He lived for nearly two years after this. Occasionally he would visit the Museum. He finished a revision of the North American species of *Phyllotreta* and was at work on a paper on *Lixus*, which Buchanan gathered together and published after his death. The last time that I saw him was on one hot July day when we took him to our place in Virginia to hear the wood thrush. He always was deeply interested in birds and loved most of all the song of the wood thrush. My small daughter toddling about him as he sat on the porch tumbled over his feet. I picked her up saying, "Poor little girl." I remember what he said, "Why do you call her *poor?* It is we old ones that are *poor*. She has all her life to live." A few weeks later, less than a year after Schwarz's death, he died rather suddenly. His sister said, "Frank had no idea that he was going to die. Mother had always told him that he would live to be 90 too."

A NEW NAME FOR Geotrupes (Peltotrupes) chalybaeus LeCONTE, WITH A DESCRIPTION OF THE LARVA AND ITS BIOLOGY

(Scarabaeidae)

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Geotrupes chalybaeus is the name under which a large Floridian species has been known since it was described in 1878 by LeConte. It appears, however, that the name of *chalybaeus* was used in *Geotrupes* by Mulsant in 1842 and that the *chalybaeus* of LeConte is therefore preoccupied. Since there are no subsequent synonyms available, it must be renamed.

Geotrupes (*Peltotrupes*) *profundus*, new name

Geotrupes chalybaeus LeConte, 1878. Additional descriptions of new species *In* Schwarz, Coleoptera of Florida. Proc. American Philos. Soc., vol 17, p. 402. (not *Geotrupes stercorarius* var. *chalybaeus* Mulsant, 1842. Histoire Naturelle des Coléoptères de France. Pt. 2. Lamellicornes, p. 358. Maison, Paris.)

In February 1949 Frank N. Young found a large colony of *Geotrupes profundus* in Putnam County, south of Interlachen, Florida. Young (1950) subsequently published a detailed account of the ecology of the area and the habits of the adults.

Young's directions made it possible for Dr. and Mrs. Henry K. Townes, my wife Anne, and me to find the colony south of Interlachen in the spring of 1951. A second trip to the area was made on November 17-18, 1951, by William B. Fox, Byrd Dozier, and the writer.

During a four-day period (April 1-4, 1951) eight adults (2 males, 6 females) were collected in cans of malt and water. Two other males were taken in a can baited with banana peels and propionic acid. One female specimen was dug from an eight inch burrow and another was collected at 8:30 p.m., April 2, beside a "push-up" of sand. Considering the tremendous number of burrows in evidence, adult activity seemed almost past for the season. On November 17-18 there was no sign of "push-ups" and no adult activity.

In April, eight old "push-ups" of sand were found in a space 6 feet by 3 feet in an open area beside a fallen live oak tree. With Dr. Townes' assistance, a hole encompassing the eight burrows was dug. For the first three feet all of the burrows were closed with sand, but below that they were open. To help follow them, long straws were pushed into six of the burrows and the two others were filled with white surface sand. The first larva (third instar) was found at a depth of 5 feet, 6 inches. Six other second- and third-stage larvae were taken at the following depths: 5 feet, 2 inches; 6 feet; 6 feet, 2 inches; 6 feet, 10 inches; 6 feet, 11 inches; and 7 feet. The eighth burrow was excavated only to a depth of 7 feet but a straw thrust in the burrow indicated that it contained at least two more feet, making a total of 9 feet! (Hence the name *profundus.*)

The next day, April 3, another similar pit was dug in the shade of a pine tree where the burrows appeared to be more recent. Five fresh cells, 2 containing an egg each and 3 cells with larvae, were found at the following depths: 4 feet, 2 inches; 4 feet, 3 inches; 4 feet, 6 inches; 5 feet, 3 inches; and 6 feet, 8 inches.

Seven months later, on November 17, Dozier and the author dug a pit 3 feet by 10 feet and 6 feet deep near the April 3rd pit in the woods. This excavation produced three fresh cells, two of which contained third-stage larvae. The first cell with a larva was at a depth of 2 feet, 8 inches, with no other cells below it. The second cell found was at a depth of 4 feet, 2 inches

and also contained a larva. Eight inches below this was another fresh cell, but no larva was found in it.

Larval Cell and Food

At the end of each burrow, the passage made a sharp bend and expanded to form a larval cell parallel to the ground surface. Each cell was between 6 and 7 inches long and 1½ to 2 inches in diameter. In one case beneath a fresh "push-up" two cells were found at the end of a single burrow, opposite each other, an inch apart in depth. Each of these contained an egg within ½ inch of the terminal end of the cell. In all other cases, with the possible exception of the two cells 8 inches apart, found in November, there was only a single cell at the end of each burrow.

The larval cells were loosely packed with surface litter. In the open area the surface litter was composed mainly of fragments of live-oak leaves (*Quercus virginiana* Mill.), a few turkey oak leaves (*Quercus laevis* Walt.), and a small quantity of pine needles and bark fragments from sand pines. In the area under the sand pine (*Pinus clausa* Sarg.) the litter was almost entirely pine needles, male pine cones, and pine bark. The adult beetles seemed to use any surface litter near the burrow to provision their larval cells. Three of the larvae that were kept alive fed indiscriminately on surface litter collected later from various sources at Raleigh, N. C.

The larva of *Geotrupes profundus* had one very interesting adaptation to its sandy habitat. As the larva ate its way through the cell litter, it used its own fecal material to construct a tube around itself. The anal lobes of the larva were kept on the edge of the tube while the larva extended its body from the fecal tube and pulled the litter to it. As the larva increased in size the tube increased in diameter to as much as one inch. The tube was very fragile and in all cases only large fragments of the tube were recovered. However, the three larvae kept alive in 2-ounce, metal, salve boxes (2½ inches in diameter by ⅞ inch deep) all constructed similar fecal tubes. The tubes were brown with an even, pebbly appearance due to the fact that each fecal pellet retained its shape. This tube prevented the food material or sand from caving-in on the larva. By the second visit in November all the larval food material had been consumed and one

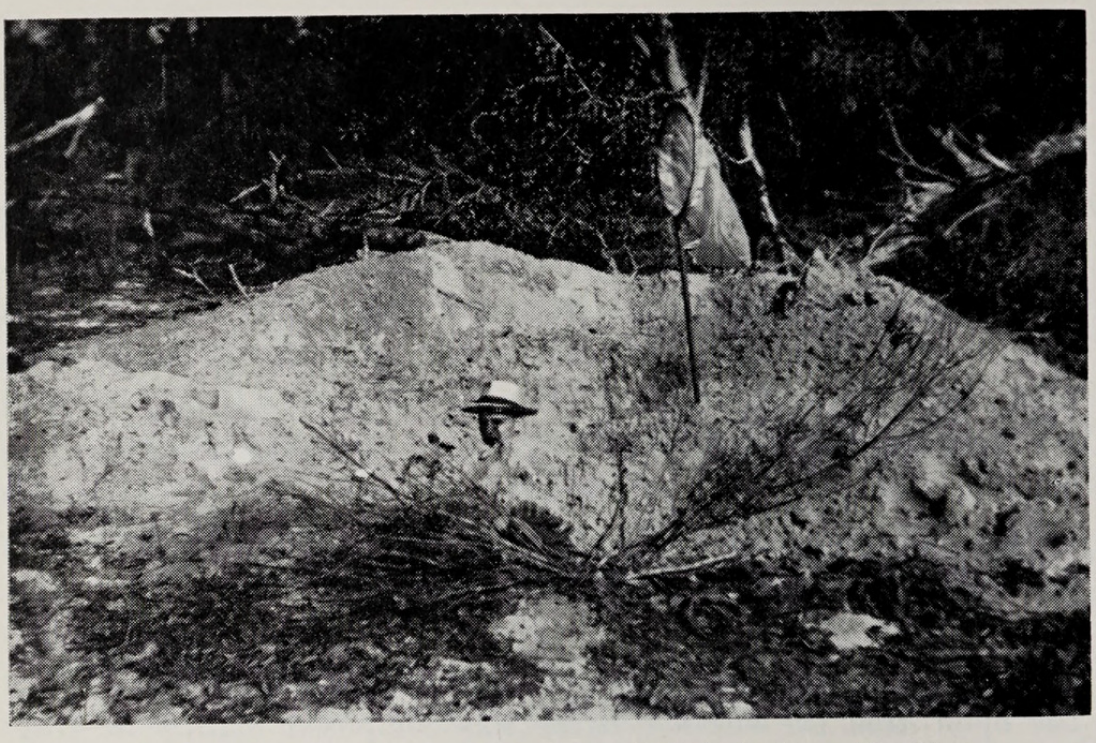

Figure 1.—The first excavation at Interlachen, Florida.

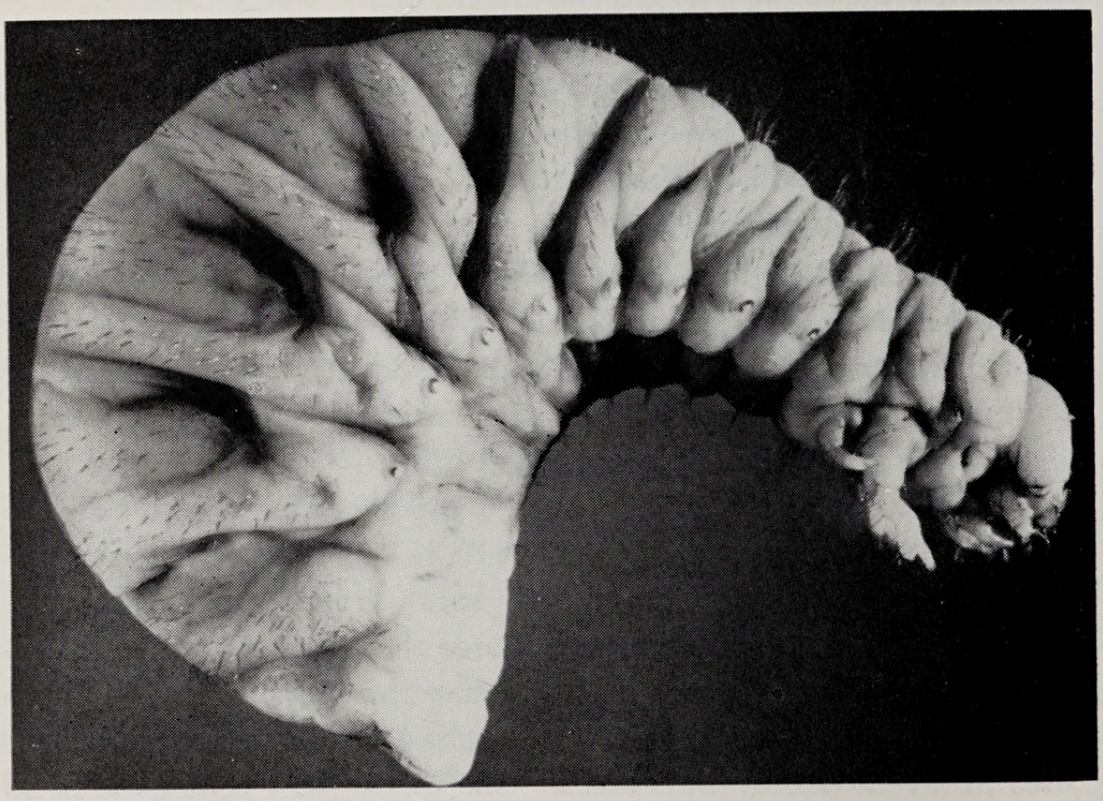

Figure 2.—Third stage larva of *Geotrupes profundus*, showing the reduced metathoracic leg and greatly swollen abdomen.

larva had walled-off its fecal tube, making a cell about 2 inches long by an inch in diameter.

The life cycle of *Geotrupes profundus* appears to take one year. Unfortunately, none of the eggs was reared to third instar, but the early development appears to be very rapid. According to Young, adult activity starts in February. During our first visit in April, second- and third-stage larvae were found in one area, eggs in burrows below fresh "push-ups" in another area. From the appearance of the mounds of sand at that time, it seems unlikely that any burrows were more than two or three months old. (*Geotrupes blackburnii* Fab. and *Geotrupes splendidus* Fab. larvae take only slightly over one month to develop to third-stage larvae.)

Since the mounds of sand were no longer in evidence in November, it also indicated that the mounds seen in April were made only a month or so before. The larvae of *Geotrupes profundus* remain as third instar for seven or eight months, since they were still third instar in November. Also, the three specimens kept alive in salve boxes were still third-stage larvae in December, a period of eight months. Since the adults emerge in February, the pupal period of necessity must be rather short.

Description of the Immature Stages

Descriptions based on the following material. Two eggs, 1 first-stage larva, 4 second-stage larvae, and 6 third-stage larvae collected April 3-4, 1951, Interlachen, Fla. Two third-stage larvae collected November 17, 1951, Interlachen, Fla.

Third Instar

Maximum width of head capsule 4.4–4.7 mm. Surface of cranium light brown, shining, and slightly wrinkled. Frons on each side with one posterior frontal seta, 2 or 3 setae at each anterior angle, 1 exterior frontal seta, and 2 or 3 anterior frontal setae (fig. 3.). Clypeofrontal suture absent. Somewhat asymmetrical labrum vaguely trilobed, wider than long; clypeus noticeably asymmetrical. Antennae 3-segmented. First antennal segment widest in diameter, 0.38–0.4 mm. long, with 2 dorsal distal setae, 2nd antennal segment slightly less in diameter, about 0.18–0.2 mm. in length with a single dorsal hemispherical sense organ distally. Third segment reduced to a small hemispherical cap, one half the diameter of the second segment (fig. 3.). Mandi-

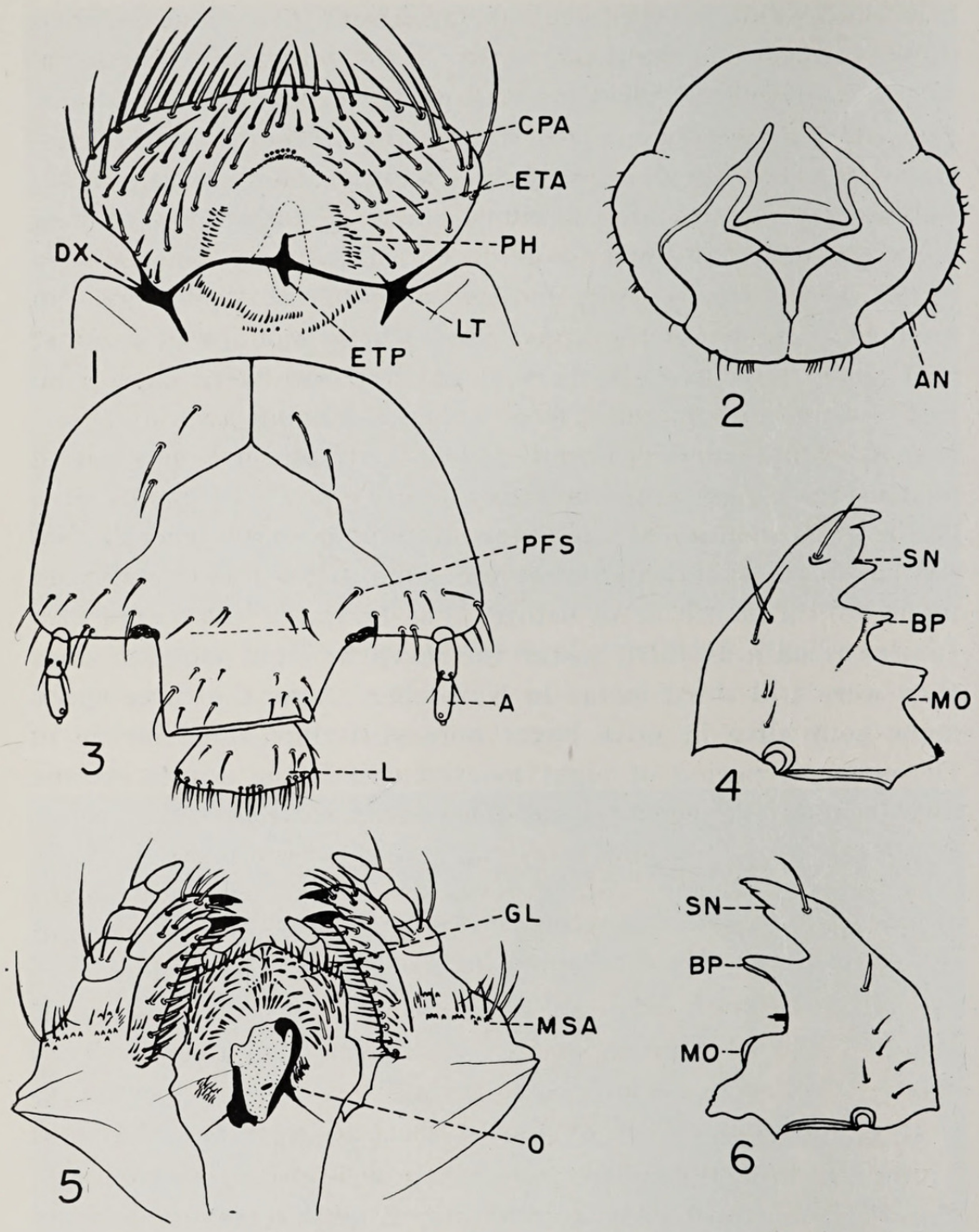

Figure 3.—Third instar of *Geotrupes profundus*. 1—epipharynx; 2—caudal view of last abdominal segment; 3—head; 4—left mandible; 5—maxillae, labium, and hypopharynx; 6—right mandible. Symbols: A—antenna, AN—anal lobe, BP—bifurcate process, CPA—chaetoparia, DX—dexiotorma, ETA — anterior epitorma, ETP — posterior epitorma, GL—glossa, L—labrum, LT—laeotorma, MO—molar region, MSA—maxillary stridulatory area, O—oncylus, PFS—posterior frontal setae, PH—phoba, SN—scissorial notch.

bles (fig. 4 and 6) somewhat asymmetrical, the scissorial areas differing less than the molar areas. Left mandibular scissorial area (fig. 4), above the scissorial notch, of two parts, a narrow blade-like portion and a broadly rounded process, with a posterior tooth-like portion below the scissorial notch. Right mandibular scissorial area (fig. 6) above scissorial notch consisting of a double toothed blade-like structure, and below consisting of a single blade-like structure. Each mandible between scissorial and molar areas with a prominent bifurcate process. Grinding surface of left molar area strongly concave, overhung by an acia having a tuft of small setae on the outer edge; grinding surface of right molar area rather flat. Tuft of setae of unequal length lies between the bifurcate process and the molar area of the right mandible. Maxillary stridulatory area (fig. 5) consisting of an irregularly set row of nine to ten conical teeth on each stipes and a similar row of two to three teeth along the posterior margin of the palpifer. Hypopharynx with two well developed asymmetrical oncyli. Anterior margin of glossa not emarginate. Epipharynx (fig. 1) quite similar to that of *Geotrupes blackburnii* described by Richter (1947, p. 6). Tormae united mesally, posterior and anterior epitormae present, phobae surrounding the spiculate pedium. Each chaetoparia with 25 or more chaetae. Respiratory plates of spiracles crescent-shaped with concave margins facing ventrally or slightly cephalad, similar to *G. blackburnii*. Spiracles cribriform with "holes" arranged in series of definite transverse rows. Spiracles of eighth abdominal segment much smaller than those of first seven. Body greatly swollen posteriorly with anal lobes (fig. 2) protruding slightly on each side of the last abdominal segment. Dorsa of abdominal segments 1 to 8 each with two vaguely defined (dorsal) annulets, with setae present mesally on all annulets; setae pronounced and rather long on anterior annulets of segments 4 to 7 and on all posterior annulets.

Last abdominal segment flattened caudally with slightly protruding lateral and ventral lobes (fig. 2). Defining sclerotized lines ventrad of triangular anal area meeting in the ventral midline, separating the ventral anal lobes by only a vague line.

Legs 3-segmented with pro- and mesothoracic legs long, metathoracic legs much reduced, as in *G. blackburnii* (Richter, 1947, fig. 24 and 28). Last two pairs of legs with stridulatory organs.

those on the mesothoracic legs consisting of a finely striated file on the outer apical part of each coxa and those on the metathoracic legs of a rasp consisting of a row of nine or ten well-defined teeth on the inner surface of the fused trochanter-femur and three or four very minute teeth at the base of the tibiotarsus. Claws absent, but the bases of several terminal setae on each leg have become tuberculate, and evidently serve as claws.

Egg

Yellowish white, almost oval, being slightly larger at one end than the other. Length 4.6–4.7 mm., width at widest point 3.0–3.5 mm. two days before hatching.

First Instar

Structurally differs very little from description of third instar with the exception of the respiratory plates of the spiracles which are reduced to small circular discs. Maximum width of head capsule 2.5 mm. Length of second antennal segment somewhat shorter in proportion to that of third instar. Broadly rounded area of left mandibular scissorial area produced to wide blade-like structure. Posterior portion of abdomen not swollen as in second and third instar.

Second Instar

Very similar to third instar. Maximum width of head capsule 3.5–3.7 mm. Antennal segments proportionately as in third instar. Mandibles quite similar to third instar.

The larvae of *Geotrupes profundus* can be easily separated from other known larvae of *Geotrupes* by the greatly reduced third antennal segment, the presence of tuberculate bases of the setae on the end of the tibiotarsus, and by the shape of the anal lobes.

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