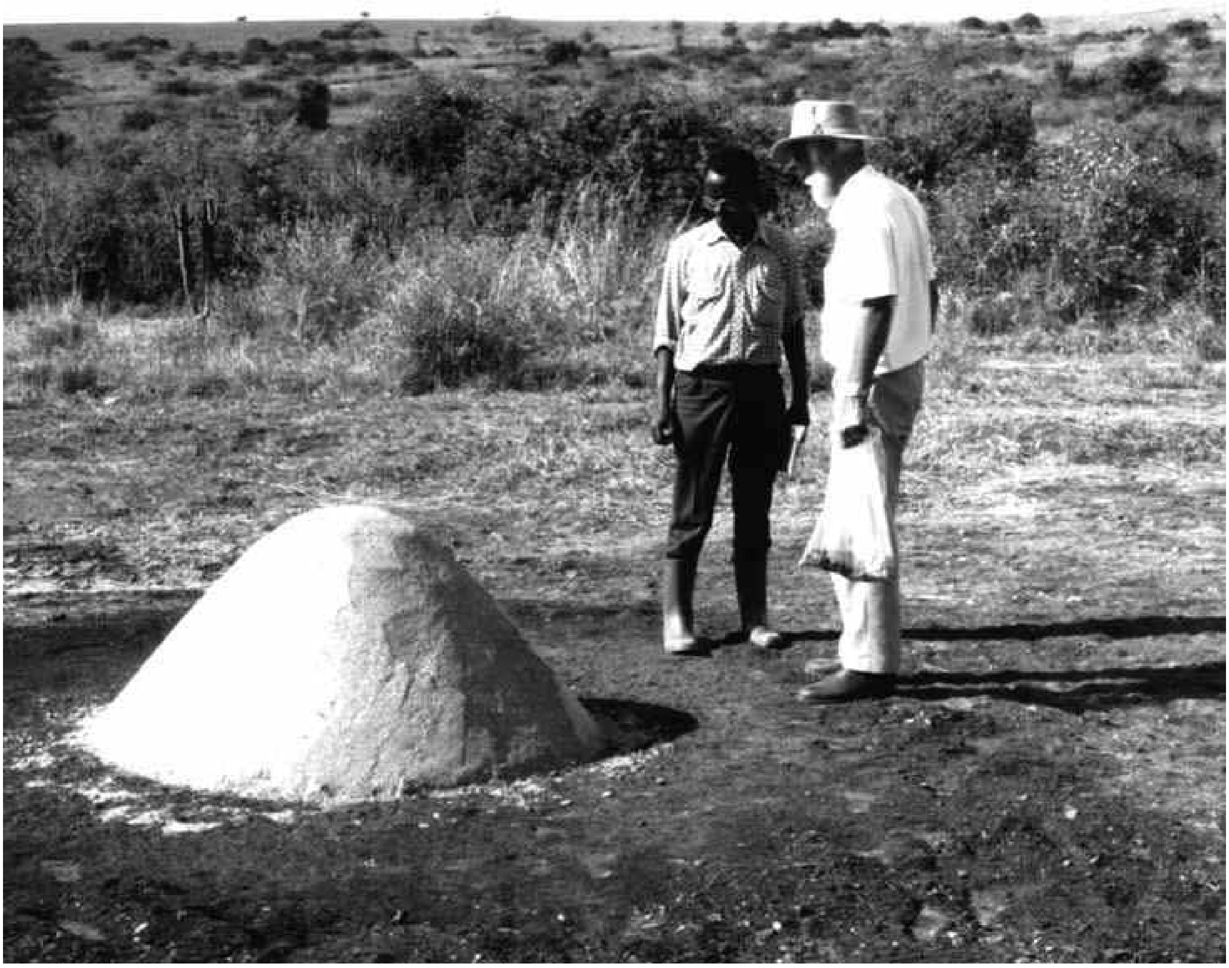

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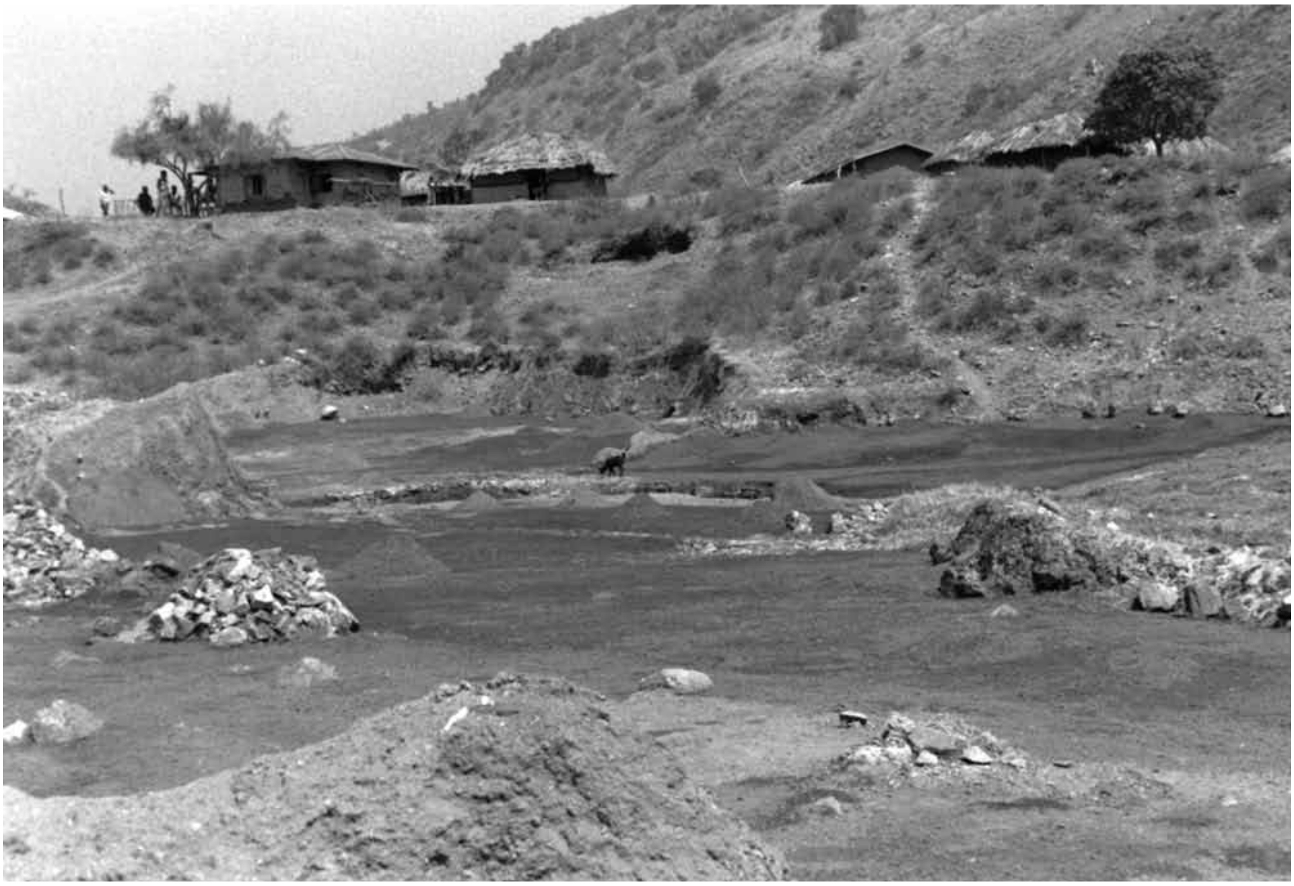

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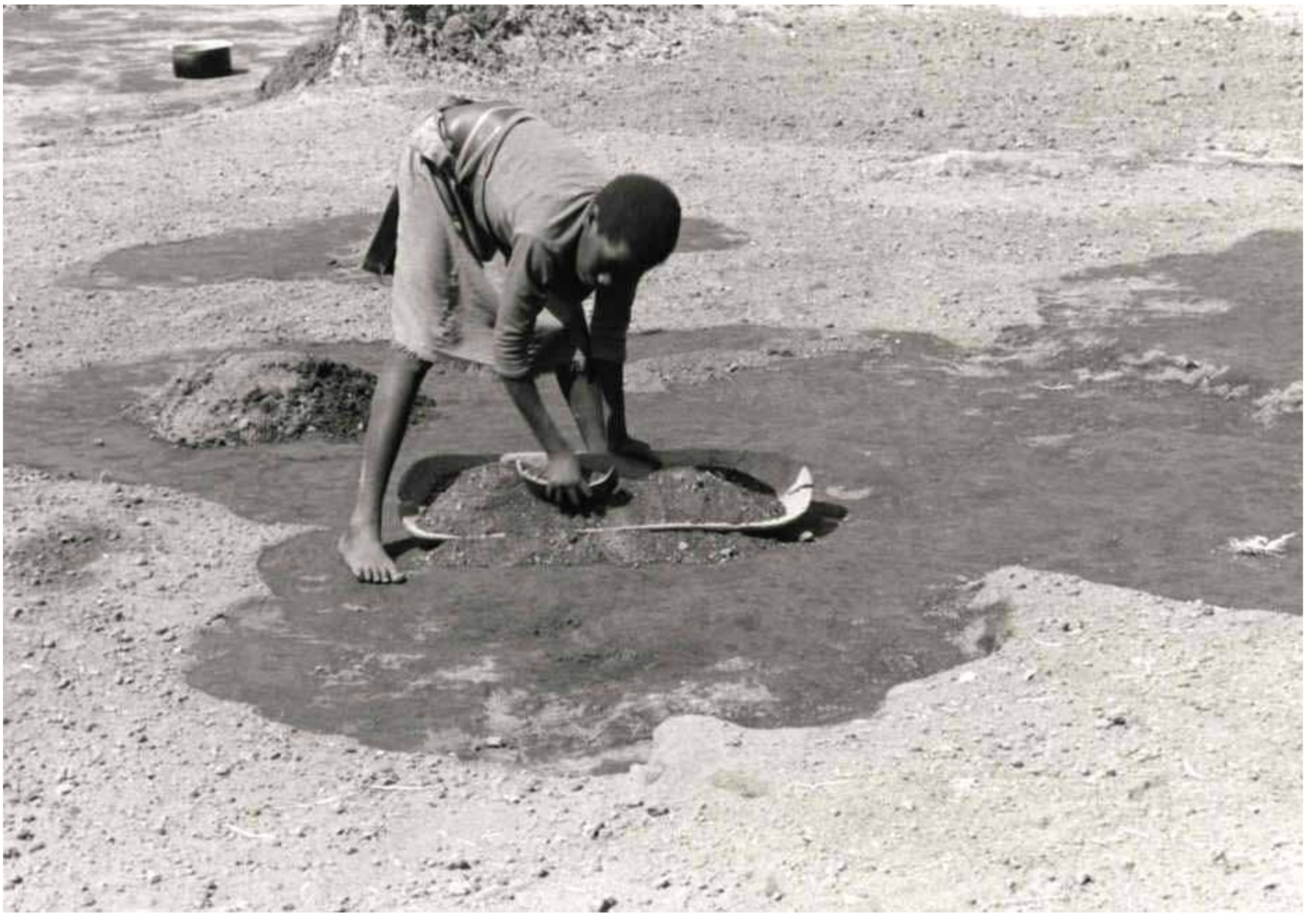

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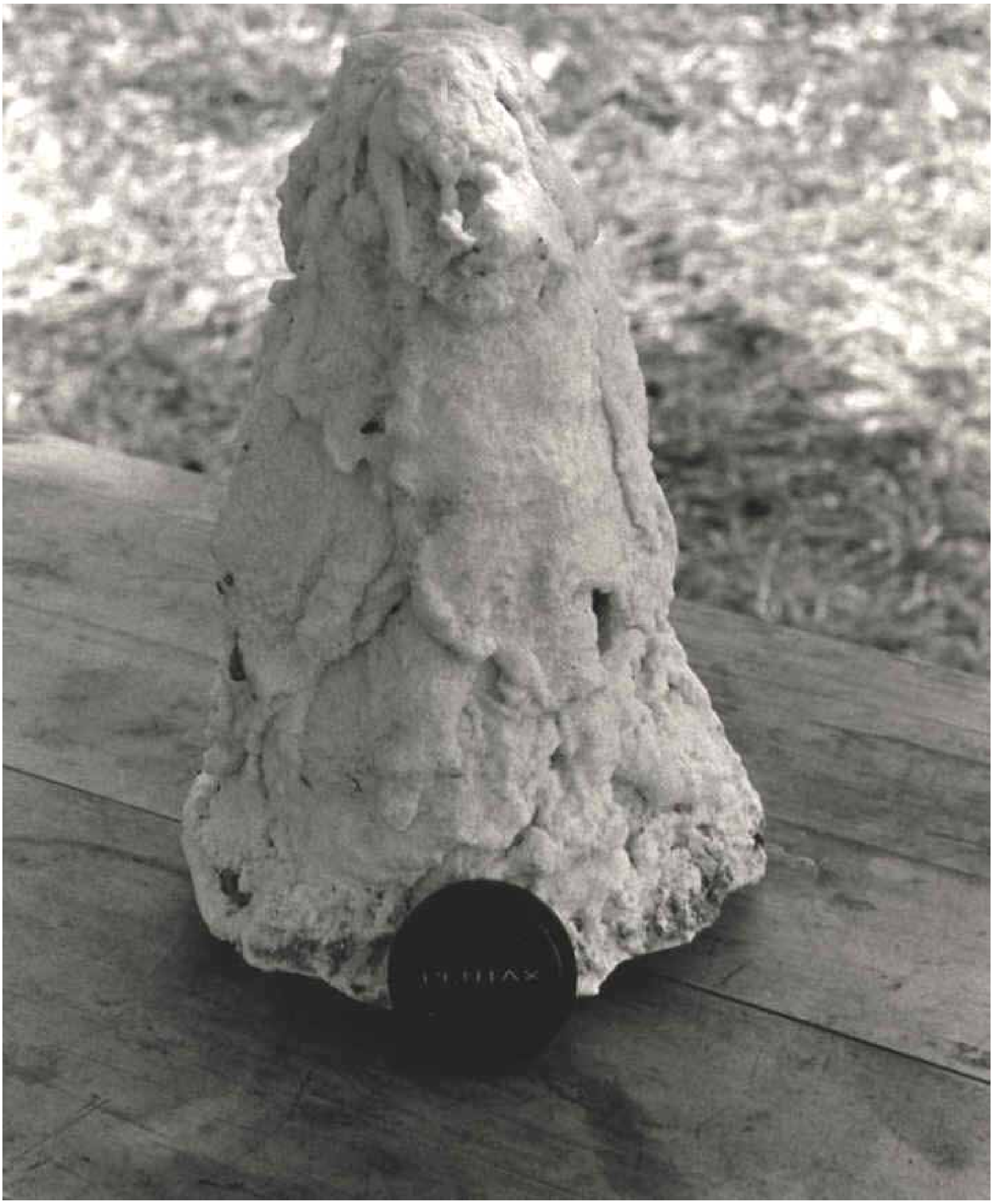

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