CHAPTER 28

Nest Castings of Some Ground-Dwelling Florida Ant Species Using Dental Labstone

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The nest building behavior of ground-nesting ants and bees has been a subject of much interest to biologists. For this reason, various attempts have been made over the years to obtain casts of the underground structure of their nests. The earliest studies involved castings of ground-nesting insects that were made more than 85 years ago (Smith 1898). Linsley et al (1952), in their work on wild bees, described several materials used by researchers in prior studies that included low temperature metal alloys, wax, water glass, and plaster of Paris. More recently, Garner (1953) used latex, while Howell (1960) employed bio-plastics. Davis and LaBerge (1975) reported on the use of plaster of Paris for the study of the biology and nest structures of ground-nesting bees. In 1956, Brian and Downing used rubber latex to make castings of the nests of several species of British ants. Markin (1964) reported that a molten lead-solder alloy could be used to make castings of ant and bee nests, and that it was superior to plaster of Paris and polyester resin. He made castings of the nests of the ant species *Formica fusca* L., *Camponotus vicinus* Mayr and several other unidentified ants as well as the burrows of some bees and wasps. He found that the lead-solder castings were much less fragile than those of plaster of Paris and required less time to prepare than ones made with polyester resin.

Recently, we experimented with another material, dental labstone, and found that it could be used very effectively to form nest castings of a number of Florida ants. This material is normally used to make impressions of teeth. We report here the procedures we used to make the castings and photographs of the castings of seven ant species.

Materials & Methods

All ant nests selected for casting were located in sandy soil, away from trees or dense vegetation so that a minimum of root structure oc-

curred around the nest. The nests were located and marked prior to preparation of the casting material which was buff-colored dental stone type III (Castone®), a gypsum material obtained from Dentsply International, Inc., York, PA 17405. Just prior to making a cast in the field, the dental labstone was mixed in water at a rate of 400 grams of labstone to 1 liter of tap water. The water was added slowly and the mixture stirred until all of the labstone was suspended, and stirred continuously thereafter, to prevent rapid settling and hardening. The labstone suspension was poured slowly into the entrance hole(s) of the ant nest using a small plastic funnel or it was drawn up into a cooking baster and forced into the entrance holes. Varying amounts of the casting mixture were needed depending upon the size of the underground structure of the ant nest. When no more material would flow into the nest, the material in the nest was allowed to harden (set) for 18-24 hours before attempting excavation.

When the casting was hardened, it was excavated by carefully removing a large ring of soil around the nest with a shovel. Then a hand trowel was used to carefully remove dirt close to the nest cast. A small, stainless steel spatula was used to clean the soil from around the individual chambers and tunnels. The casting was then lifted carefully from the ground, and a small artist's brush was used to remove most of the remaining soil attached. Finally, the nest was washed and allowed to dry. Any pieces of the nest (chambers or tunnels) that broke off during excavation and handling were easily reconnected using glue from a hot glue gun.

Discussion

Casts were made of 9 species of Florida ground-nesting ants. The nest castings of 7 species are shown in Figures 1-7 as follows: *Pheidole morrissi* Forel, (Fig. 1); *Iridomyrmex pruinosus* (Roger), (Fig. 2); *Pheidole dentata* Mayr, (Fig. 3); *Formica pallidefulva* Latreille, (Fig. 4); *Monomorium viride* Brown, *(Fig. 5); Conomyrma bureni* Trager, (Fig. 6); *Trachmyrmex septentrionalis* (McCook), (Fig. 7). Castings were made successfully of nests of *Solenopsis invicta* Buren, and *Camponotus socius* Roger, but they are not shown in this report.

Dental labstone proved to be an excellent material for making the nest castings. This material has been used previously for the construction of artificial rearing nests for maintaining fire ants in the laboratory (Bishop et al 1980), and is used routinely in our laboratory. The penetration of labstone into tunnels and chambers of the nests was very good. As the labstone mixture flowed into the nest, the water penetrated the surrounding soil, leaving a labstone coating on the

sides of the tunnels and chambers. Many of the casts of the tunnels and chambers were, for the most part, hollow and often contained live workers and brood. Although labstone was more fragile than some of the materials mentioned previously, we believe that its ability to penetrate the nest tunnels and chambers makes it a superior casting material. In addition, we believe that heavy metals such as lead-solder alloys, will collapse the small intricate network of tunnels found in complex nests.

Subjectively, the resemblance of the labstone casts to the original nest structures was superior to any casting of ant nests seen previously in the literature. Dental labstone is very inexpensive, easy to use and mix, requiring only water, and when mixed does not pose a danger to the users, which would certainly be the case with hot molten lead. It is relatively nontoxic and, unlike polyester resins and acrylics which are quite toxic, it presents less of an environmental hazard.

Several important considerations must be kept in mind when using labstone to cast ant nests. For example, soil conditions (texture and moisture) can have an effect on how well the material penetrates to tunnels and chambers of the nest and whether the labstone will harden (set) sufficiently in order to remove the casting intact from the ground.

The season of the year will also affect the time required for the labstone to harden, e.g., quickly during the hot summer months, and slowly during colder, winter months. Also, the ground is much harder during the winter months, and therefore, excavations are more difficult. Time of the year also affects the depth and shape of the nest structures.

The nest size and structure can be an important factor to consider. Smaller and simpler nests are much easier to cast and excavate while large nests consisting of numerous branching tunnels and chambers require great care, patience, and time to cast and excavate.

The ratio of labstone to water of the casting mixture was also important and affected the strength and flowability (penetration) of the material. When 300 grams of labstone to 1 liter of water was used to pour nest casts, the castings were too fragile and broke into many pieces while being removed from the soil. Also, when the amount of labstone was increased to 500 grams or more per liter of water, the mixture was too viscous and hardened too quickly, thus, it did not penetrate all areas of the nest structure. In addition, this mixture collapsed most of the smaller, branching tunnels in the nest.

Finally, the castings can be mounted with wires on a platform for study and display. We believe that this new approach to making cast-

ings of nests of ants and bees will be an excellent tool for the future study of their nesting behavior.

Acknowledgements

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Literature Cited

Bishop, P. M., W. A. Banks, D. F. Williams, C. E. Stringer, J. A. Mitchell, and C. S. Lofgren.
1980 Simple nests for culturing imported fire ants. J. Ga. Entomol. Soc. 15: 134-7.

Brian, M. V., and B. M. Downing.
1956 The nests of some British ants. Proc. Tenth International Congr. Entomol., Montreal, 1956. 2: 539-40.

Davis, L. R. Jr., and W. E. LaBerge.
1975 The nest biology of the bee Andrena (Ptilandrena) erigeniae Robertson. (Hymenoptera: Andrenidae). IL Nat. Hist. Survey, Biolog. Notes No. 95, 16 p.

Garner, M. T.
1953 The preparation of latex casts of soil cavities for the study of tunneling activities of animals. Science 118: 380-1.

Howell, J. F.
1960 A technique employing Bioplastic in the excavation of burrows of ground-nesting bees. Ann. Entomol. Soc. Amer. 53: 679-82.

Linsley, J. F., J. W. MacSwain, and R. F. Smith.
1952 Outline for ecological life histories of solitary and semi-social bees. Ecology 33: 558-67.

Markin, G. P.
1964 A lead-solder alloy casting technique for studying the structure of ant nests. Ann. Entomol. Soc. Amer. 57:360-2.

Smith, J. B.
1898 A new method of studying underground insects. Proc. Amer. Assoc. Advance. Sci. 47: 366.

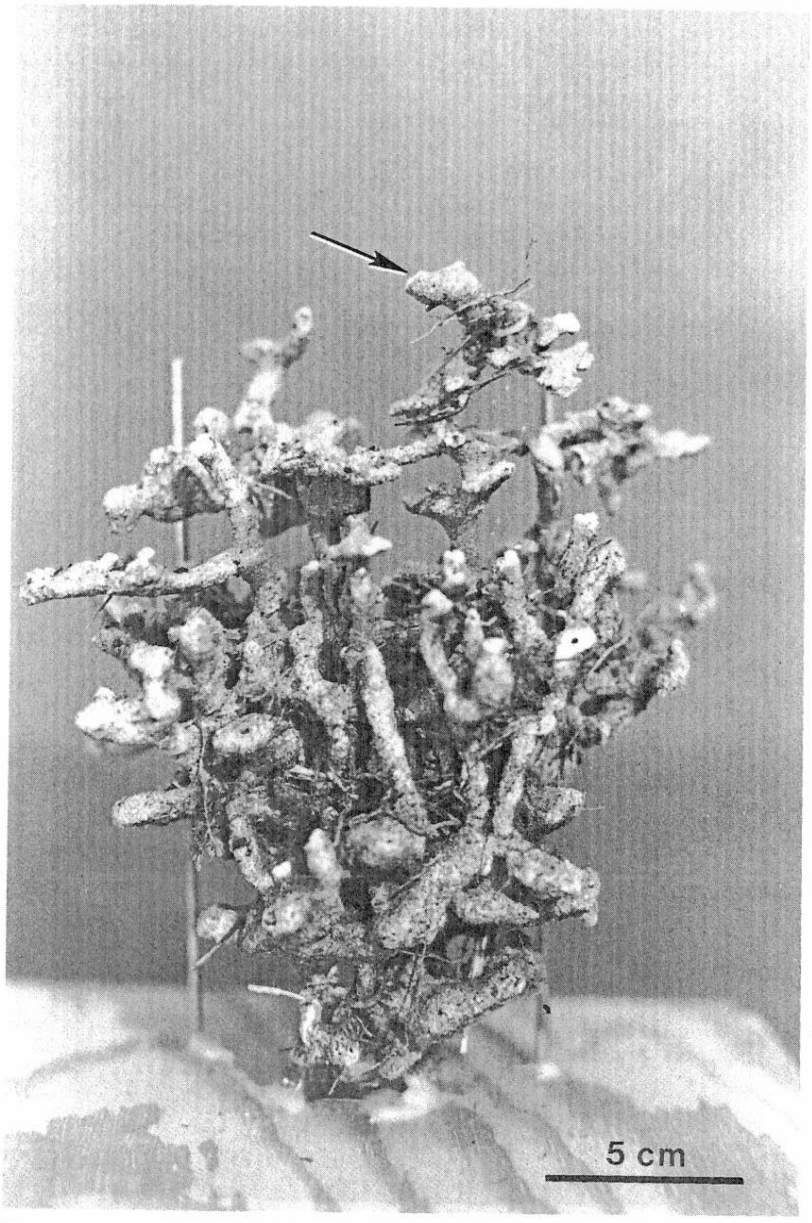

Figure 1. Dental labstone casting of nest of *Pheidole morrisi* (Arrow indicates nest entrance).

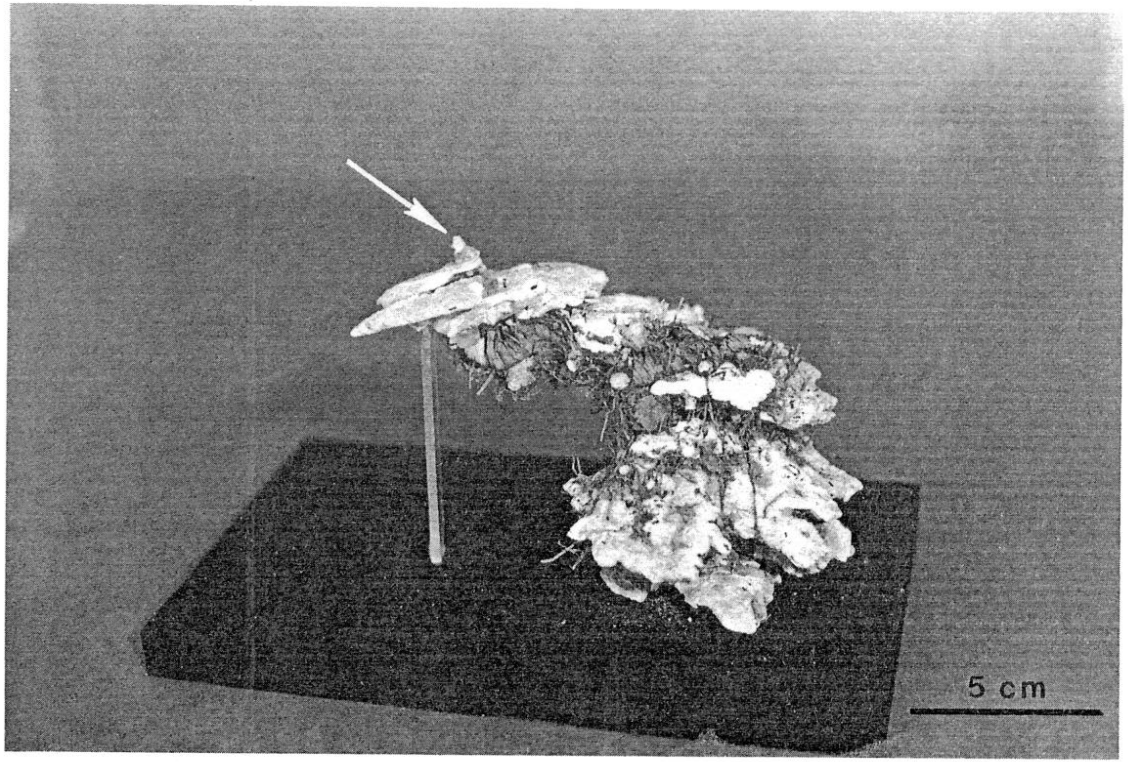

Figure 2. Dental labstone casting of nest of *Iridomyrmex pruinosus*. (Arrow indicates nest entrance).

Figure 3. Dental labstone casting of nest of *Pheidole dentata*. (Arrow indicates nest entrance).

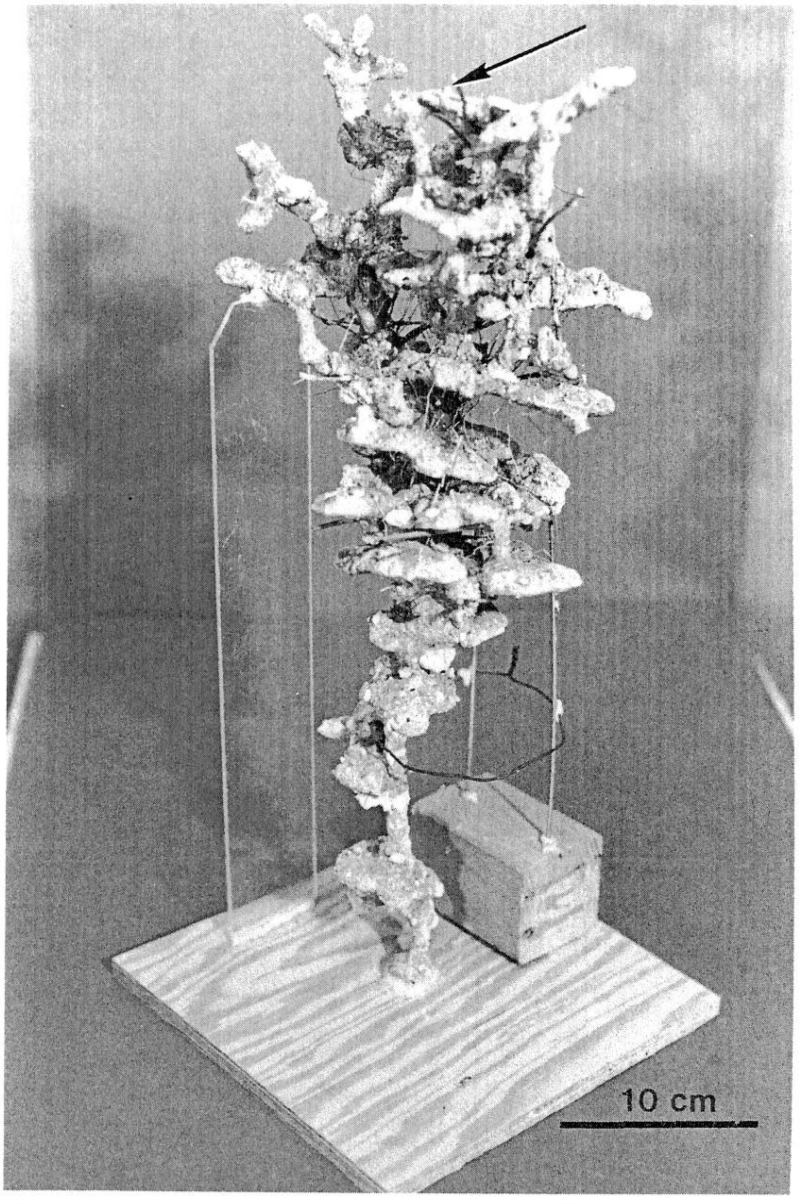

Figure 4. Dental labstone casting of nest of *Formica pallidefulva*. (Arrow indicates nest entrance).

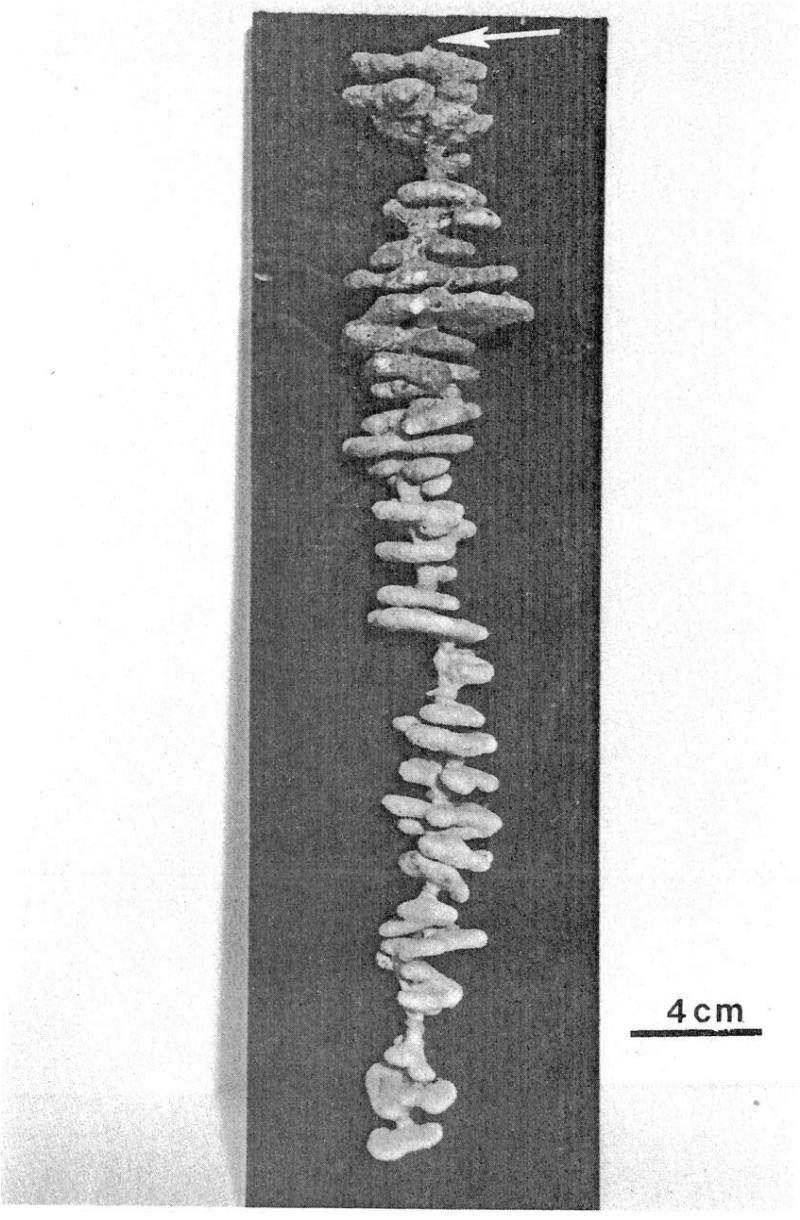

Figure 5. Dental labstone casting of nest of *Monomorium viride*. (Arrow indicates nest entrance).

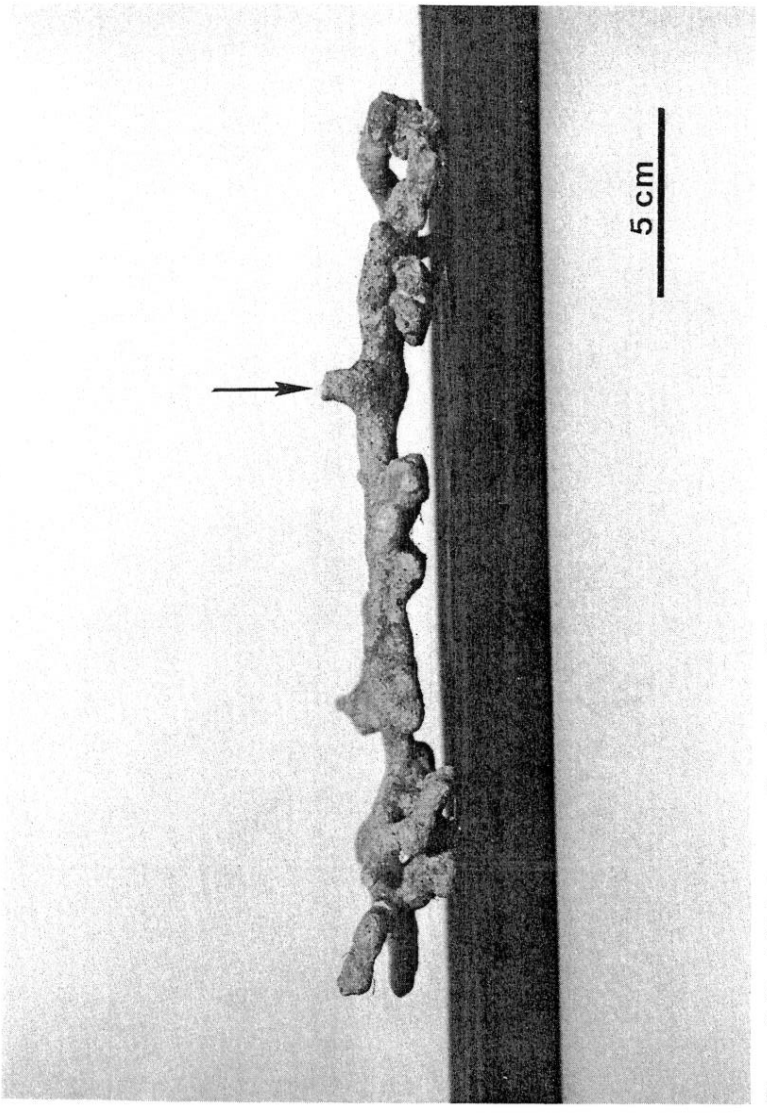

Figure 6. Dental labstone casting of nest of *Conomyrma bureni*. (Arrow indicates nest entrance).

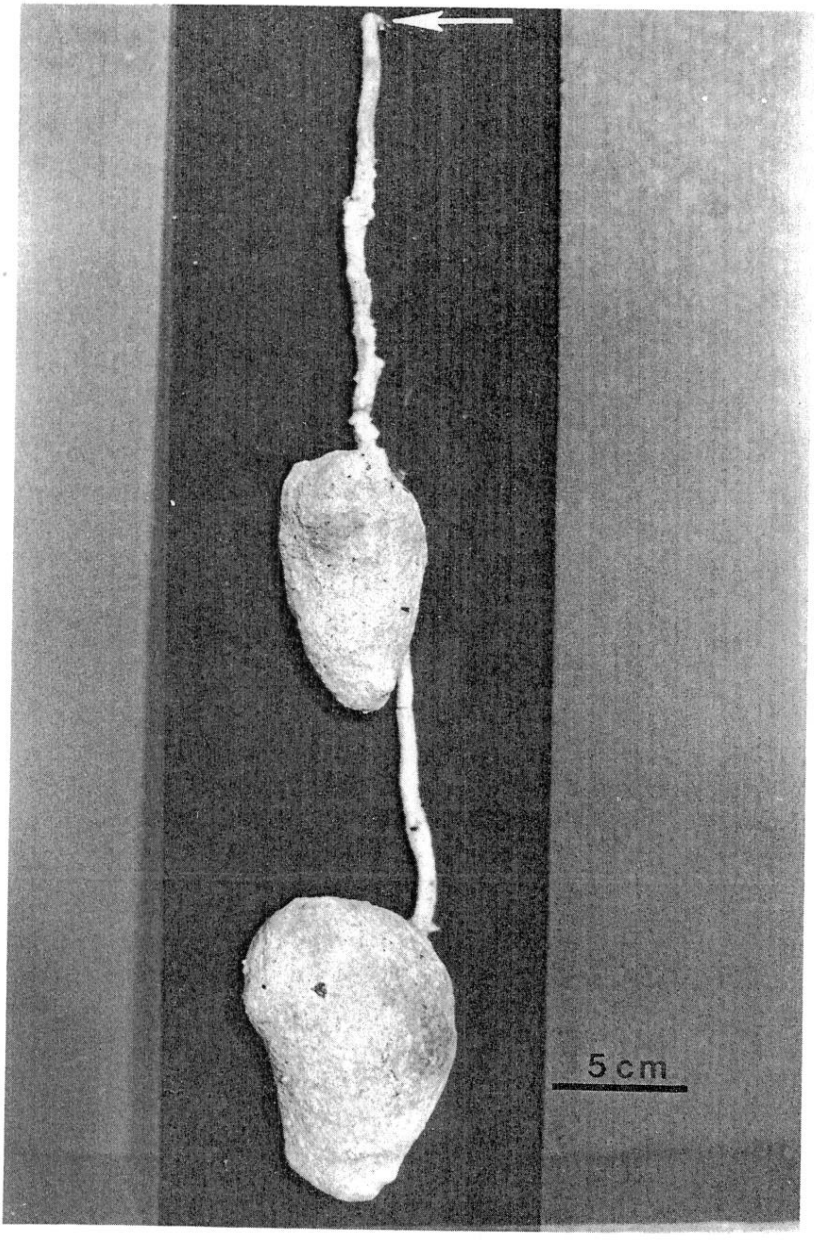

Figure 7. Dental labstone casting of nest of *Trachmyrmex septentrionalis*. (Arrow indicates nest entrance).