AIR FLOW, EVAPORATION AND MINERAL ACCUMULATION IN MOUNDS OF MACROTERMES SUBHYALINUS (RAMBUR)

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INTRODUCTION

Accumulations of mineral salts such as calcium carbonate in certain African termite mounds (Hesse 1955; Milne 1947; Watson 1962, 1967; Weir 1969, 1972; Wild 1952) are of considerable ecological and agricultural importance in savanna grasslands and other areas, though the mechanisms which lead to them remain uncertain. In some cases the mound is a mass of subsoil raised above ground level by the termites (Hesse 1955), and if the subsoil is mineral-rich the mounds will be also. The chemical composition of termites and of fungus gardens has been analysed and discounted as a source of minerals (Hesse 1955), though it has since been shown that fungus comb may be consumed and replaced by termites very rapidly (Grassé & Noirot 1958a; Sands 1969). The upward movement of water through the soil (Milne 1947) was shown not to be primarily responsible for mineral accumulation in two mounds in Rhodesia (Watson 1969).

Measurements and experiments on air flow through mounds of Macrotermes subhyalinus (Rambur) (formerly known as M. bellicosus), were done on the Serengeti Plains, Tanzania, during the months of September and October 1969, and the effect of this air flow on the thermal, mineral and water budgets of the mounds is assessed.

LOCALITY AND METHODS

The Macrotermes subhyalinus mounds investigated were typical of those occurring throughout a large area of the Serengeti National Park, Tanzania, at an altitude of 1500–2000 m. Mounds were examined near tributaries of the Seronera River on plains 5–10 km south-east of the Serengeti Research Institute; in thin woodlands at Seronera and at the Research Institute; in woodland at Banagi 14 km north of the Research Institute; in valleys near the Kamarische Hills 30–50 km north-west of the Research Institute, and in hilly country 30–35 km north-east of the Research Institute. M. subhyalinus was the only species of Macrotermes found in these areas. Mounds had a consistent range in size and structure, with the exception of certain mounds on black and grey alluvial soils in river valleys north-west of the Research Institute.

Mounds throughout these areas usually had bare earth sides with little grass or herb cover. Occasional thorn bushes grew on them, but cast little shade. Many mounds in woodland areas were shaded by trees for part of the day. In some regions, such as the plains 5–10 km south-east of the Research Institute, mounds were not shaded.

Measurements were made on forty-five mounds; some were excavated in detail and others used for experiments; termites were collected from thirty-nine.

Air movement was measured with a Casella flow meter, relative humidity with an
Airflow in Macrotermes mounds

electric hygrometer (Hygrodynamics Ltd) and air and soil temperatures were measured both by laboratory thermometers and by thermocouples. The oxygen and carbon dioxide content of air in the mounds was measured by chemical analysis, by use of caustic soda and pyrogallol.

Soil samples from mounds were dried in air and analysed in comparison with samples from adjacent soil and subsoil to determine whether or not mineral accumulation was occurring in these mounds. Analyses were therefore restricted to estimation by acid extraction and aqueous extraction, and subsequent measurement on a flame photometer of calcium, sodium and potassium (Weir 1969).

RESULTS

Mound structure and air flow

Preliminary examination of sixteen mounds of varied sizes showed that air passed into the mound at certain openings and emerged from the mound at other openings. The system of openings or pits and connecting tunnels in the mounds was unlike that of any other Macrotermes nest structure (Harris 1956; Luscher 1955; Grassé & Noirot 1961; Noirot 1970); their number varied, small mounds 0·5–1·0 m high, having two or three openings, and large mounds 2·0–3·0 m high, having ten to eighteen openings. The cross-sectional areas of these openings were measured, the directions of air flow, and the rate of movement of air into or out of the mound were recorded.

Examination of the same mounds over a period of days showed that the direction of air movement could alter in some cases, but was not seen to do so in others. It was apparent that the direction of flow in some funnels reversed or ceased, following a change of wind direction or speed.

After a period of experimental study on mounds covering a range of sizes it was possible to separate pits and funnels into functional categories. On small mounds, the differences in function were very clearly defined. The pits functioned regularly for entry and in mounds of four or fewer openings, reversal was seldom seen. On these small mounds entry pits were basal, peripheral, and often, though not always, in the lee of the mound relative to the wind prevailing at that season. The exit funnels were usually central and on top of the mound and provided with well-defined rims. These characteristics are seen in Figs. 1 and 2.

In larger mounds (Fig. 3) categories were less clearly defined. While some openings were peripheral, basal and rimless, they did not always function as well-defined entrances, but may well do so under other wind conditions. In these larger mounds at this season, a functional division of entrance and exit holes was as follows.

1. Rimless, basal, peripheral pit openings by which air enters the mound, occasionally without pronounced air flow, never reversed.

2. Funnels on the marginal slope of the mound partly ‘turreted’ (with steep well-defined rims), but with turrets only complete on the side nearest the mound; these function most frequently as entry funnels, particularly on the down-wind side of mounds.

3. Funnels on the margin of the mound, turreted or with rims of uniform height all round usually function as exits, particularly on the up-wind side of the mound though flow can be reversed.

4. Central funnels in the main body of the mound, usually with thick, low, even rims, consistently function as exit funnels.

Examination of the deep structure of small numbers of mounds showed considerable...
FIG. 1. Small mound A used in experiments on the effect of sealing funnels. The lateral view shows the position of the polythene seal placed over the exit funnel and the polythene plug inserted into the entry funnel. Measurements were made by insertion of instruments through a sleeve on the polythene over the exit funnel. New thin-walled workings created by the termites after the experimental closure are shown as stippled areas. The extent of the bare area round the mound is indicated and wind direction (arrows) is shown.

FIG. 2. Small mound B used in measurements of evaporation from mounds is shown to the same scale as Fig. 1. The direction of the wind and of air movement (arrows) is shown.
variation, funnels opening into long, deep, straight tunnels running to a depth of 1 or 1.5 m below the level of the surface of the adjacent soil, and forming a network of tunnels connecting with a space below the hive. In small mounds the tunnels were connected simply (Figs. 1 and 2) but the arrangement in medium-sized and large mounds was more complex.

A large mound used in experiments (Fig. 3) was examined on two successive days between which there had occurred a change of wind direction of 120°. The direction of air flow varied on these days (Table 1).

![Diagram of mound structure](image)

**Fig. 3.** The structure of a larger mound with twelve funnels or openings which was used in measurements of evaporation from mounds. During the period of measurement wind direction changed and both predominant directions are shown. Faeces accumulation at one side of the mound is shown diagrammatically and the surrounding bare area is indicated.

**Measurement of air flow through mounds**

Air flow measurements were made on two small mounds, three medium-sized mounds, and three large mounds. The small size and simple entry and exit systems of the small mounds made them particularly suitable for investigation. The derivation of an air budget for one of these mounds (B, Fig. 2) lying within 1000 m of the Serengeti Research Institute, not shaded by trees and with no surface cover of vegetation, is shown in Table 2.
A small termite mound of the type used for experimental work. Entry at bottom left hand; exit funnel behind. (Photograph by J. S. Weir.)

(Facing p. 512)
The total volume of air passing through this mound was calculated from the cross-sectional area of the openings together with flow measurements. Consistent discrepancies between the calculated volumes entering and leaving the mounds reflect the presence of internal constrictions in the tunnels and the effect of the air flow meter which itself obstructed air movement to some extent, particularly in exit holes. This effect could not be measured, but suggests that the flow rates recorded were 5% to 10% lower than the normal air flow through the mound. Variation in air flow as recorded in Table 1 results from the interaction of wind speed and wind direction; winds were often gusty and variable during the afternoon and early evening.

Table 1. Large mound shown in Fig. 3 and air flow on two successive days

<table>
<thead>
<tr>
<th>Opening</th>
<th>Type</th>
<th>Air direction and velocity (m/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>In 170 In 68</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>In 70 Eddies</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>Out 88 Out 48</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>Out 100 In 120</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>Out? Eddies?</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>Eddies In 56</td>
</tr>
</tbody>
</table>

(but in an unusual central upper position)

| G       | 3    | Out 80 Out 50                     |
| H       | 4    | Out 40 Out 70                     |
| I       | 1    | Out 130 In 40                     |

(typical entry structure but functioned as exit on one day)

| J       | 2    | In 200 Out 66                     |
| K       | 2    | In 180 In 46                      |
| L       | 2    | In 200 In 30                      |

Table 2. Derivation of evaporation budget for mound; data for mound B at 17.15 hours on day 2 are used as an example

<table>
<thead>
<tr>
<th>Environmental air speed</th>
<th>150–160 m/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated volume of air entering mound</td>
<td>1243 l/min</td>
</tr>
<tr>
<td>Calculated volume of air leaving mound</td>
<td>982 l/min</td>
</tr>
<tr>
<td>Mean volume of air passing through mound</td>
<td>1113 l/min</td>
</tr>
<tr>
<td>Change in R.H. of air between entering and leaving mound</td>
<td>27% (24–29%)</td>
</tr>
<tr>
<td>Temperature of air on leaving mound</td>
<td>27.5 °C</td>
</tr>
<tr>
<td>Weight of water in air entering mound</td>
<td>1-418 g/min</td>
</tr>
<tr>
<td>Weight of water in air leaving mound</td>
<td>9-870 g/min</td>
</tr>
<tr>
<td>Weight of water evaporated from mound</td>
<td>8-453 g/min at 17.15 hours</td>
</tr>
</tbody>
</table>

Flow rates in the medium-sized and large mounds were similar to those recorded from the small mounds, as was the volume of flow per tunnel. Estimates of air budgets were less easy in these mounds, as the air flow appeared to be very easily affected by placing the flow meter in it. The effect could be detected with cigarette smoke.

Experimental removal of portions of the rims of tunnels resulted in alteration of the rate of flow in the tunnels. No extensive work was undertaken on this point, owing to the difficulty of constructing suitable accessory rims to fit on to tunnels. The asymmetrical rims of the peripheral tunnels appeared to be important in allowing funnels to act as reversible flow channels. Those funnels with even rims on all sides showed more consis-
tent direction of flow. It seems likely that such funnels function to drive air through the mound and that the energy for this is derived from venturi forces operating on the rims of the funnels.

Partial occlusion of certain openings with the meter suppressed flow in these openings but apparently increased the flow in adjacent openings. Gusty conditions with rapid

![Diagram](image)

**Fig. 4.** The measured volume of air (thousands of litres per minute) flowing through mounds of various sizes. The size of the mound refers to the calculated volume above ground level. Other measurements are available on mounds of less than 4 m³, but the volume is not accurately known. \( F \) refers to the number of funnels on the mound. Readings for the small mounds all fall within the blocks shown. Individual readings for larger mounds were more variable and are shown as points.

![Diagram](image)

**Fig. 5.** The weight of water evaporated (g/min) in the airflow through a small mound. Highest evaporation rates occur in the afternoon, though there is much variation due to gusty winds. A hypothetical mean value is inserted and this is used as the basis for calculation of total daily evaporation in the airflow.

changes in wind speed made it difficult to obtain consistent readings from all the openings on a mound under uniform conditions. This became even more difficult on mounds with twelve to sixteen openings, and reliable information was only obtained from one such large mound (C, Fig. 3).
Comparisons of these results shows (Fig. 4) that the volume of air passing though a mound is proportional to the size of the mound, as measured by the volume of soil in the mound above ground level. The larger volume of air flowing through larger mounds is due to an increase in the number of tunnels per mound (both for entry and exit) rather than to any alteration in the cross-sectional area of the tunnels or in the rate of air flow.

Readings at night were not extensive. Comparative measurements of the total airflow through mounds are based on readings in the morning and early afternoon (Fig. 4).

**Evaporation of water from mounds**

The weight of water vapour in air entering the mounds was compared with the weight in air leaving the mound. In every case it could be shown that water vapour was removed from the mounds by the airflow. The weight of water lost from the mound in this airflow was calculated as shown in Table 2, and a daily budget for a small mound is shown in Fig. 5. The line inserted deliberately underestimates the values recorded, as the main source of variation was the nature of the gusts of wind and the length of quiet periods between gusts. The total estimated water loss from mounds of a wide size range can be derived in this way for the period mid-August to mid-November. Examinations of climatological data suggest that water loss from mounds during and after the wet season is likely to be considerably greater than the values recorded here. The most accurate data are available for the small mounds with a water loss of 8.5 kg/day (Fig. 5), equivalent to 765 kg in 90 days, which would suggest that annual water loss will not be less than 2000 kg. Similar figures for medium-sized mounds are 25 kg/day, 2259 kg in 90 days and 7000 kg per annum; and for large mounds, 100 kg/day, 9000 kg in 90 days and 25,000 kg per annum.

**Mineral accumulation in mounds**

Information from Watson (1969) can be used to calculate the mineral accumulation to be expected by the evaporation of known quantities of water with a mineral content of 0.04 mEq/l of calcium, and a similar concentration of magnesium, as reported by Watson under Rhodesian conditions (Table 3). Rhodesian mounds considered by Watson (1962), Weir (1971), and Wild (1962), may reach a height of several metres and have a basal circumference far in excess of the Serengeti mounds.

While 64 kg of calcium and magnesium carbonates would make a significant contribution to the accumulation of bases in the ‘Kutsaga’ mound examined by Watson (1969), it would not contribute markedly to the massive mineral accumulations present in many Rhodesian mounds such as the ‘Umtali’ mound of Watson (1962). Equally, while mineral accumulation occurs in the Serengeti mounds (Table 4), it is unlikely that any of these mounds are 700 years old, nor are the mounds of a uniform age, as it seems likely that size is related to age in these mounds.

The soils of the Serengeti region have abundant water-soluble bases (Anderson & Talbot 1965; Weir, unpublished), and ground water is likely to have a much higher level of water-soluble bases than in Rhodesia. Thus large quantities of bases should accumulate in the Serengeti mounds if water evaporates from the tunnel system.

**Experimental investigation of the rôle of airflow**

One small mound and two medium-sized mounds were covered with heavy-duty polythene sheeting, tied over the surface of funnels, and polythene was also plugged into pits and funnels. Much of the surface of the mounds was still exposed to the air. The
experimental method is shown diagrammatically in Fig. 1, which shows a small mound 220 yd from mound B, of similar size, and structure, in similar conditions, which has been plugged and covered with polythene. A polythene sleeve was fitted to the main funnel and thermocouples and R.H. probes inserted into the mound structure with minimal airflow or air escape. Measurements of soil temperature at 1 m depth in this tunnel are recorded in Fig. 6 in comparison with equivalent measurements from mound B and similar small mounds. In this small mound the polythene cover was placed on the mound on day 1 at 10.00–11.00 hours. The first major effects were noticeable on the following morning, with heavy condensation inside the polythene cover on the funnels, saturation humidity within the mound and a much higher temperature than in mound B. This was followed by a rise in temperature in the late afternoon and evening, due to radiant heat from the mound surface penetrating to the interior of the mound. Termites were active on the surface or just below the soil surface at this time, and termites built up the external wall or funnel surrounding the former entry hole to about twice its previous height. There was considerable construction of small thin-walled galleries on the surface, unlike any others found in natural conditions at this season. Considerable amounts of polythene were eaten, but this was repaired and the nest remained sealed for 3 days. On the third night the nest caved in under foot while readings were being taken. The structure was investigated and found to soft, damp, and soggy throughout, and any pressure caused further collapse.

Two medium-sized mounds were also covered with polythene and plugged. In these, termites attacked the polythene repeatedly and from time to time managed to open the cover sufficiently to allow air to flow. Readings from these mounds showed that soil temperature within the mounds rose above those of normal mounds of similar structure

Table 3. Total weight (g) of calcium and magnesium carbonates expected to accumulate by evaporation in mounds of varying sizes over varied periods of time

<table>
<thead>
<tr>
<th>Time of accumulation</th>
<th>Small mounds</th>
<th>Medium mounds</th>
<th>Large mounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td>2.76</td>
<td>8.28</td>
<td>33.12</td>
</tr>
<tr>
<td>1 year</td>
<td>7.36</td>
<td>25.76</td>
<td>92.0</td>
</tr>
<tr>
<td>700 years</td>
<td>5152.0</td>
<td>18052.0</td>
<td>64400.0</td>
</tr>
</tbody>
</table>

(Watson 1967)

Table 4. Minerals in 1: 5 acid extracts of soils

<table>
<thead>
<tr>
<th></th>
<th>Parts per million</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Na</td>
</tr>
<tr>
<td>Mound A</td>
<td></td>
</tr>
<tr>
<td>Mound structure</td>
<td>290.0</td>
</tr>
<tr>
<td>Adjacent top-soil</td>
<td>46.5</td>
</tr>
<tr>
<td>Adjacent sub-soil</td>
<td>47.0</td>
</tr>
<tr>
<td>Mound B</td>
<td></td>
</tr>
<tr>
<td>Mound structure</td>
<td>320.0</td>
</tr>
<tr>
<td>Adjacent sub-soil</td>
<td>35.0</td>
</tr>
<tr>
<td>Mound C</td>
<td></td>
</tr>
<tr>
<td>Mound structure</td>
<td>47.0</td>
</tr>
<tr>
<td>Adjacent sub-soil</td>
<td>23.5</td>
</tr>
</tbody>
</table>

from the mound surface penetrating to the interior of the mound. Termites were active on the surface or just below the soil surface at this time, and termites built up the external wall or funnel surrounding the former entry hole to about twice its previous height. There was considerable construction of small thin-walled galleries on the surface, unlike any others found in natural conditions at this season. Considerable amounts of polythene were eaten, but this was repaired and the nest remained sealed for 3 days. On the third night the nest caved in under foot while readings were being taken. The structure was investigated and found to soft, damp, and soggy throughout, and any pressure caused further collapse.

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adjacent to them. Although condensation was seen inside the polythene covers, and though humidity reached saturation level, there was no obvious collapse of the mound as noted in the small mound. Termites made surface runways at the bases of these mounds, and also enlarged the basal openings at the periphery of the mounds (those that were formerly entry tunnels). No construction was seen on the upper surface of the mounds near the former exit funnels, though the polythene covers on these, and their string and Sellotape bindings were repeatedly eaten away by workers. The difficulties of maintaining the polythene covers overnight became too great, and experiments on these mounds were abandoned after 40 h.

![Image of graph showing temperature changes over time for mound A on 3 successive days, with the mound having been sealed at 10.00 hours on the first day.](image_url)

**Fig. 6.** The effect of experimental closure on the internal funnel temperature of a small mound, in relation to shade temperature and the temperature in funnels of normal small mounds. Readings for mound A on 3 successive days are shown, the mound having been sealed at 10.00 hours on the first day.

**DISCUSSION AND CONCLUSIONS**

The wide range in the structure of *Macrotermes* mounds described previously may be due to regional variations in climate and soil as well as to differences between species. Typical structures of the present mounds are shown in Figs. 1, 2 and 3.

Various authors have reported funnels at the base of *Macrotermes* mounds which open to the 'cellar' or 'paraecie' below the hive (Luscher 1955, 1956; Grassé & Noirot 1958b; Ruelle 1964) and such openings have sometimes been attributed to erosion (Noirot 1970). In the present case the openings are clearly due to termite activity and they are actively maintained by the termites, even when artificially closed. Previous studies on airflow in termite mounds have been concerned with the measurement of airflow inside sealed or partially sealed systems of spaces within the mounds and sensitive anemometers have recorded flow rates of up to 270 cm/min, though usually less than 1 m/min (Loos 1964) with an average of about 12 cm/min (Luscher 1961).

Air leaves these mounds after flowing through tunnels at a consistently higher relative humidity than on entry, and air temperature may also change. Calculations show that water loss is greater in larger mounds as is the volume of air flowing through. The
abundant water-soluble bases in this mineral-rich volcanic soil (Anderson & Talbot 1965; Weir, unpublished) could lead to extensive mineral accumulation in these mounds by evaporation. It is difficult to estimate how much mineral accumulation would result under conditions of seasonal aridity and different soil structure in Rhodesia (Watson 1969). Mineral accumulation in the mounds described here is presumably not due solely to this evaporative process but also to the use of the calcareous subsoil in mound construction (Hesse 1955), to the differential leaching of intervening soil to give an apparent concentration in the mounds (Watson 1969), and to the normal evaporation from the soil surface of the mound. Different mechanisms are likely to be responsible for such mineral accumulations in different areas of Africa. It is possible that a mound inhabited by one species of Macrotermes at the present day has seen a succession of different colonies come and go. It is unlikely that the same colony will survive in a mound for the periods of up to 700 years known to be involved in the existence of a mound (Watson 1967).

While the present tunnels could be reached readily by termites, there was no large connection with the interior ‘hive’, and the tunnels were open to the air. When attempts were made to correlate environmental changes of temperature and humidity with those in the tunnel system and in the ‘hive’, thermocouples, thermometers, humidity probes, and cables, inserted into the hive were rapidly and repeatedly covered with wet soil by termites, so that readings from this region were valueless. Experimental sealing of mound A and other mounds resulted in drastic changes in termite behaviour and in the internal environment of the tunnels.

Howse (1966) suggested that air movement initiated building activity by termites. The small mounds on the Serengeti distort the surface airflow and this distortion appears to be utilized in turn to drive the airflow through the mound. The creation of the tunnel will itself alter the original distortion of airflow, and so lead to new stimuli being offered to the termites. The ‘stigmergie’ building theory of Grassé (1959) has been reviewed by Harris & Sands (1965) and by Stuart (1969), who points out that nest construction must involve many stimuli. Air currents are shown here to be primarily the result of mound construction, and they may initiate in turn other constructions such as tunnels, in a continuing sequence. It seems likely that some of the force required to drive air through the tunnels in larger mounds is derived from venturi forces acting on the varied rim shapes of the funnels. The nature of the airflow in the inner chamber (‘hive’) of the mound has not been investigated. Experimental closure of the funnels in one small mound resulted in a burst of building activity at the ‘entrance’ funnel. There was no air movement in or out of the mound during this period. These atypical constructions occurred at the interface from the saturated atmosphere of the mound to the air and may reflect a response to a steep humidity gradient (Stuart 1963). No explanation can be offered for the repeated localization of building activity outside the former entrance funnels in sealed mounds. It seems that termites in a sealed mound can differentiate among and respond to the various openings of the mound surface in relation to the directions of airflow prior to sealing. The direction of airflow is, of course, related to the structural type of the funnel.

The complex Macrotermes mound has been regarded (Emerson 1956) as a mechanism for providing a degree of homeostatic regulation, under social control, of environmental variables such as humidity, gas composition, temperature and micro-organism growth. A trend towards homeostasis was detectable within the mound tunnels and in the soil lining these tunnels. Air circulation in these mounds has three rôles in thermal adjustment:
(1) the mound is cooled by the airflow overnight; (2) it is reheated rapidly in the morning; and (3) it is cooled by evaporation in the afternoon. Suppression of airflow in sealed mounds resulted in a rise in air and soil temperatures in the mounds.

The nest structure is a social matrix necessary to maintain the spatial relations of a very large and complex social group. A mound containing the group may be exposed to radiant heat which raises its temperature. This need not necessarily lead to the development of an air circulation through the mound, but many mounds which lack such a circulation are shaded by trees (Lake Manyara National Park, Voi, Entebbe, Wankie National Park, Ruaha National Park and many others). The nature of the association of termite mounds and trees is not clear and certainly varies from region to region (Jackson & Gartlan 1965; Wild 1952), and with the species of *Macrotermes*. Over much of the Serengeti Plains there are no trees, the soils being light volcanic ash (Anderson & Talbot 1965). It is possible that in a treeless region an air cooling mechanism for the mound might be of advantage to *Macrotermes*.

Experimentally, mound closure led to a marked change in the mechanical strength of the mound as a whole. The entire structure became soft and damp and eventually collapsed if one stood on it. In this region the airflow has structural value, as it provides a number of mechanically strong rigid 'spars' which support the massive mound structure, below the soil surface, in recent volcanic soils which appear to be mechanically weak when saturated. It is probable that without this airflow, only small mounds could survive on these soils.

ACKNOWLEDGMENTS

This work was carried out at the Serengeti Research Institute, Tanzania, and I am indebted to the Director, Dr Hugh Lamprey, and to members of the Institute for their advice, assistance, and co-operation. Dr W. A. Sands, of the British Museum has contributed most helpfully in discussion and assistance, and I am also indebted to Mr A. H. Hall and Mr I. Parker of Leicester University for technical advice and equipment. This work was part of a research programme undertaken with the aid of a grant from the Royal Society for which I am most grateful.

SUMMARY

(1) Mounds of *Macrotermes subhyalinus* (Rambur) on the Serengeti plains, Tanzania, have tunnels permitting a rapid flow of large volumes of air through the mound.

(2) Airflow is probably induced by vortices caused by the mound structure and by venturi forces acting on the rims of exit funnels.

(3) The number of tunnels, and consequently the volume of air flow are proportional to mound size.

(4) The airflow removes water by evaporation from soil surfaces within the mound and thus can lead to the deposition of soluble salts in the mound structure.

(5) Airflow and evaporation are related to the thermal regime of the mound, to the mechanical strength of the mound, and to termite building behaviour.

REFERENCES


Air flow in Macrotermes mounds


