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AN *ANOLIS* (SAURIA, IGUANIDAE) IN AMBER

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ABSTRACT—*Anolis electrum* sp. nov.—described on the basis of two partial specimens in amber from Chiapas, Mexico—is believed to be Oligocene or Miocene in age. It is thus the earliest record of this lizard genus. The new species has the characteristic digital pads of *Anolis* very well developed and is unique in combining small, uniform middorsals, smooth, subimbricate ventrals, and small scales around the interparietal with unicarinate limb scales.

INTRODUCTION

SOME time ago Robert C. Stebbins, of the Museum of Vertebrate Zoology, brought to the attention of Ernest E. Williams, of the Museum of Comparative Zoology, the occurrence of remains of the lizard *Anolis* in two blocks of Chiapas amber. This discovery is believed to constitute the first authentic record of reptilian remains in amber. The specimens were subsequently loaned to the Museum of Comparative Zoology through the kindness of Paul D. Hurd, Jr., of the Department of Entomology, Museum of Paleontology, University of California, Berkeley (UCMP).

Langenheim (1964, p. 259–276) has summarized present information and thought on Chiapas amber from a botanical viewpoint, and Hurd, Smith, and Durham (1962) have done the same from a zoological viewpoint. At present there is little that can be said in a general and synthetic way about Chiapas amber that clarifies the situation of the new species. Hurd (pers. comm.) reports that the fossils were recovered from a lot of amber purchased from local people at Simojovel; for this reason I am unable to provide precise details on the type locality of the new species, and certainly I cannot attempt a general survey of what is known about Chiapas amber here. The two papers cited above, however, are precedent to such a general survey to be undertaken subsequent to the detailed reports of specialists on the various plant and animal inclusions, of which the present paper is an example.

SYSTEMATIC DESCRIPTION

ANOLIS ELECTRUM[1] sp. nov.

Pl. 54, figs. A,B

Type.—UCMP 648496, loc. B-7047-1, the entire right hind limb, and portions of the left hind limb and trunk, imbedded in amber (see pl. 54, fig. B)

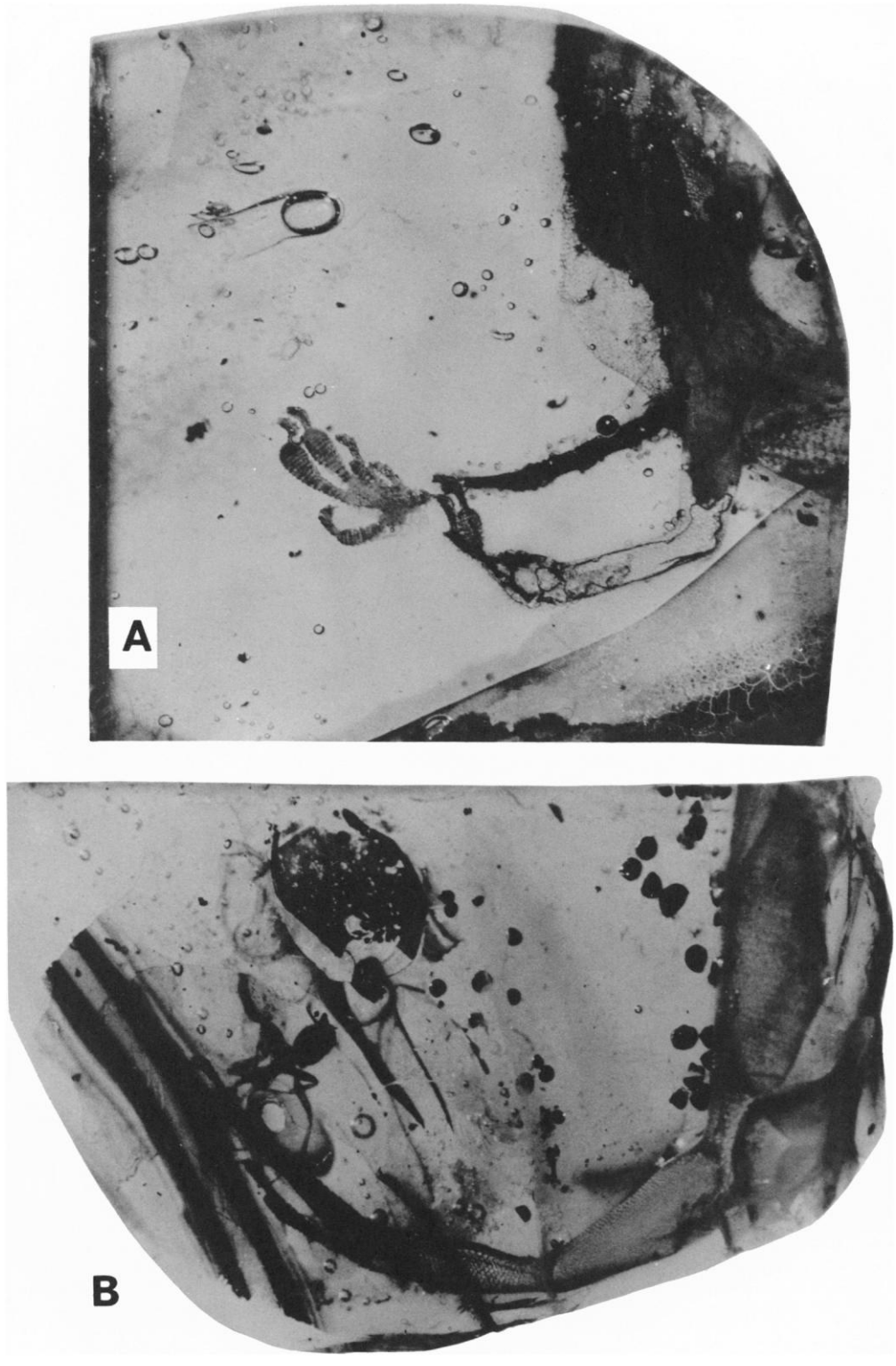
Type locality.—"From the Simojovel, Chiapas, Mexico area; precise locality unknown, but in view of known occurrences in the area, probably of latest Oligocene-early Miocene age, but possibly as young as mid-Miocene." (fide J. Wyatt Durham, Museum of Paleontology, University of California, Berkeley.)

Paratype.—UCMP 68497, loc. B-7047-3, portions of the head, trunk, and forelimbs imbedded in amber. Same data as the type.

[1] *Electrum*, Latin for amber, is here used as a noun in apposition to the generic name *Anolis*

EXPLANATION OF PLATE 54

FIGS. *A,B*—*Anolis electrum* sp. nov. *A*, Portions of head, trunk, and forelimbs (paratype, UCMP B-7047-3). *B*, Portions of posterior trunk and hind limbs (type, UCMP B-7047-1). Parts of the photographs of the amber blocks not containing *Anolis* have been trimmed from the photographs. Photos by Frank White, Department of Biology, Harvard University.


A
B

Diagnosis.—Interparietal scale bordered posteriorly by small scales blending into dorsal granules; no enlargement or other modification of the middorsal scales; dorsal granules uniform from nape to rump; ventrals smooth, swollen, subimbricate, arranged in transverse rows, and twice as large as dorsals; limb scales unicarinate; those of anterior surface of forearm nearly as large as the ventrals, those of anterior surface of hind limb smaller than ventrals, but larger than dorsal granules; digital pad and dilation pronounced; 21 or 22 lamellae under second and third phalanges of fourth toe.

Description on the type.—The thigh is ca. 5.2 mm., the lower leg ca. 4.1 mm., the distance from the heel to the tip of the fourth toe ca. 7.0 mm. The digital dilation is ca. 0.9 mm. at the widest part. The trunk, at the level of the hind limbs, is ca. 3.0 mm. in diameter.

The dorsal granules extend onto the dorsal surface of the hind limb and become gradually flattened and subquadrangular. These scales become larger and subimbricate anteriorly and distally, those along the tibia being distinctly larger than the dorsals, imbricate, and unicarinate. The supradigital scales are imbricate and multicarinate. The digital dilations are of the "raised" type of Boulenger (1885) and Williams (1963); that is, the digital pad and its lamellae extends beyond and "above" the proximal scales of the fourth phalanx.

Precise determination of the number of subdigital lamellae under the second and third phalanges is difficult without being able to move the toe. Nevertheless, there are at least 21 and perhaps 22 under these phalanges of the fourth toe.

The ventrals are smooth, subimbricate, swollen, and arranged in transverse rows. There is a distinct yolk-sac scar at the midline of the abdomen, indicating that this individual was a hatchling.

The ventrals are abruptly distinct from the dorsal granules, which are uniform and one half the size of the ventrals.

The paratype.—The anterior portions in 68497, here designated as paratype, add considerable useful information. The complete absence of modified middorsals is confirmed by examination of the shoulder and nape regions. Although the scales bordering the interparietal posteriorly are larger and flatter than the dorsal granules, they are still quite small; there is a gradual transition from them into the dorsal granules, rather than any sharp demarcation between occipital plates and dorsal granules.

The forelimb scales become immediately large, imbricate, and unicarinate. Those on the radial surface of the forearm are largest, being but slightly smaller than the ventrals.

The head, at the level of the interparietal, measures ca. 4.8 mm.; the upper arm ca. 3.9 mm.; the forearm ca. 3.2 mm.; the foot ca. 3.6 mm.

Size.—From the measurements obtained from the type the proportions can be reasonably judged; it seems evident that the paratype represents an individual of the same size as the type, and it may be the same individual (see below). *Anolis electrum* seems to have been an anole of unspecialized proportions; the type, a hatchling, probably measured between 26 mm. and 31 mm. in snout-vent length. Comparison to modern forms whose juveniles show a similar degree of yolk-sac scarring at comparable size (*e.g. A. fuscoauratus* or *A. chloris*) indicates that *Anolis electrum* probably did not grow larger than 70 mm. This is not a large *Anolis*.

Comparisons.—*Anolis* is perhaps the largest genus of living reptiles and is certainly one of the largest living amniote genera. However, since the vast majority of known species in this extremely diversified group show some sort of modification of middorsal, ventral, interparietal, or limb squamation, identification and comparison of the fossils is greatly facilitated. Middorsals may be in an enlarged zone of many scales, a double row of aligned scales, or a single row. They may be flattened, tectiform, carinate, or spike-like. Ventrals may be flattened, tectiform, or carinate. The scales around the interparietal may be variously enlarged, plate-like, swollen, tectiform, or carinate. Limb scales are often multicarinate. Many modern species of *Anolis* combine modifications in each of these areas of squamation.

There are, therefore, few living forms in which the combination of characters seen in *Anolis electrum* is at all closely approached. For example, living species like *tigrinus*, *solitarius*, and *nasofrontalis*, though they have middorsals, ventrals, and limb scales basically similar to those of *electrum*, possess strikingly enlarged and otherwise modified scales around the interparietal. Species like *limifrons*, *polylepis*, *ortoni*, *antoni*, and *leptoscelis*, though they resemble the fossils in the scales around the interparietal, ventrals, and limb scales, possess distinctly enlarged and otherwise modified middorsals. Some, like *leptoscelis*, differ as well in having narrow digital dilations and low lamellae counts.

Both *Anolis fuscoauratus* and *A. maculiventris* are very close to *A. electrum*. There is virtual agreement with respect to middorsals, ventrals, scales around the interparietal, and limb scales. Each of these, however, differs from *A. electrum*

in having comparatively narrow digital dilations and consistently less than 19 lamellae under the second and third phalanges of the fourth toe.

Anolis chloris, on the other hand, resembles *A. electrum* in ventrals, scales around the interparietal, limb scales, digital dilations, and number of subdigital lamellae. As in the fossil, the middorsals of *A. chloris* are not notably enlarged; these middorsals are, however, aligned in a distinct double row. Despite this difference, it is entirely possible that *Anolis chloris* is the closest living relative of *Anolis electrum*.

DISCUSSION

Whether or not we are dealing with two individuals, or merely two portions of the same individual, is debatable. Not only do the type and paratype indicate similar size and proportions, but the two blocks would seem to fit rather closely together. In both blocks the trunk shows evidence of twisting, so that if they do in fact represent a single individual it is not remarkable that the right side posteriorly and the left side anteriorly are the best preserved. Thus the evidence is not inconsistent with the opinion that a single individual is represented.

It is evident from degree of the differences noted that, insofar as it can be compared, *Anolis electrum* is not remarkably different from some species of *Anolis* living today — despite the fact that it may be as much as 28 million years old. Auffenberg (1957), Tihen (1962), and Estes (1962) have all noted the presence of reptile or amphibian forms in the Miocene, or even earlier, that belong to recent species groups. In the case of *Anolis*, however, it should be noted that this genus, and its close allies, represent a specialized and homogeneous subgroup of the family Iguanidae, and that this family is not known prior to the Upper Cretaceous (see Romer, 1956, p. 534).

Some of the external generic characters of *Anolis* have been discussed by Williams (1963). Regrettably, the paratype of *A. electrum* apparently represents a hatchling, and therefore the absence of a throat fan, or dewlap, is to be expected. The condition of the digital pad, however, is worthy of comment.

Among living lizards only geckos and anoles show dilations under the penultimate phalanges that form pads. These pads show various arrangements in geckos, but anoles consistently possess a single series of overlapping, transversely arranged scales—the subdigital lamellae. It is common among anoles for this pad, with its lamellae, to be sufficiently well developed so that it protrudes beyond the distal end of the penultimate phalanx, and actually overlies the proximal squamation of the terminal phalanx. This is the "raised" condition mentioned above, and the condition demonstrated definitively in *Anolis electrum*.

It is unusual in vertebrate paleontology when structures other than bones can be compared. In this case, however, only the skin and its squamation remain; the fossils were preserved in amber, and apparently initially imbedded in such a way so that there was access to the internal structures for decay and other degenerating agents. If vertebrae or portions of the skull were available, it would be much easier to relate this fossil form more precisely to species of living *Anolis*.

Anolis electrum gives every indication of being a thoroughly arboricolous form; well developed digital dilations and comparatively high lamellae counts, for a rather small species, are excellent evidence of arboreal habits. This interpretation is corroborated by the very fact that this hatchling became entrapped in an amber-forming tree resin (Langenheim, 1964).

Anolis today is not only a very large and diverse genus, but a widely distributed one as well. Anoles occur throughout most of tropical and coastal Mexico, all of Central America and the West Indies, over most of tropical South America, the southern United States, and even on such eastern Pacific islands as Malpelo and Coco. Of the three forms apparently closest to *Anolis electrum*, however, none occurs in southern Mexico or Central America today. *A. fuscoauratus* is widely distributed over northern South America east of the Andes. *A. maculiventris* and *A. chloris* are both forms from the Choco region of coastal Colombia, though the latter occurs southward into Ecuador. Of all the anoles closely comparable to *electrum*, only one, *A. limifrons*, occurs in southern Mexico today; it is very close to *A. fuscoauratus* and extends southward to Panama. In this form the dorsals enlarge gradually towards the midline, where they are aligned to form a noticeable, double, middorsal row. All other species of *Anolis* currently known from Mexico differ so markedly from *A. electrum* that comparison is not called for.

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