GEOLOGICAL SURVEY OF ALABAMA

WALTER B. JONES, STATE GEOLOGIST

MUSEUM PAPER 34

NEW GENERA OF ANOPHTHALMID BEETLES FROM CUMBERLAND CAVES

(Carabidae, Trechini)

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LETTER OF TRANSMITTAL

University, Alabama
November 2, 1952

Honorable Gordon Persons
Governor of Alabama
Montgomery, Alabama

Sir:

I have the honor to transmit herewith the transcript of a report on "New Genera of Anophthalmid Beetles from Cumberland Caves", by J. Manson Valentine. It is requested that this be printed as Museum Paper 34 of the Geological Survey of Alabama.

Respectfully,

WALTER B. JONES,
State Geologist

INTRODUCTION

Over a hundred years ago, the first anophthalmid cave beetle from North America was described by Ericson. Believing it to be congeneric with European species, he named it **Anophthalmus tellkampfi** in 1844. This form, an exceedingly abundant cavernicole inhabiting the great cave complex of central Kentucky's Green River basin, has remained up to the present writing, the largest and most aberrant of our known anophthalmid fauna, which is an impressive one comprising scores of species. In 1920, Jeannel, recognizing its divergent character, separated **tellkampfi** from the many, more primitive forms, designating it as a new genus **(Neaphaenops)** and establishing another new genus **(Pseudanophthalmus)** to contain all our other species known at the time. The older name **(Anophthalmus)** was necessarily restricted to the original genotype and its immediate relatives which form a compact group of specialized cavernicoles endemic to the Julian Alps.

The present paper is descriptive of three, perfectly distinct genera none of which is referable either to **Pseudanophthalmus** or to **Neaphaenops.** Two of these (**Nelsonites** and **Darlingtonea**) appear to be sufficiently close to the pseudanophthalmid series to warrant inclusion within it. The third (**Ameroduvalius**) represents an evolutionary line that is new to our known biota.

Jeannel considers **Pseudanophthalmus** and its allies to be an emergence of an ancient trechine line which he refers to as the "phyletic series of **Trechoblemus**". The latter, an Old World ditypic genus, has been assumed to be close to the ancestral line of both the Appalachian cavernicolous fauna and a small group of eyeless species **(Duvaliopsis)** confined to caves in the Carpathian and Transylvanian Alps.

Trechoblemus micros Herbst is a trechinid of wide distribution in both Europe and Asia, with a distinct segregate (**T. postilenatus** Bates) in Japan. It is a rarely found, winged beetle possessing well developed eyes but often living in total darkness in caves and exhibiting a predilection for limestone regions. A close fossil relative (**Trechoides fasciatus** Motsch.) from the Baltic Amber points to long geological history dating back at least to the Oligocene. No epigeal ancestor of our anophthalmids has yet been discovered in America and there

is little likelihood, in view of the exhaustive collecting of Appalachian carabids over the past fifty years, that one will turn up. It seems reasonable to suppose, however, that the ancestral type, altho extinct in America, may still be surviving in the Palearctic Region, possibly in the form of **Trechoblemus** itself.

The principal characters uniting the Old and New World sections of the **Trechoblemus** series, as pointed out by Jeannel, are these: 1, retention of the primitive, dorsal pubescence in all but the most specialized forms; 2, retention of a primitively large series of prebasilar setae (8 to 12); 3, fusion of the labium (submentum) with the prebasilar plate; 4, union of the apical, recurved elytral stria with the third discal stria; 5, the asymmetrical character and lateral position of the transfer apparatus in the internal sac of the aedeagus.

In distinct contrast to the **Trechoblemus** series is another, more homogeneous line of cavernicolous speciation, as prolific in eastern Europe as the former is in eastern North America. This is Jeannel's "phyletic series of **Duvalius**", by far the largest genetic assemblage of anophthalmid species, with headquarters in the mountainous regions of the Balkans and derivatives in the Alps, Apennines, Pyrenees and the Djurjura of Algeria. Indeed, the majority of Palearctic cavernicolous trechines belong to this group. **Duvalius,** the largest and morphologically the most conservative genus, is divided into many subgenera, while three other genera **(Trichaphaenops, Anophthalmus** and **Aphaenopidius)** exhibit spelean adaptations that range from moderate attenuation to the extreme modification found only in species that spend their lives in the deepest recesses of montane cave systems.

The characters serving to integrate the **Duvalius** series are these: 1, dorsal pubescence variable but generally suppressed; 2, prebasilar setae reduced to six; 3, a freely articulated labium retained; 4, orientation of the apical, recurved elytral stria which points in the direction of the fifth discal stria; 5, the symmetrical character and ventral position in the internal sac of the transfer apparatus of the aedeagus.

As has been stated above, two of the new genera **(Nelsonites** and **Darlingtonea)** fall within the **Trechoblemus** series and the third **(Ameroduvalius)** within the **Duvalius** series,

but only under the broadest interpretation of the first four of the five alternative categories. Consequently, the phylogenetic status of these forms depends upon a critical evaluation of the characters which Jeannel considers to be of fundamental importance and which form the basis of his keys.

1. There is little ground to dispute the alleged primitive significance of the carabid **pubescence.** It is a character that appears in all major branches of the family to a varying degree. Where developed to its fullest extent **(Chlaenius, Brachynus** etc.), it functions as a water-repellent vestiture and hence may be considered an adaptation to subaquatic existence. In many others **(Atranus, Anillus, Helluomorpha,** etc.), it conceivably might be interpreted as the survival of an archaic character of probable but obscure advantage. In the cavernicolous Trechini, the evolution and devolution of pubescence quite clearly corresponds with changing habitats and troglodytic specialization. According to Jeannel, **Lasiotrechus** and **Trechoblemus,** totalling three species only, are examples of surviving epigeal trechinids that can be considered close to the source of a line of spelean evolution. In other words, they are truly archaic and probably ancestral types. Both are conspicuously pubescent, pigmented, oculate, alate and widely distributed over the Palearctic Realm. Their blind, depigmented relatives in eastern North America are often more or less pubescent **(Pseudanophthalmus pubescens,** Horn, **P. ciliatus** Val. etc.), while others have lost their pubescence entirely **(P. robustus** Val., **P. intermedius** Val., **Neaphaenops tellkampfi** Er.). The subterranean derivative of the **Trechoblemus** line in eastern Europe **(Duvaliopsis)** has retained its primitive pubescence. A majority, however, of the more stereotypic Old World anophthalmids are devoid of pubescence, a condition to be again reversed in many of the highly evolved, attenuate species belonging to groups that habitually seek the depths of profound montane caverns **(Aphaenops, Trichaphaenops, Anophthalmus** etc.). In such forms the pubescence, probably endowed with tactile sensitivity, reappears as sparse, rather long hair, often associated with supernumerary setae. These hypertrichous, spidery beetles are among the most extraordinarily aberrant of all carabids. There seems more justification for interpreting

their peculiar pubescence as atavistic rather than as vestigeal specialization. Be that as it may, the fact remains that pubescence, tho possibly an indication of primitivity, is an untrustworthy criterion of relationship.

2. Let us now consider the prebasilar setae. Here again the evolutionary trend is in the direction of reduction. **Trechoblemus** has a row of twelve, the highest count; and ten to twelve are also found in other epigeal, trechine primitives remote from anophthalmid stocks (**Perileptus,** etc.). Their more evolved relatives of special habitats tend to have fewer —eight to ten for the North American troglodytes of the **Trechoblemus** series, only two for the curious marine genera of **Perileptus** affinity (**Aepus,** etc.). Aside from **Duvaliopsis**, a restricted genus relatively unchanged from its **Trechoblemus**-like ancestor, all of the many subterranean trechine proliferations that have taken place in the Palearctic Region, including not only the several lines of cave-inhabiting species but numerous soil-dwelling types as well, are convergent in at least this one character—a prebasilar plate with setal rank reduced to six, sometimes four (**Geotrechus** etc.). Hundreds of species and scores of phyletic branches are involved in this general picture. Oddly enough, however, some of the most ultra-specialized forms, such as **Pheggomisetes** and many species of the bizarre **Aphaenops** series, have reverted to the older condition of seven or eight setae, a phenomenon paralleling the reappearance of hypertrophied pubescence in these and other species exhibiting extreme spelean modification. Conversely, where the body pubescence is suppressed in a usually trichate group (**Pseudanophthalmus**), the prebasilar setae tend to be reduced in number also. **P. robustus**, for example, normally has eight in contrast to the average of ten for the genus as a whole. Another glabrous American type, however (**Neaphaenops tellkampfi**), possesses a full prebasilar compliment of ten to twelve setae. In some specimens as many as fourteen may be observed, the angular pair being duplicated. As has been pointed out above, **Neaphaenops** is a much modified cave beetle, and one would expect it to exhibit a variable recrudescence in primitive traits. Herein lies a most intriguing and challenging concept—the return of certain archaic characters in exaggerated and unstable form as a result of extreme spelean evolution. Yet from

a taxonomic standpoint this can only be negatively helpful; the more the possibilities of convergence are explored, the less reliable such characters seem to become.

3. Third to be considered is the condition of fusion of the labium (submentum) to the prebasilar plate. Whether the former structure is free to move or not has been given considerable taxonomic importance by Jeannel. Actually, the flexibility of this mechanism may be correlated roughly with the number of prebasilar setae and therefore could constitute as much a functional as a phylogenetic character. Let us assume that the free labium as found in the archaic trechinid, **Perileptus**, typifies the primitive condition. The entire **Trechoblemus** series, then, would necessarily be removed from this category since all belonging to it agree in having a fused labium. There is not even a trace of the suture remaining in any species with the exception of **Trechoblemus** itself, where there is a vague vestige of it. On the other hand, the great majority of Palearctic cavernicoles possessing only six prebasilar setae are equipped with a freely movable labium, altho within groups typifying this condition certain genera or species have developed a completely *fused* labium. Characteristic of the latter are many anomalous forms that may be spotted by their extreme modification in other respects. Most of the attenuate **Aphaenops** of high setal count, for instance, including the ultra cavernicole **Pheggomisetes,** have fused labia. The highly evolved **Orotrechus** of the **Neotrechus** series and the extreme deviant **Aphaenopidius** of the predominantly free-labial **Duvalius** series are other cases in point. So here again is evanescent morphology that must be taken at relative value rather than absolute in making taxonomic decisions regardless of general acceptance as a "key character".

4. The proximad direction taken by the recurved elytral stria, stressed in Jeannel's analysis, is another subject that requires comment. In the great majority of epigeal trechine types, especially in **Trechus** itself, this apical stria or sulcus appears to curve anteriorly and terminate in allignment with the distal end of the fifth elytral stria. In a few instances, where the elytral striae are sufficiently impressed posteriorly, the third and fourth join the recurved stria prior to the latter's termination (**Thopidotrechus** etc.). With the

subterranean anophthalmids, a slightly different picture presents itself. The apical stria, with its associated apical carina, becomes hypertrophied in certain groups, the groove at its tip curving abruptly interiad toward the outwardly veering end of the third stria. This is most noticeable in the **Trechoblemus** phyletic series where the recurved stria is deep and conspicuous, forming a sulcus, and Jeannel has attached great importance to it in his separation of the series from other groups, notably the great phyletic category of **Duvalius**. Certainly, in our striate anophthalmids, whenever the carina is prominent the sulcus appears well defined; but where the elytral striae become effaced as a result of extreme speleal modification **(Neaphaenops, Nelsonites)**, the true relationship of the striae becomes a matter of considerable conjecture. Most of the European anophthalmid lines at one point or another show a similar devolution, some quite strikingly, the effacement reaching its maximum in the highly modified species whose posterior sculpture may become practically obliterated. However, detailed drawings in Jeannel's Monograph of elytral apices in three genera of the **Aphaenops** series **(Geotrechus, Aphaenops, Speotrechus)** distinctly show the vestigeal apical stria curving toward the *third* stria in absolute contradiction to the key. All are claimed to possess an apical stria directed toward the *fifth*. Both conditions are again amply represented in **Neotrechus** of the **Neotrechus** phyletic series, while the largest series of all—that of **Duvalius**—seems to be uniformly, if obscurely, of the more derived, fifth-strial type. It must be observed, however, that in this latter division the apical sculpture is extremely weak and confused, with the recurved stria often quite obliterated. The groove, when present, *appears* to point in the direction of the fifth stria, but this may well be due to the fact that it lacks sufficient development to show involvement with the third stria also. On the other hand, there remains the distinct possibility that the uniformly vague sculpture pattern in **Duvalius**, especially obscure in its spelean derivatives **Anophthalmus** and **Trichaphaenops,** is evidence of phylogenic integrity in a very large assemblage of troglodytes and cavernicoles.

By the foregoing, it must be concluded that a phylogeny of anophthalmids based on external, paralleling and often

evanescent characters lacks weight and stability. We will now turn to the evolutionary evidence provided by the male genitalia, for herein lies the trump card of the systematist; and it must be admitted in all fairness that Jeannel has played it exceedingly well in unravelling the baffling intricacies of trechine affinities.

Our Appalachian anophthalmid fauna, divergent as its various components may seem outwardly, has demonstrated a surprising consistency of genitallic plan. The right wall of the internal sac of the aedeagus bears a transfer apparatus in the form of two, elongate, nested pieces variously modified. Typically, the right one is a trowel-shaped element, the left a slender styliform rod. The orientation of the transfer apparatus is always in the long axis of the aedeagal tube, but on edge, so to speak, with its transverse axis at right angles to that of the tube. Obviously this is an asymmetrical arrangement. It is repeated in the **Trechoblemus** series of the Old World, but here a *single* piece—the trulliform one—is present. It is Jeannel's opinion that the left, accessory style is a peculiarity of the American anophthalmids without parallel in Palearctic evolutions. Yet in half of his six phyletic aggregates, not including the limited **Trechoblemus** series, the divergent **Neotrechus** series or the extensive **Duvalius** series, an apparently identical combination of a laterally placed trulliform element plus a more medial style occurs. Furthermore, the **Trechoblemus** and **Neotrechus** groups agree in all basic genitallic features except that in both genera the medial or left, styliform piece is missing. This seems to be a secondary condition. One of the Nearctic anophthalmids (**Pseudanophthalmus horni** Garman) has undergone a similar reduction. Thus it may be seen that a common plan of asymmetry equates the male genital systems of *all* anophthalmids whether on the east or west side of the Atlantic, with the outstanding exception of the sizable fauna belonging to the European **Duvalius** series and **Ameroduvalius,** the new genus to be described herein as a probable relative of the former. A uniformly distinct type of genital system characterizes and ties together the many members of this superficially heterogeneous series in a most convincing manner. Here the transfer apparatus, instead of being asymmetrical and lateral, is symmetrical and ventral. Typically, it is composed of a long,

spatulate or canaliculate element, often distally bilobed, combined in certain forms with a thin, tectal sclerotization, the entire apparatus, viewed dorsally, forming a symmetrical unit with transverse axis paralleling that of the aedeagal tube. In summarizing, it may be said that there is virtually no point of correspondence between these two major schemes of genital evolution; and there is virtually no comparison in relative value between such reliable systematic evidence as supplied by genitalia and that provided by evanescent external characters, especially when the latter appear to be influenced by changing environment and habits.

ACKNOWLEDGMENTS

The author wishes to acknowledge with deep gratitude the indispensable part played by Dr. Walter B. Jones, State Geologist of Alabama and Director of the Museum, in organizing the speological expeditions to Kentucky and Tennessee which made these and many more cave beetle discoveries possible. His untiring enthusiasm in the field, his expert caving technique and amazing collecting ability combine to create a constant source of inspiration to his fellow cavers and never fails to bring forth the desired results. To Woodson Diamond, Geologist of Pulaski County, Kentucky, the author extends appreciative thanks for much time and effort expended in our behalf in locating and exploring the numerous caves in the vicinity of Somerset. No other form of entomological collecting is quite so dependent for success upon friends and helpers as is the rugged task of capturing cavern-dwelling Coleoptera.

NELSONITES, gen. nov.

Descriptive characters:

General—Large size for an anophthalmid; elongate, convex, attenuate, of aphaenopsoid form; extremely depigmented; micro-alutaceous, glabrous or nearly so; polished; setae hypertrophied thruout.

Head—Considerably enlarged; totally anophthalmous; labrum doubly emarginate; clypeal setae variable, genae setose, supraorbital setae normal, prebasilar setae 10 in all, the subangular pair greatly hypertrophied; labium (submentum) and prebasilar plate fused, lateral and median spurs of labium elongate, former flared terminally, latter bifid.

Pronotum—Relatively small; margins very narrow, hind angles acute, produced; marginal setae normal.

Elytra—Elongate oval, narrowed basally with sloping, angular humeri; margins narrow; striae indistinct, punctured; apical recurved stria and apical carina poorly developed; normal compliment of chaetotaxial setae present, humeral marginal group closely spaced.

Appendages—Mandibles exceptionally large, wide, powerful, equipped with broad, multicuspid retinacula; all appendages of labium and maxilla elongate, terminal segment of galea, digitus and paraglossae long, arcuate; ligula armed with 8 to 10 hypertrophied setae; antennae long, fine, distal segments diminishing in size; legs very long and slender, anterior tibiae pubescent, not grooved externally, male protarsus with 2 basal segments spurred dorsally.

Aedeagus—Relatively large (genital index .24), produced apically in a narrow, spout-shaped process; transfer apparatus composed of two, longtitudinally ribbed, nested, spoon-shaped pieces asymmetrically arranged in the internal sac, the proximal wall of the latter spiculate; parameres slender, elongate, armed with 4 long, heavy setae.

Diagnostic characters:

The characteristically large head with its long, wide jaws is unique among anophthalmids; so also is the excessive

development of the retinacula, the left one bearing two teeth, one of which is bicuspid, the right, a single, deep, elongated flange, is 4- to 5-cuspid. The penultimate segment of the maxillary palp lacks the well defined setae seen in **Neaphaenops** and **Pseudanophthalmus** but bears a few exceedingly minute setae along its length. Several elytral characters are also highly diagnostic; the humeri, sloping concavely to distinct angles, are flanked interiorly by areas of discal planation; the recurved apical stria, tho feebly impressed, is sufficiently distinct to be followed to the fifth elytral stria rather than the third, a most unusual condition in American anophthalmids; noteworthy also is the close grouping of the humeral setigerous papillae. In the aedeagus, the complex, spoon-shaped elements of the transfer apparatus are distinctive, as is also the spiculate internal sac.

Relationships:

In spite of the anomalous condition of the apical groove and other body characters expressing a degree of cave specialization seldom met with in our fauna, there seems no doubt concerning the position of **Nelsonites** within the main phyletic series of North American anophthalmids. Other fundamental traits of chaetotaxy and aedeagus militate strongly against removal from the **Trechoblemus** line, while evidence supplied by undoubted ancestral types provides still more convincing proof of close relationship. **Pseudanophthalmus intermedius** Val. and **P. templetoni** Val. are two, very similar species that have long been known to occupy an isolated place in the genus. They are large, long-limbed, ranging cavernicoles that have evolved from **Pseudanophthalmus** stock and dwell in the larger caves of central Tennessee. With **Nelsonites** they also agree in being elongate, convex and glabrous; in having closely grouped and widely separated marginal sets of humeral and medial setal papillae; in having large, long jaws with well developed retinacula and glabrous subterminal maxillary palp segments; in having an unusually high genital index (.24), and a similarly designed, tho far simpler, type of transfer apparatus. In body proportions and sculpture, however, these species resemble **Pseudanophthalmus** more closely. Of the two, **P. templetoni** demonstrates a closer approach to **Nelsonites** in its larger size

(7 mm.), straighter humeri, more complex transfer apparatus and a recurved apical stria that bends deeply mediad to join the third elytral stria. The chain relationship starting from some unknown **Pseudanophthalmus** ancestor thru **P. intermedius** to **P. templetoni** leads directly to **Nelsonites,** yet so drastically is this new form modified that it requires recognition under a separate genus.

A new name, **Tennessarius** subgen. nov. is herewith proposed in order to segregate the two aberrant species above referred to (**Pseudanophthalmus intermedius** Val. and **P. templetoni** Val.) under a new subgenus of **Pseudanophthalmus.** The latter species was originally described ('48) as a subspecies of **P. intermedius.** Jeannel ('49) subsequently raised it to specific rank. After further study, the present author concurs in this decision.

Chorology:

So far as is known, the range of **Nelsonites** is confined to the drainage area of the upper Cumberland River in south central Kentucky and north central Tennessee. It is of interest to note that **Tennessarius** occupies caves in south central and central Tennessee near the divide between Cumberland and Tennessee River watersheds, **P. Tennessarius templetoni** residing definitely within the former and only thirty miles from the type locality of the more southerly species of **Nelsonites.** The occurrence of **Nelsonites** is definitely sporadic, apparently emerging from the deeper recesses of the caves seasonally, perhaps for breeding purposes. Like **Neaphaenops,** it is truly a spelean type and can be taken wandering freely about on moist walls, flowstone and stalagmites near pools or drips. Often it seeks shelter beneath stones or wood.

Etymology:

It is, indeed, a source of considerable satisfaction to name this remarkable new genus of cave beetles, together with its type species, in honor of Pvt. 1st Cl. Nelson Bolling Jones, killed in action in Germany April 2, 1945. Nelson, Dr. Walter Jones' oldest son, was himself an ardent and courageous cave explorer—one who would have taken the greatest delight in the discovery of the cavernicole that now bears his name.

Nelsonites jonesei sp. nov.

General—Characters of the genus plus the following: **Length** 6.7 - 7.3 mm., **width** 2.1 - 2.3 mm.; ferrugino-testaceous; nearly glabrous.

Head—Characters of the genus plus the following: Relatively wide (index .57 - .59); distinctly granulo-alutaceous; genae swollen, much rounded, epicranial grooves deep, arcuate; clypeus with usually 4 but often 6 setae; geneal setae long, plentiful.

Pronotum—Characters of the genus plus the following: Relatively wide (index 1.1 - 1.2); finely reticulo-alutaceous; very convex; margin extremely narrow, much rounded over anterior half; hind angles sharply acute, slightly produced, slightly elevated; basal angles obsolete, base rather truncate.

Elytra—Characters of the genus plus the following: Very convex, widest point about midway from base to apex (index .61 - .62); scutellum very elongate; humeral area of planation triangular or trapeziform, reaching from the slightly concave humeral margin to the suture which is elevated in this region only, and forming a concavity at its junction with another, more limited area of planation extending posteriad from the base below the scutellar papilla; margins nearly straight from slightly rounded humeral angles to point of maximum width, thence gently arcuate to apices which are separately rounded; striae obsolete over anterior areas of planation, very shallow but distinct over main disc, broken and confused over apical areas, shallowly and closely punctate, intervals convex; apical groove and carina much reduced but distinct, the former joined to the 5th stria by a series of punctures and/or pigment spots (which underlie all the striae); the setigerous papillae of the humeral group closely and equidistantly spaced, the posterior 3 forming a straight line which departs slightly from the margin, the group far removed from the medial marginal pair (setal index .55); the medial pair of discal setae unusually remote from the anterior pair, on a level with or below the posterior medial marginal setae; elytra very sparsely pubescent with minute hairs seen only in good illumination.

Appendages—Characters of the genus plus the following: Right retinaculum of mandible with anterior cusp greatly enlarged, its posterior edge with one or two, blunt, secondary cusps, the proximal portion of the retinaculum having two, sharp, primary cusps; ligula with 6 to 8 forward directed setae and 2 longer latero-ventrally directed setae; terminal segment of maxillary palpi 1/5th longer than subterminal (palpal index .83).

Aedeagus—Characters of the genus plus the following: Tube relatively narrow, terminal process acute viewed dorsally, arcuately deflexed and blunt in lateral aspect, basal bulb not well differentiated; copulatory pieces relatively wide, the right element large, spoon-shaped with a median keel, the internal one narrower with thickened margins; parameres long, very slender.

Type series—Holotype male, allotype female: Richardson's Cave, 2.5 miles east of Somerset, Pulaski County, Ky., Nov. 6, 1949, W. B. Jones, J. M. Valentine, W. Diamond; 7 paratypes: Sept. 29, 1949, same data otherwise.

Chorology—Caves in the Somerset area on *both* sides of the Cumberland River contained this beetle, but nowhere was it taken in anything like the abundance of its two common associates—**Darlingtonea** and **Ameroduvalius.** In Taylor or Stab Cave, 10 miles northeast of Somerset, a fair sized colony was found. A few others were captured in Blaze Valley Cave, 5 miles southeast of Somerset, and in Sloan's Valley or Cassidy Cave, 6 miles southeast of Burnside, Pulaski County. Most unfortunately, the last named locality, a gigantic cavern containing a rich fauna, has been completely flooded by the impounded waters of the Cumberland River. A few specimens of **Nelsonites** were taken on the terraced floor of a remote chamber where a waterfall cascaded over great stalactites into a series of pools.

Raciation—The colonies of **Nelsonites jonesei** located in various caves exhibit no or very slight deviation from the type. The Taylor Cave population seems to be a trifle narrower, especially in the pronotum, while the Sloan's Valley Cave form, a colony isolated from the others by a large and deep river, cannot outwardly be distinguished from the typi-

cal excepting by its slightly more rounded humeral angles and narrower elytra (elytral index .56 - .59).

Nelsonites walteri sp. nov.

General—Characters of **N. jonesei** with the following differences: **Length** 7.5 - 8.0 mm., **width** 2.4 - 2.6 mm.; testaceous (all specimens more or less teneril); completely glabrous.

Head—Characters of **N. jonesei** with the following differences: Narrower (index .49 - .51), epicranial grooves straighter; genae less convex with fewer shorter setae on sides.

Pronotum—Characters of **N. jonesei** with the following differences: Narrower (index 1.0 - 1.1); less convex; sides less rounded, margins slightly wider, hind angles more produced and elevated.

Elytra—Characters of **N. jonesei** with the following differences: Less convex, slightly more narrow (index .58 - .59); striae less evident, intervals flatter, punctures less impressed; apical groove and carina slightly less distinct but the former obviously directed toward the 5th stria; medial discal setae situated *anterior* to the medial marginal papillae; no pubescense could be observed.

Appendages—Characters of **N. jonesei** with the following differences: Jaws similar but the anterior portion of right retinaculum slightly more hypertrophied; ligula with 8 setae in all; terminal and subterminal segments of maxillary palpi subequal (index .93).

Aedeagus—Characters of **N. jonesei** with the following differences: Tube relatively wider, terminating in a longer deflected process which, viewed dorsally, is spatulate and slightly expanded distally; copulatory pieces narrower; parameres shorter, wider.

Type series—Holotype male: Johnson's Cave, 7 miles southwest of Monterey, Putnam County, Tenn., Oct. 20, 1948, W. B. Jones, J. M. Valentine; allotype female, 6 female paratypes, 1 male paratype: Sept. 23, 1949, otherwise same data.

Chorology—The type locality is on the Calfkiller River which feeds the Cumberland about 50 miles to the southwest

of the area in Kentucky inhabited by **N. jonesei.** The entrance room of Johnson's Cave is an enormous, domed chamber, the irregular clay floor of which has been disturbed to a considerable extent by century-old saltpeter operations. In the rotting wood around the ancient hoppers, a thriving colony of an anophthalmid (**Pseudanophthalmus robustus** Val.) was discovered by the author in 1931. A subsequent visit to the spot by the noted speleocoleopterist H. Henrot in 1946 was productive of another species (**P. valentinei** Jeann.) taken as a comparative rarity among the **robustus** colony. Seeking specimens of this new form, Jones and Valentine entered the cave in October of 1948 and, after an exhaustive search which yielded nothing but the usual **robustus,** were on the point of leaving when a large block of loose flowstone under a heavy drip attracted Dr. Jones' attention. He managed to turn it over. Out from under ran what bid fair to be the most spectacular cave beetle ever seen in North America. It was, of course, the first specimen of its genus to be captured. Most appropriately it now bears the name **Nelsonites walteri.** Chunks of wood thrown into the drip basin and left to rot evidently attracted others, for just eleven months later seven more specimens were taken in or near the same spot. All, including the original find, were teneril. It seems quite possible that this truly spelean type is migratory in its movements, emerging from the deep cave only to propagate and retreating from the rearing ground as soon as the transformation to adult has taken place.

DARLINGTONEA gen. nov.

Descriptive characters:

General—Size attained equal to (or exceeding) the largest known American anophthalmid **(Neaphaenops);** elongate, convex, similar in form to **Neaphaenops** tho less convex, less attenuate; color relatively dark; micro-alutaceous, rugosely sculptured over areas of head and pronotum, polished; glabrous except for vestigeal pubescence in humeral region.

Head—Normal; totally anophthalmous; labral margin with a small median lobe; clypeal setae 4, outer pair considerably hypertrophied, supraorbital setae normal, lateral

genae setose, prebasilar setae 8 in all, subangular pair directed latero-posteriad; labium (submentum) and prebasilar plate fused, lateral and median spurs of labium rather elongate, former cupped inwardly, latter bicuspid.

Pronotum — Normal, elongate; margins narrow; hind angles acute, elevated, produced; marginal setae normal.

Elytra — Normal, elongate elliptical-ovoid; humeri much rounded; margins narrow; striae rather well impressed, punctate; apical groove and carina short but well formed, the former meeting the 3rd elytral stria; marginal setigerous papillae closely grouped in the humeral region, a long gap separating this group from the medial marginal pair; only 2 pairs of discal setae present, the posterior pair completely absent.

Appendages — Mandibles large, long, equipped with strong, tricuspid retinacula; all articulated appendages of the maxilla and labium elongate, the subterminal segment of the maxillary palpi much longer than terminal, setose, the terminal segment of the galea elongate, arcuate; labium usually bearing 10 setae, the 2 central pairs much longer than the laterals, paraglossae short, arcuate, with long cilia; antennae normal; legs fairly long, anterior tibiae pubescent, not grooved externally, male protarsus with 2 spurred basal segments.

Aedeagus—Normal size (genital index .17); tube widely expanded distally into a flattened bulb, conspicuous in dorsal aspect, terminating in a short, spout-like process; internal sac armed with two, laterally arranged, nested, hooked, petaloid pieces; the internal sac distinctly spiculate; parameres short, broad, bearing 5 rather short setae.

Diagnostic characters and relationships:

Darlingtonea, with its laterally oriented, asymmetrical transfer apparatus agreeing in general plan with the phyletic series to which **Pseudanophthalmus, Neaphaenops** and **Nelsonites** belong, can definitely be referred to this evolutionary group. The characters combining to remove it from **Pseudanophthalmus** are principally these: Extreme length of penultimate segment of the maxillary palp; complete loss of the

chaetotaxially important posterior pair of discal elytral setae; the great distance separating the humeral and medial sets of marginal setigerous papillae of the elytra. It will be noted that these three characters are features diagnostic of **Neaphaenops. Darlingtonea,** however, can definitely be excluded from this genus on several counts: The right retinaculum not supplemented by a dorsal tooth (present in **Neaphaenops**); the prebasilar plate bears a reduced number (8) of setae (**Neaphaenops** possesses 10 to 12); a full compliment of supraorbital setae are present (**Neaphaenops** lacks the anterior pair); most important is the presence of elytral striae and a strong apical groove, typical of **Pseudanophthalmus** (no trace of the latter remains in **Neaphaenops**). But it is undoubtedly true that **Darlingtonea** is a very close relative of **Neaphaenops**; indeed, it might be said that a direct ancestral relationship exists. The general form of **Darlingtonea,** its glabrous condition and cursorial habits all strengthen this conclusion.

Chorology:

Darlingtonea occupies rather a wide range along both banks of the upper Cumberland River in south central Kentucky. It was taken in every cave visited in the general Somerset area (13) with the exception of two, both simple stream caves. In many of the localities it was extremely abundant, wandering about in every conceivable situation that was not bone dry—on mud banks, flowstone terraces, stalagmites, clay benches, but seemed to favor particularly the flat shelves raised above general level. This free-ranging habit and excessive abundance is very reminiscent of **Neaphaenops** which, altho apparently a spelean type, is not restricted to the deep cave as are most of the highly modified cavernicoles, but often ventures toward the mouth into the semidarkness. The same may be said of **Darlingtonea.** The distribution of **Darlingtonea** along the upper reaches of the Cumberland, especially on the right bank where presumably in the past it could have gained access into Green River drainage, easily fits the picture of an ancestral **Darlingtonea** evolving into a specialized deviant over a peripheral portion of the original range now isolated.

Etymology:

The genus is named in honor of Philip J. Darlington, Jr., Curator of Entomology in the Museum of Comparative Zoology, Harvard College, an outstanding world authority on the Carabidae and a versatile student of zoogeography and evolution.

Darlingtonea Kentuckensis sp. nov.

General—Characters of the genus plus the following: **Length** 7.3 - 7.7 mm., **width** 2.3 - 2.6 mm.; rather flat discally; relatively dark, ferrugino-testaceous to ferruginous.

Head—Characters of the genus plus the following: Elongate narrow (index .48 - .50), genae gently rounded, epicranial grooves long, irregular, arcuate, ending rather abruptly posteriorly; finely granulo-alutaceous; lateral genae finely pubescent; clypeus, antennal areas, epicranial disc distinctly, often roughly rugose.

Pronotum—Characters of the genus plus the following: Elongate narrow (index .91 - .97), sides gently arcuate, hind angles considerably produced, acute; triangular areas on basal and apical disc distinctly rugose; finely reticulo-alutaceous.

Elytra—Characters of the genus plus the following: Elongate elliptical, narrow (index .59 - .61), humeri almost evenly arcuate, sides very gently rounded, apices almost truncate; finely reticulo-alutaceous; apical groove very distinct, arcuate, leading into the 3rd elytral stria, apical carina well formed; striae evident, punctate, the impressions elongate, intervals feebly convex; humeral set of marginal papillae remote from medial set (setal index .38 - .40), the former closely spaced and only slightly removed from the margin posteriorly; apical discal pair of setae entirely wanting.

Appendages—Characters of the genus plus the following: Jaws with large retinacula, the left composed of a long, sharp anterior tooth with a flat, bicuspid tooth behind, the right a deep, tricuspid flange, the anterior prong by far the greatest cusp, the terebra not forming a supplementary ex-

ternal tooth; subterminal segment of maxillary palpi long (palpal index .74), sinuate, furnished with a number of setae; antennae rather short, reaching only midway down the elytra; legs quite long.

Aedeagus—Characters of the genus plus the following: Apical spout-like process distinctly deflexed; ventral and lateral walls of apical enlargement perforated with an unusual number of sensory organs; pieces of transfer apparatus thickly ribbed longitudinally, the left one nearly as large as the right.

Type series—Holotype male, allotype female: Richardson's Cave, 2.5 miles east of Somerset, Pulaski County, Ky., Sept. 29, 1949, W. B. Jones, J. M. Valentine, W. Diamond; paratypes (large series): as above but also Nov. 6, 1949.

Chorology—Beside the type locality, the various caves of the Somerset area from which **Darlingtonea kentuckensis** was taken are the following: Blaze Valley Cave, 5 miles east of Somerset; Diamond Cave, 3.5 miles northwest of Somerset; Dyke's Cave, 10 miles east of Somerset; Taylor (Stab) Cave, 10 miles northeast of Somerset. These localities are all on the right bank of the Cumberland River; caves on the left bank which yielded the species are the following: Sloan's Valley (Cassidy) Cave, 6 miles southeast of Burnside, Pulaski Co.; Mill Creek Cave, 11 miles southeast of Somerset; Hogg Cave, Touristville (Mill Springs), Wayne Co.; Cooper Cave, 3 miles east of Mill Springs; Lasher Steele Cave, 3 miles southeast of Monticello, Wayne Co. In many of these, large series were captured. It is interesting to note that where **Nelsonites** is found, it is usually in association with **Darlingtonea,** both forms favoring caves that are not subject to flood.

Raciation—South and east of the Cumberland (left bank) the many populations of **Darlingtonea kentuckensis** have a common aspect that differs slightly from the typical form as it occurs in caves about Somerset, on the right bank. They seem to agree in being slightly more convex, in having slightly wider elytra and in the humeri that are still more rounded than in the type. It will be noted that these are precisely the characters that differentiate a vague race of **Nelsonites jonesei** found in Sloan's Valley Cave south of the Cumberland. In either case, there appears to be too little morpho-

logical distinction to warrant subspecific recognition. Another segregate on the Rockcastle River, however, requires different treatment. The Rockcastle is a tributary of the upper Cumberland, flowing thru the much dissected country of Rockcastle County, Ky. Big Saltpeter Cave in this area (8 miles north of Livingston) harbors a small colony of a distinctive race of **Darlingtonea kentuckensis** for which the subspecific name of **lexingtoni** is herewith proposed. This form resembles the typical in all apparent respects except for the color which is a paler, ferrugino-testaceous, the very slightly narrower pronotum, the obviously flatter elytral disc, especially in the humeral region, but particularly in the aedeagus (figured). The terminal process of this organ is widely rounded in dorsal view, almost as in typical **kentuckensis,** but in profile it is straight and narrows to a small, beaded end. The right piece of the transfer apparatus is nearly typical; the left is considerably smaller and terminates in an abrupt hook. The type locality is a huge, dry cave that offers little support for an anophthalmid population except in the vicinity of a tiny waterfall that fills a circular basin called "The Spring". Here this beetle was fairly abundant. The type series consists of holotype male, allotype female and 13 paratypes.

It is surprising how little variation in size is exhibited by **Darlingtonea.** A lone, unusually small specimen (6.8 mm.) was taken in Dyke's Cave where very possibly, judging by the absence of a sizable population, the environment was unfavorable. On the other hand, Cooper Cave which supports an enormous colony produced a specimen that is fully 8 mm., the largest individual of an American anophthalmid the author has yet seen.

AMERODUVALIUS gen. nov.

Descriptive characters:

General—Size moderate, very variable; form broad, rather flattened; ferrugino-testaceous to ferruginous; conspicuously micro-alutaceous, shining; sparingly pubescent.

Head — Normal; totally anophthalmous; labral margin with a weak median lobe; dorsal setae normal, lateral genae densely and extensively setose; prebasilar setae 8 in all, the

six transverse pairs forming a condensed series far removed from the angular, lateral pair; labium (submentum) fused with the prebasilar plate but a trace of the suture sometimes visible at the sides, the median and lateral spurs of the labium normally produced, former bifid.

Pronotum—Normal; margins, except near the posterior angles, rather narrow; hind angles wide, flaring, obtuse or rectangular with rounded sides; setae normal.

Elytra — Normal, elliptical with distinct but rounded humeri; humeral margin vaguely serrate, apices more or less produced; striae distinct, punctures feebly impressed; apical groove and carina well developed, the former leading to the 3rd but sometimes also to the 5th and 6th elytral striae; chaetotaxial setae normal, humeral group of marginal papillae closely spaced, forming nearly a straight line that departs slightly from the margin, situated at a considerable distance from the approximated medial marginal pair; pubescene extremely fine, arranged in rows that follow the intervals.

Appendages — Mandibles normal in size, retinacula with blunt, rounded teeth arranged as follows: the left tricuspid, the anterior tooth being more or less separate and dorsal, the right retinaculum broken into two parts with a gap between, both portions bicuspid; palpi normal, the subterminal segment of the maxillary subequal to the terminal, the former bearing several setae; ligula normal with 8 setae, the central pair elongate, the paraglossae long, narrow and arched; antennae and legs of normal length, protibiae setose and not grooved, protarsi of male with dorsal spurs on the two basal segments.

Aedeagus—Very distinctive; size normal (genital index .16); tube arciform, rather wide, the basal bulb poorly defined, the apex terminating in a short process, the apical 4th, viewed dorsally, expanded into a broad spatula; the copulatory pieces are *symmetrically arranged on the floor* of the internal sac and consist of a ventral, bilobed organ, the lobes more or less separated thruout its length, covered dorsally by a concave tectal element; walls of internal sac richly spiculate; parameres normal, bearing 4 setae.

Diagnostic characters and relationships:

As has been pointed out above, **Ameroduvalius** with its symmetrical, ventrally located internal sac equipment, has no rightful place within the North American pseudanophthalmid line, presumably a proliferation of the Eurasian trechoblemid evolution. It apparently belongs to the **Duvalius** phyletic series. If true, **Ameroduvalius** becomes the first representative of this great Palearctic stock to be found in the New World. Aside from genital characters, the genus departs from **Pseudanophthalmus** chiefly by virtue of its peculiar dentition, its unique prebasilar arrangement and the apical stria which sometimes fails to reach the 3rd elytral stria but contacts the 5th, or it may send branches to both. In this connection, it should be borne in mind that one of the most emphasized criteria of the **Duvalius** series is the direction taken by the apical stria which is invariably toward the 5th discal. It has already been observed that the reason for this condition in **Duvalius** may well be, in part at least, a general absence of good definition of the apical groove thruout the entire series. In **Ameroduvalius,** it *is* well defined, but even so, involvement with the fifth elytral stria is not of rare occurrence.

Chorology:

Wherever **Darlingtonea** has been found so also has **Ameroduvalius,** almost without exception. From only two out of eleven caves in the Somerset area in which the former occurred was the latter apparently missing. However, an ecological distinction could be drawn between the two. **Darlingtonea,** a cursorial, ranging beetle, preferred the upper galleries while **Ameroduvalius** more often was taken among the bits of trash and fine debris lining the margins of muddy pools. The smaller, flatter beetle of mesophilic habits and shorter appendages is adapted for such an existence. Other free ranging mesophiles and a tiny, fast running subhydrophile, all belonging to the genus **Pseudanophthalmus,** were associated to a greater or lesser extent with the three genera treated herein, the subaquatic beetle, a minute form of **P. cumberlandus,** being restricted to very wet situations, particularly to the gravel and sand bars of cave streams. These species will be described in a forthcoming paper.

Etymology:

The name **Ameroduvalius** is of obvious origin, denoting the extension of the Old World **Duvalius** line into the New World. Its type species, **jeanneli,** is named in honor of Dr. Rene Jeannel whose vast and challenging contributions to our knowledge of carabid evolution and dispersal has inspired many a student to take a broader view toward his chosen field of taxonomy.

Ameroduvalius jeanneli sp. nov.

General — Characters of the genus plus the following: **Length** 4.7 - 5.7 mm., **width** 1.7 - 2.1 mm.; flattened discally; color rather dark, ferrugino-testaceous to ferruginous.

Head—Characters of the genus plus the following: Fairly wide (index .58 - .63), flat, genae very gently rounded; epicranial furrows well developed, long, arcuate; without macrosculpture but microsculpture distinctly granulo-alutaceous; entire sides of genae setose.

Pronotum—Characters of the genus plus the following: Rather wide (index 1.1 - 1.2), discally flat; sides sinuo-arcuate, margins well reflexed, narrowest at point of median seta, expanding considerably posteriorly, hind angles wide, elevated, more or less rectangular with sides (especially the basal) rounded; distinctly granulo-alutaceous, extremely finely, sparsely pubescent.

Elytra — Characters of the genus plus the following: Elliptical-ovoid, rather wide (index .66 - .69), disc flat, somewhat depressed along suture, humeri well developed, rounded, apices separately produced; margin well reflexed, widest in subhumeral region; marginal papillae closely grouped, the two anterior sets well separated (setal index .55); striae impressed, punctures shallow, confused, intervals moderately convex; apical groove well impressed but irregular, whether or not it attains the 3rd elytral stria depending on the degree of development of its terminal mediad bend; distinctly alutaceous, very finely, remotely pubescent.

Appendages — Characters of the genus plus the following: Terminal and subterminal segments of the maxillary pal-

pi subequal, (index 1.0); antenna reaches somewhat beyond middle of elytra.

Aedeagus—Characters of the genus plus the following: Bilobed, ventral copulatory piece elongate, each lobe a separate lingulate element supported dorsally by a longitudinal rib, more or less overlapping, the whole structure bridged dorsally by a simple, scoop-shaped element; apical expansion of the tube twice the diameter of the tube.

Type series—Holotype male, allotype female, large series of paratypes: Sloan's Valley (Cassidy) Cave, 6 miles southeast of Burnside, Pulaski County, Ky., Nov. 7, 1949, W. B. Jones, J. M. Valentine, W. Diamond.

Chorology—The type series was collected in a restricted micro-locale. Beneath a long overhang at the side of one of the huge rooms in Cassidy Cave was a drying, muddy pool, the margin of which was littered with fine leaf debris. Running over this shelving bank and taking cover beneath the litter were numerous examples of **Ameroduvalius jeanneli.** It is a great pity that the type locality should now be destroyed, submerged under the rising waters of the Cumberland. But it is also fortunate that some record of the fauna of this magnificent cave has been preserved in the form of collections made on that one occasion in 1949. The other localities in which this species has been collected are the same as those where **Darlingtonea** was found, with the exception of Hogg Cave and Lasher Steele Cave.

Raciation—There seems to be considerable parallelism involved in the raciation of all three genera over the ranges studied. In both **Nelsonites** and **Darlingtonea,** the populations in caves on the left bank of the Cumberland have consistently shown greater convexity, less elongation, less angulation. The same may be said of **Ameroduvalius.** A definitely flatter, narrower form occupies the Somerset caves (Richardson's, Blaze Valley, Diamond, Dyke's) northwest of the river. There is even a large form of **A. jeanneli** (6.2 mm.) in Cooper Cave where the largest specimens of **D. kentuckensis** were taken. All these local products are what might be termed secondary races—too vague to merit description, at least not until more material is collected and studied. As might be expected, however, Big Saltpeter Cave of Rockcastle County, in a subsidiary

drainage area, is productive of a definite race of **A. jeanneli** paralleling **D. kentuckensis lexingtoni** of the same cave. Like the latter, it is a *paler, flatter, narrower* modification of its prototype. It is proposed that the name for this new subspecies shall be **Ameroduvalius jeanneli rockcastlei.** In addition to the above distinctions, it differs from the typical **jeanneli** in being less punctate, in having weaker striae with flatter intervals and in the pronotal contour which is more constricted posteriorly. The aedeagus is considerably different, but the alterations are quantitative rather than qualitative as in the case of its companion race. The apical enlargement of the tube, viewed dorsally, is less than twice the diameter of the tube. The transfer apparatus has a much shorter, bilobed ventral element and a proportionally much longer dorsal tectum which completely covers the lobes. As in typical **jeanneli,** the walls of the internal sac are abundantly spiculate and the lateral and apical portions of the distal end of the tube are richly supplied with sensory organs.

CONCLUSIONS

There seems a strong likelihood that the main American anophthalmid line, with its four known genera (**Pseudanophthalmus, Neaphaenops, Nelsonites** and **Darlingtonea**), bears an archaic relationship to the **Trechoblemus** series of Jeannel, an affinity which might conceivably be stretched to include other cavernicolous types of the Old World. The closest Palearctic spelean relatives of this great Nearctic evolution are thought to be **Duvaliopsis,** a small group *not* in the **Duvalius** series) confined to the Balkans. The same geographic area is the center of the very large **Duvalius** series to which the problematical **Ameroduvalius** most probably belongs. Of all the many cavernicolous branches of the series, perhaps the subgenera **Duvalidius** and **Neoduvalius** come closest to providing cogent points of similarity, the former because a conspicuous tectal piece is present in the transfer apparatus, the latter because of the presence of a deeply lobed ventral piece very reminiscent of the condition in **Ameroduvalius.**

Assuming that the anophthalmid fauna of eastern North America (south of glaciation) *does* consist of two, separate stocks, both of Eurasian origin, would we be any closer to a solution of this puzzling problem of distribution by introducing continental drift? Perhaps so, but let it be borne in mind that another point of view is also quite plausible: *Two* freely flying ancestors like **Trechoblemus** might have made the crossing during the Eocene, a time of equable climate when shorter, northern routes were accessible, established successful evolutionary lines in the less rigorous environment of caves and subsequently undergone extinction as an epigeal fauna.

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J. M. Valentine—Speciation and Raciation in **Pseudanophthalmus;** Trans. Conn. Acad. Arts Scs., vol. 36, 1945.

J. M. Valentine—New Anophthalmid Beetles from the Appalachian Region; Geol. Surv. Ala., Mus. Paper 27, 1948.

EXPLANATION OF PLATES

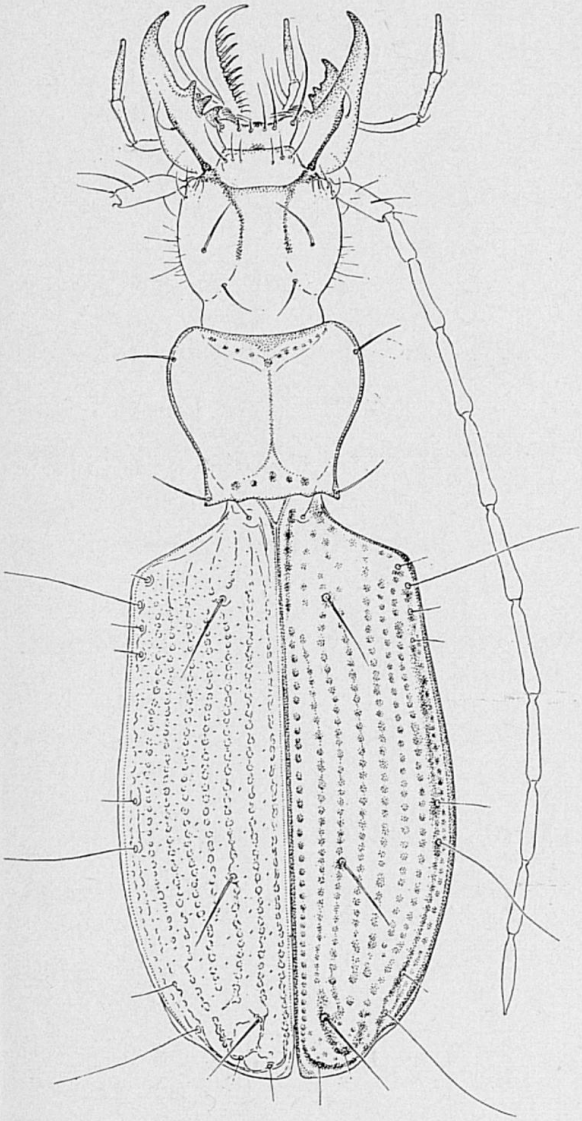
In the drawings of the entire beetle (minus the legs and left antenna), the sculpture and pubescence are shown on the left elytron, the deep pigmentation on the right. Random reduction of the plates has unfortunately thrown the figures out of uniform scale.

Plate I

Fig. 1. *Nelsonites jonesei* gen. sp. nov.; holotype male, Richardson's Cave, Somerset, Ky. x 17

1a. Labium of same. x 43

Fig. 2. *Nelsonites walteri* gen. sp. nov.; holotype male, Johnson's Cave, Monterey, Tenn. x 17



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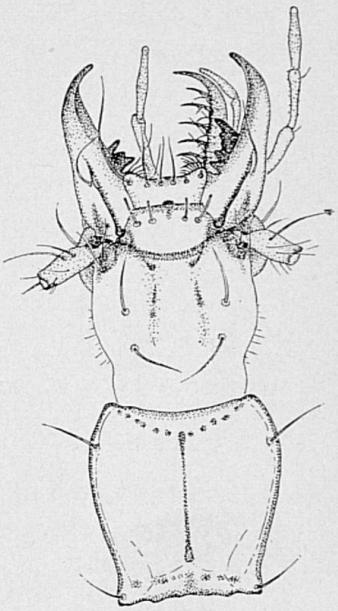

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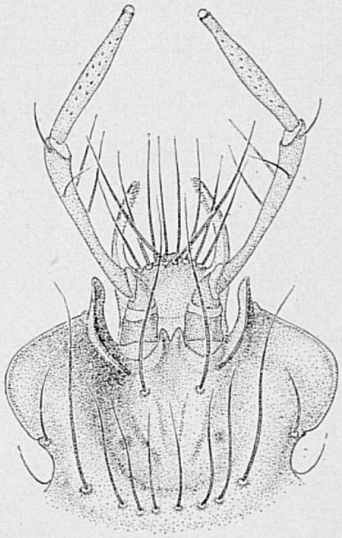

1a

Plate II

Fig. 1. Aedeagus of *Nelsonites jonesei* gen, sp. nov.; Taylor Cave, Somerset, Ky. x 80

1a. Transfer apparatus of same, dorsal aspect, dissected. x 80

1b. Aedeagus of same, dorsal view of apical portion. x 100

Fig. 2. Aedeagus of *Nelsonites walteri* gen, sp. nov.; holotype male, Johnson's Cave, Monterey, Tenn. x 80

2a. Apical process of same, dorsal aspect. x 80

2b. Transfer apparatus of same, dorsal aspect. x 80

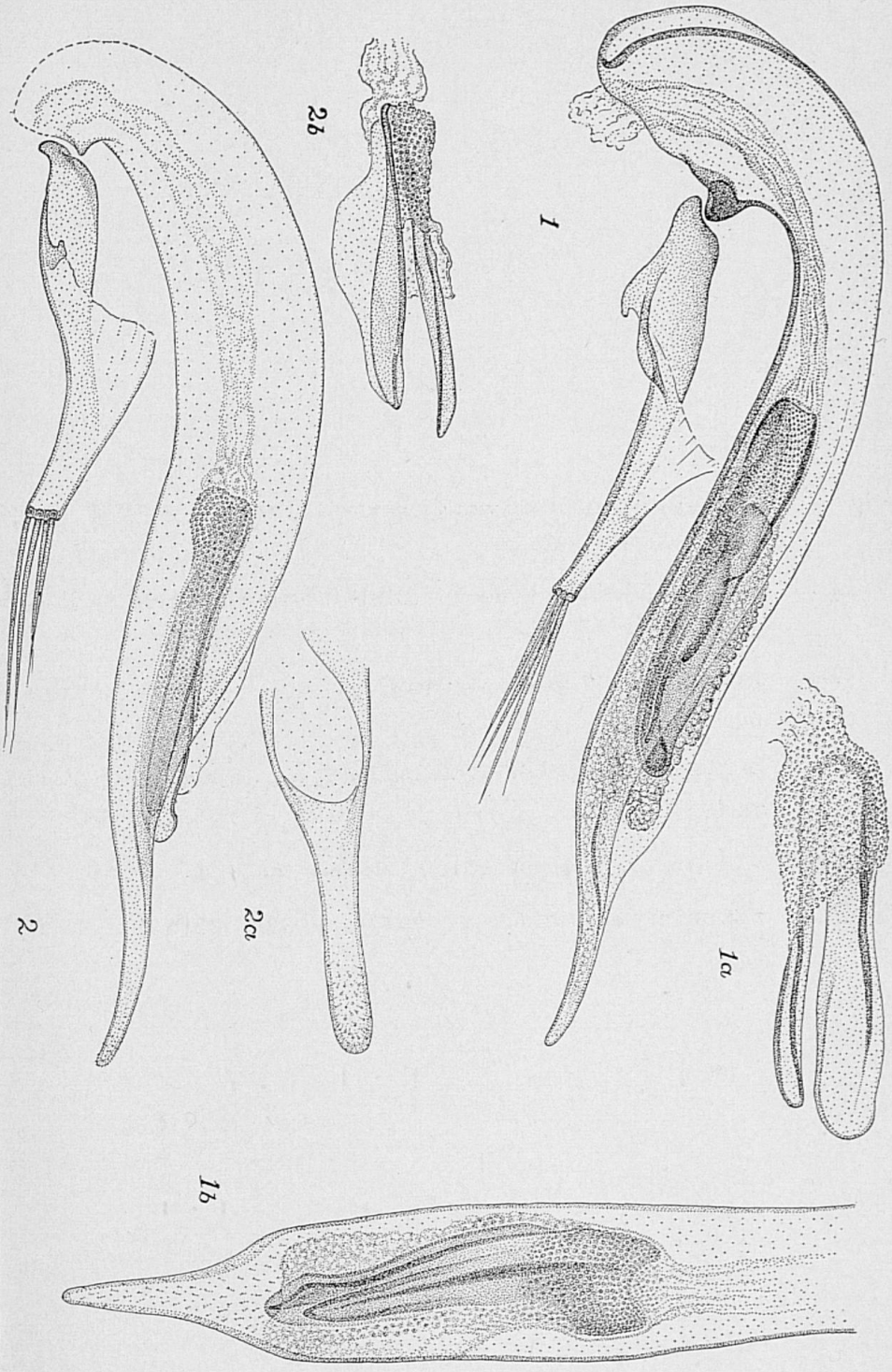
1
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Plate III

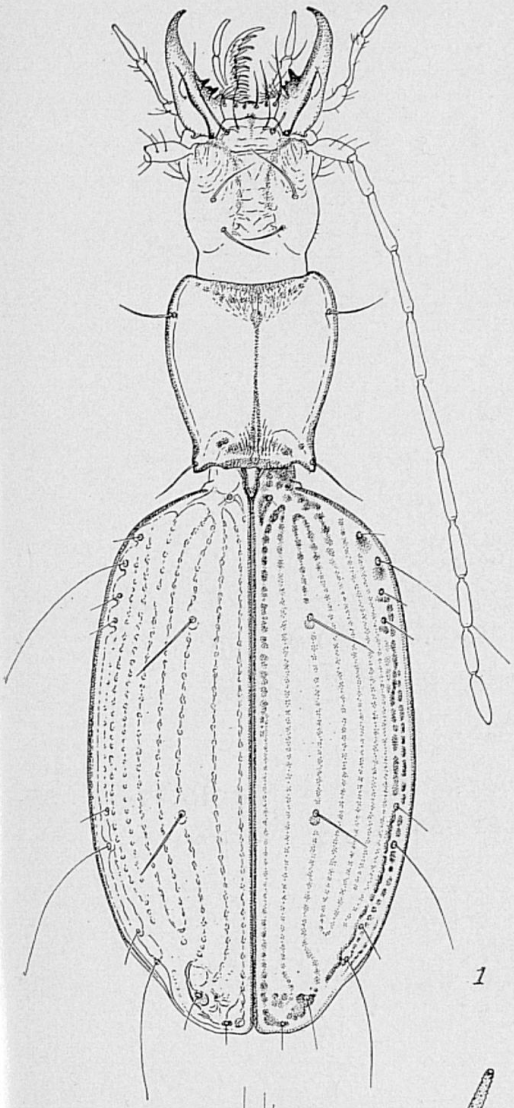
Fig. 1. *Darlingtonea kentuckensis* gen. sp. nov.; holotype male, Richardson's Cave, Somerset, Ky. x 18

1a. Labium of same. x 40

Fig. 2. *Ameroduvalius jeanneli* gen, sp. nov.; holotype male, Sloan's Valley Cave, Burnside, Ky. x 18

2a. Mandibles of same. x 40

2b. Labium of same. x 40



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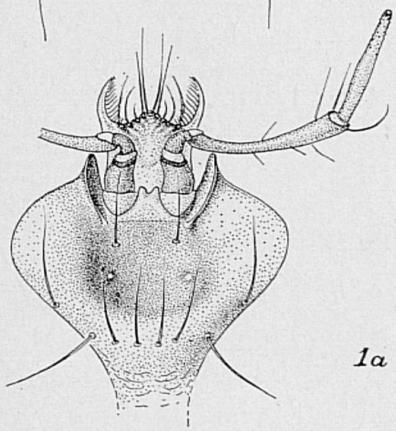

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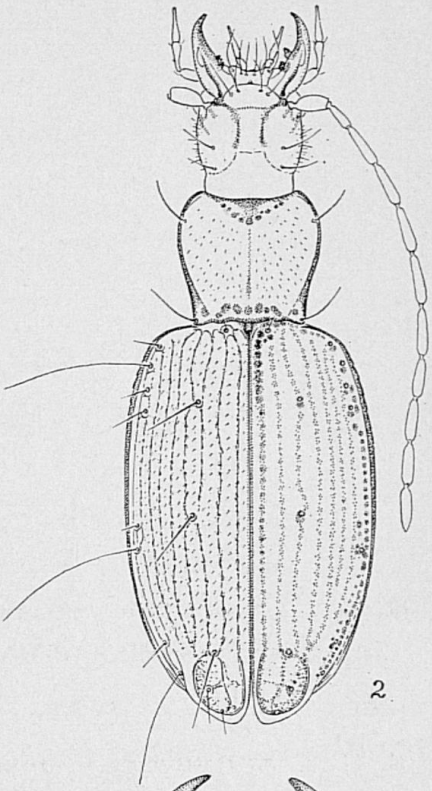

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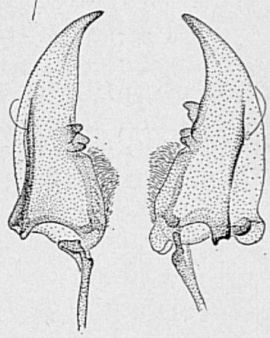

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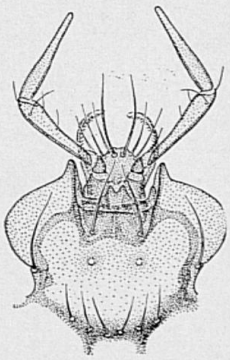

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Plate IV

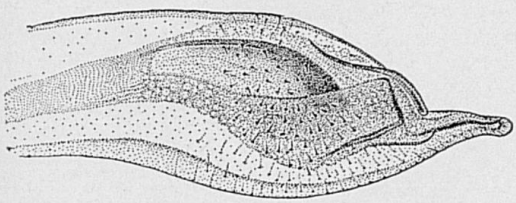
Fig. 1. Aedeagus of *Darlingtonea kentuckensis* gen. sp. nov.; Richardson's Cave, Somerset, Ky. x 80

1a. Apical end of same, transfer apparatus extruded. x 80

Fig. 2. Aedeagus of *Darlingtonea kentuckensis lexingtoni* gen. sp. ssp. nov.; Big Saltpeter Cave, Livingston, Ky.; left aspect of apical end. x 80

2a. Same, dorsal aspect. x 80

2b. Same, dorsal of transfer apparatus dissected. x 80



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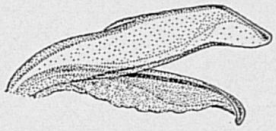

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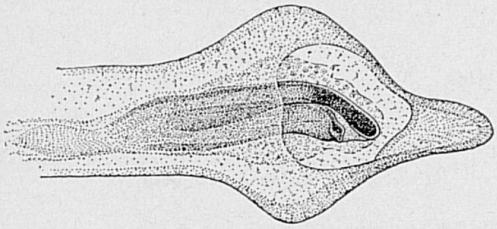

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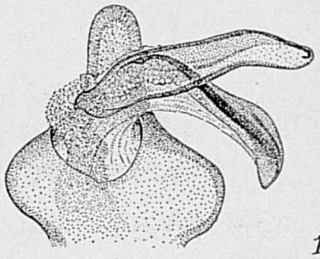

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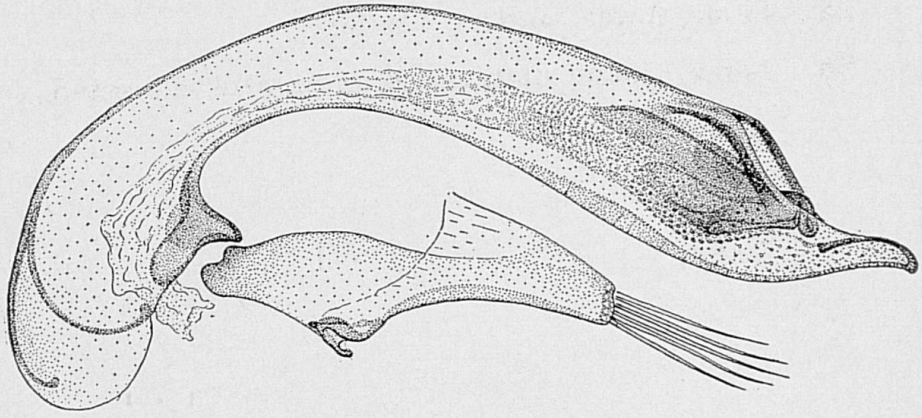

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Plate V

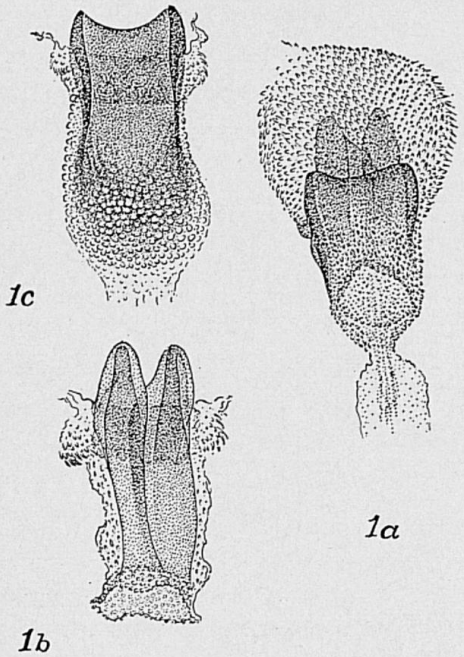
Fig. 1. Aedeagus of *Ameroduvalius jeanneli* gen. sp. nov.; Sloan's Valley Cave, Burnside, Ky. x 94 Dorsal view x 47

1a. Internal sac and transfer apparatus of same, dorsal aspect. x 94

1b. Ventral element of transfer apparatus of same, ventral aspect. x 94

1c. Dorsal element of transfer apparatus of same, dorsal aspect. x 94

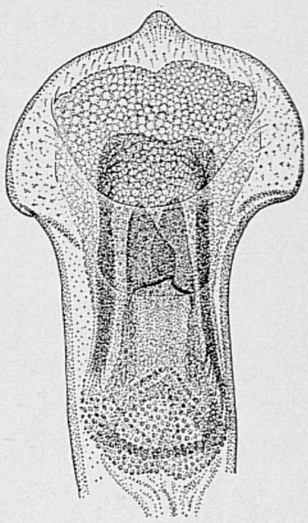
Fig. 2. Aedeagus of *Ameroduvalius jeanneli rockcastlei* gen. sp. ssp. nov.; Big Saltpeter Cave, Livingston, Ky. x 94



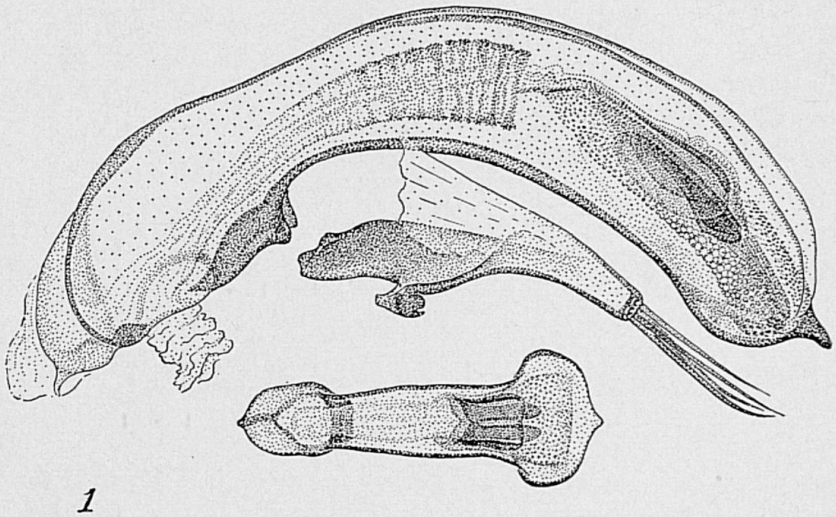
1c

1b

1a



2



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