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GIANT CARNIVOROUS LAND SNAILS FROM MEXICO AND CENTRAL AMERICA

FRED G. THOMPSON[1]

Abstract: The taxonomy of four known species of *Euglandina* (Gastropoda, Pulmonata, Spiraxidae) is reviewed, and each is redescribed. *E. vanuxemensis* (Lea) includes the following synonyms: *Achatina coulteri* Gray, *Glandina coronata* Pfeiffer, *Glandina uhdeana* Martens and *Glandina guttata* Crosse and Fischer. *E. aurata* (Morelet) includes as a synonym *Achatina lignaria* Reeve. *E. sowerbyana* consists of two subspecies: *E. s. sowerbyana* (Pfeiffer) and *E. s. estephaniae* (Strebel). *E. gigantea* Pilsbry is monotypic. *E. gigantae gabbi* Pilsbry is a synonym. *Euglandina pan* new species and *Euglandina titan* new species are described from Guatemala.

RESUMEN: Se revisa la taxonomía de cuatro especies conocidas de *Euglandina* (Gastropoda, Pulmonata, Spiraxidae), y se redescribe cada una de ellas. *E. vanuxemensis* (Lea) incluye los siguientes sinónimos: *Achatina coulteri* Gray, *Glandina coronata* Pfeiffer, *Glandina uhdeana* Martens y *Glandina guttata* Crosse y Fischer. *E. aurata* (Morelet) incluye a *Achatina lignaria* Reeve como sinónimo. *E. sowerbyana* consiste de dos subespecies: *E. s. sowerbyana* (Pfeiffer) y *E. s. estephaniae* (Strebel). *E. gigantae* es monotípica. *E. gigantae gabbi* Pilsbry es un sinónimo. Se describe dos especies nuevas provenientes de Guatemala: *Euglandina pan* y *Euglandina titan*.

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INTRODUCTION

The purpose of this paper is to review the taxonomy of six species of carnivorous land snails from Mexico and Central America belonging to the typical species group of *Euglandina*. Species of this group attain a

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length of over 90 mm and are closely related to *E. aurata* (Morelet), the type species of *Euglandina*. They are large and attractive, and because of these qualities they were among the first land snails collected by naturalists. Relatively few specimens have been available to earlier reviewers of the genus, and considerable confusion exists in the literature concerning the systematics of the group. Apparently they are closely related, but this is not a settled question. Their shells share characteristics of sculpture and color suggesting kinship. However, the anatomy of only *E. sowerbyana* (Pfeiffer) has been described (Strebel 1887:34–35), and specimens satisfactory for dissection are not available for the other species. Thus, important questions concerning interspecific relationships must remain in obeisance. This group includes the largest species of *Euglandina*. They are exceeded in size among land snails only by some species of *Achatina*, *Corona*, *Megabulimulus*, and *Placostylus*, all of which are herbivores.

Euglandina is a very large, widely distributed genus. Over one hundred species have been described. The genus is distributed from Texas to Bolivia, with one species of Mexican derivation occurring in the southeastern United States. The majority of the species are found in Mexico. The genus is difficult to work with taxonomically. Most species are known only from a few specimens, and their shells are highly variable. All too often original descriptions lack critical details of the sculpture and embryonic shell structure, and the descriptions are scattered among nineteenth century journals and treatises that are available in only a few libraries. Important references to *Euglandina* are Strebel (1875), von Martens (1890), and Pilsbry (1907). Numerous species have been described since Pilsbry. Strebel classified species within the genus based on characteristics of the embryonic shell. Later authors followed his system with minor alterations. Baker (1941, 1943) proposed a classification based on shell and soft anatomical features.

Euglandina has undergone extensive adaptive radiation. Species are found in biomes as diverse as the Sonora Desert, thorn scrub forests, montane pine forests, cloud forests, and tropical rain forests. Most subgenus and species groups are found in a single type of biome and have rather discrete geographic distributions similar to those demonstrated by reptiles and amphibians. Habitat selection and ecological-geographical isolation appear to have been key factors involved in speciation. Of the six species discussed in this paper, five are arboreal in rain forests and confined to a single physiogeographic region, and one is terrestrial and found in xeric habitats in the desert plains of Puebla and adjacent states. The majority of specimens in museums were collected by herpetologists, whose field techniques lead them to examine epiphy-

tic habitats, such as bromeliads, and to search trees and shrubs at night for amphibians and reptiles. The arboreal habitat of these snails is reflected in the streaked color pattern of their shells. Arboreal snails usually have patterned shells, whereas terrestrial species generally are unicolor. Most species of *Euglandina* are terrestrial.

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ABBREVIATIONS

The following standard museum designations are used in this paper.

AMNH - American Museum of Natural History, New York
FMNH - Field Museum of Natural History, Chicago
MCZ - Museum of Comparative Zoology, Harvard University
UF - Florida State Museum, University of Florida
UMMZ - Museum of Zoology, University of Michigan
USNM - National Museum of Natural History, Washington

THE GIANT SPECIES OF *EUGLANDINA*

This paper discusses those Mexican and Central American species of *Euglandina* that are closely related to *E. aurata* (Morelet), the type species of *Euglandina*. Five are alike in being arboreal, in having relatively ponderous shells with pronounced axial and spiral sculpture, a crenulate suture, and a glossy yellow-orange periostracum with occasional darker longitudinal shreaks. A sixth Mexican species, less closely related, is also included in this group because of its large size and similar sculpture. It differs by its terrestrial habitat and color pattern. It is the first species to be discussed.

Euglandina vanuxemensis (Lea)

Figures 7–9

Achatina vanuxemensis Lea 1834:84.
Glandina coulteri Gray, *in* Beck 1837:78.
Achatina coronata Pfeiffer 1846:158.
Glandina uhdeana Martens 1863:540.
Glandina guttata Crosse and Fischer 1869:250.

A nearly complete synonymy of each of these names was given by Martens (1890:54,56). Subsequent citations add no information concerning their taxonomic status. The most recent revisions of the genus recognize two species (Martens 1890; Pilsbry 1907): *Euglandina vanuxemensis* (Lea) (syn.: *coronata*, and subspecies *guttata*) and *E. coulteri* (Gray) (syn.: *uhdeana*). The material that I have examined permits only one taxon to be recognized (see discussion).

DESCRIPTION.—Shell medium to large in size, attaining a length of up to 100 mm. Oblong in shape, being widest near the base at maturity; less mature specimens may be elliptical-ovate in shape; shell about 0.42–0.47 times as wide as high. Spire variable in shape, usually convex-conical in outline (Fig. 8); some specimens have a concave-shaped spire which may be attenuated at definitive growth. Spire 0.34–0.47 times length of shell. Suture moderately impressed. Whorls evenly convex between sutures. Body whorl widest in middle in immature specimens (Fig. 7), widest near base at maturity (Fig. 8). Embryonic whorls 3.2–3.4 (Fig. 3), dome-shaped with a very weakly impressed suture. First three embryonic whorls smooth; next half whorl with fine close longitudinal striations. Subsequent postembryonic whorls with close axial threads that vary greatly in intensity. *Some of these coalesce dorsally to form relatively widely spaced conical white denticles that crenulate the suture* (Fig. 11). *Denticles not demarcated from threads by spiral striations along their bases*. Axial threads crossed by widely spaced, weakly differentiated spiral striations that produce vaguely defined decussations on the axial threads (Fig. 11). *Spiral sculpture restricted to upper third of whorl*. Aperture elongate auriculate in shape; widest near base. Parietal wall convex. Columella moderately long and strongly twisted to the right at an angle of about 27–30° to shell axis. Outer lip extended forward below middle; basal lip retracts slightly. *Ground color tan or light ochraceous-brown; marked with scattered blurred white spots followed by darker brown streaks extending in direction of mouth*. Spots and streaks evident even in dead bleached shells.

Measurements in mm of four specimens selected to show variation are:

	length	width	aperture height	whorls	width/length	apert./length
MCZ 102961	47	21	28	6.1	0.45	0.59
MCZ 254629	58	24	31	6.1	0.41	0.53
UF 34909	62	29	41	6.8	0.47	0.66
UF 20808	100	42	55	7.5	0.42	0.55

TYPE LOCALITIES.—*Achatina vanuxemensis*: Mexico, without nearer indication of locality. *Glandina coulteri*: no locality stated. *Achatina coronata*: Mexico, without nearer indication of locality. *Glandina uhdeana*: State of Veracruz. *Glandina guttata*: near Pueblo (presumably the city of Puebla in the state of Puebla).

DISTRIBUTION (FIG. 16).—Confined to south-central Mexico in the desert plateau of Oaxaca, Puebla, and adjacent areas of Mexico and Hidalgo at altitudes of 1285–2375 m.

SPECIMENS EXAMINED.—PUEBLA: 3.6 mi SW of Chapulco (UF 34909); 8.1 mi SW Izucar de Matamoros 4800 ft alt (UF 34721); Hwy. 150, 1.5 mi SW of Veracruz-Puebla border (UF 35027); Puebla (USNM 185940, MCZ 201215, MCZ 102961-paratype of *G. guttata*); Tecamachalco, 7500 ft alt

(UF 21327); 1.1 mi N of Tecamachalco, 7500 ft alt (UF 21329); Tehuacan (UNSM 443810, USNM 522954, USNM 162305, MCZ 254626, MCZ 10716, MCZ 137982); Tepeaca (UF 34670). OAXACA: El Punto (UF 20808); Cuicatlan (USNM 251618); Huajuapan de Leon (USNM 591572); 8.3 mi SE of Nochistlan, 7700 ft alt (UF 34571); Hwy. 131, 3.2 mi E of turnoff to Nacaltepec (UF 35306); 0.7 mi W of Tlapacoyan, 5000 ft alt (UF 34651). "CAMPECHE" (USNM 192985). "MEXICO" (USNM 116746, USNM 57079, UMMZ 10970).

OTHER RECORDS.—Martens (1890:54,56) recorded this species for the following localities. HIDALGO: Zimapan. MEXICO: Volcan de Mexicalcingo. OAXACA: Oaxaca; Juquila. GUERRERO: Omilteme. VERACRUZ: Jalapa. Baker (1941:60) gave the following records. MEXICO: Teotihuacan; Guajimalpa.

Martens (1890: pl. 2, fig. 2) figured the specimen from Zimapan, based on a drawing of a shell presented to Mr. Abraham Lincoln and later deposited in the Peel Park Museum. It differs from typical *E. vanuxemensis* by its slender form, weak subsutural crenulation and its coloration, having longitudinal reddish streaks on a white background. It is similar to another specimen I have examined from 9.5 mi SW of Pinal de Amoles, Queretaro (UF 21329). Martens also figured the specimen from Omilteme. It differs in shape from other specimens I have examined,

being considerably wider and ovate in form, and its subsutural denticles are weak and poorly defined. I do not believe the specimens in question are *E. vanuxemensis*. Other records given by Martens and Baker are geographically proximal to the distribution based on specimens I have examined.

REMARKS.—This species is variable in shape and undergoes considerable ontogenetic change. The synonyms are based on varying degree of obesity and different growth stages. *Achatina vanuxemensis* Lea was based on a half grown specimen 53 mm long with a weakly convex spire. *Glandina coulteri* Gray was based on a slender specimen 90 mm long, 30 mm wide, and an aperture 57 mm long (Pfeiffer 1859:642–643). *Achatina coronata* Pfeiffer was based on an adult 88 mm long with an obese convex spire. *Glandina uhdeana* Martens was founded upon a specimen 67 mm long with a narrow attenuated spire. *Glandina guttata* was based on a typical medium-sized specimen 69 mm long with a regularly conical spire. The material that I have examined does not allow any to be recognized as distinct taxa.

The date of publication of the name *vanuxemensis* usually is cited as 1837, the final date of publication of Volume 5 of the *Transactions of the American Philosophical Society*. However, the date of publication of the issue in which the species is described was 1834. Its description was read before the society in 1832. Thus *vanuxemensis* is the oldest available name among five synonyms, dating in publication from 1834.

Euglandina vanuxemensis is characterized among other species by its color pattern, which is unique within the genus. Its sculptural characteristics differentiate it from the species discussed in this paper. *E. vanuxemensis* also differs from these other species in that it is terrestrial and lives in xeric habitats at moderate to high altitudes (about 1500–2300 m). Specimens were found at night by John B. Iverson and me crawling on rock piles and cactae. Baker (1941:60) reported finding specimens in plant debris in xeric stations.

Euglandina s. sowerbyana (Pfeiffer)

Figures 17–20

Achatina sowerbyana Pfeiffer 1846:32.—Pfeiffer, 1853:292.—Reeve 1849:pl. 8, figs. 26.
Glandina sowerbyana (Pfeiffer) Albers 1850:198.—Fischer and Crosse 1870:98.—Strebel 1875:15; pl. 5, figs. 10a–11.—Strebel 1878:34–44, pls. 15–21 (anatomy).—Martens 1890:55.
Oleacina sowerbyana (Pfeiffer) Gray 1855:33.—Tryon 1885:36, pl. 6, fig. 86.
Euglandina sowerbyana (Pfeiffer) Pilsbry 1907:186.
Glandina lignaria (Reeve) Fischer and Crosse 1870:97; pl. 3, fig. 1.

DESCRIPTION.—Shell large, up to 110 mm in length; moderately stocky, being about 0.42–0.48 times as wide s high. Spire 0.42–0.49 times length of shell, variable in contour; most specimens have a convex outline (Fig. 17); some have an attenuated spire that is concave in outline (Fig. 19), as in *E. gigantea*. Specimens over 85 mm long with 7.0–7.5 whorls. Suture moderately impressed with whorls evenly convex between sutures. Embryonic whorls 3; *apical whorl raised and dome-shaped* (Fig. 1), not coiling in a plane as in *E. gigantea*. Embryonic whorls initially smooth, but third whorl with comma-like striations along suture which continue as well-defined growth striations on subsequent whorls. Postembryonic whorls with nearly uniform, moderate, incremental striations and spiral striations (Fig. 10). The latter decrease slightly in intensity near base, and decussate incremental striations to form *elongate granules that are about twice as high as wide*; granules strongest on upper half of whorls. Suture bordered by a band of elongate bead-like denticles that are nearly uniform in size and are demarcated by a weak spiral groove. *Aperture elongate-auriculate, being widest near the base*; about 0.51–0.58 times length of shell. Parietal wall strongly *convex*. *Columella short and twisted to the right* at an angle of about 30° to the axis of the shell; forming a continuous curvature with the left basal side of the body whorl. Outer lip arched forward below periphery.

Measurements in mm of three large specimens follow.

	length	width	aperture height	whorls	width/length	apert./length
MCZ 219466	85	39	54	7.0	0.44	0.64
USNM 128291	97	41	55	7.2	0.42	0.57
UF 21334	109	52	61	7.5	0.48	0.58

TYPE LOCALITY.—Totontepec, Oaxaca, Mexico. Holotype in British Museum (Natural History).

DISTRIBUTION (FIG. 16).—Known from eastern Mexico in the states of Veracruz and immediately adjacent areas of Oaxaca and Puebla.

SPECIMENS EXAMINED.—PUEBLA: Puerto Morales, nr. Acultzingo 2770 m. alt. (MCZ 219466. 8 specimens). VERACRUZ: Catamaco (UF 21334); Cerro Mano Blanco, nr. Catamaco (MCZ 201236); Cerro Chicahuaxtla nr. Cuantlapan (UF 39852); Jalapa (USNM 512042); pine forest nr. Veracruz (USNM 526229); Volcan San Martin (UF 20807); Volcan Tuxla (Volcan San Martin), 1475 m alt (USNM 128291). "MEXICO": (USNM 317426, USNM 10529, MCZ 10707).

OTHER RECORDS.—Martens (1890:55) recorded *E. s. sowerbyana* from the following localities in the state of VERACRUZ: Misantla; San Jose; San

Juan Miachutlan; Pacho; Jalapa; Mirador; Cerro Necoxtla between Jalapa and Orizaba, 3000–5000 ft; Orizaba.

Martens listed a specimen collected at Omilteme, Guerrero, by H.H. Smith. This record is dubious because such a biogeographic distribution is unprecedented among land snails. Records from Guatemala refer to *Euglandina pan* Thompson. Records from Costa Rica and Panama refer to *Euglandina gigantea* Pilsbry.

REMARKS.—*Euglandina s. sowerbyana* is a well differentiated snail with a restricted distribution in eastern Mexico. It is most similar to *E. gigantea,* but differs from the latter as is discussed under that species. Like *E. gigantea* it is an arboreal snail. Strebel (1878:35) stated that live specimens were found on trees and banana plants, as well as in vegetative debris on the ground. Roy McDiarmid collected a live specimen in an arboreal bromeliad (UF 29852).

Euglandina sowerbyana estephaniae (Strebel)

Figures 21–22

Glandina sowerbyana form D, Strebel 1875:17–18; pl.3, figs. 3, 3a.
Glandina estephaniae Strebel 1878:45; pl. 16, figs. 1–8 (anatomy).—Tryon 1885:36; pl. 8, fig. 5.
Euglandina sowerbyana estephaniae (Strebel) Pilsbry 1907:186.

This subspecies differs from typical *sowerbyana* by its smaller size and slender form. The largest specimen I have examined is 88 mm long (UMMZ 10969). Measurements taken from Strebel (1895:17) and the few specimens I have examined give a width/height ratio of 0.38–0.45.

TYPE LOCALITY.—Miahuatlan, between Jalapa and Misantla, Veracruz, Mexico.

DISTRIBUTION (FIG. 16).—This subspecies is known only from a small area around the type locality. I have examined only one specimen from a specific locality, Jalapa (FMNH 75). Baker (1941:60) collected specimens from Cordoba to Sumidero, 2625–3400 ft altitude.

Euglandina gigantea Pilsbry

Figures 25–26

Euglandina sowerbyana form B, Strebel 1875:16; pl. 5A, figs. 10.
Euglandina gigantea Pilsbry 1926:128; pl. 11, figs. 5–7; pl. 10, fig. 8.
Euglandina gigantea gabbi Pilsbry 1926; pl. 11, figs. 1, 2.

DESCRIPTION.—Shell large, attaining a length of 105 mm; stocky, 0.44–0.48 times as wide as high. Spire conical, and straight sided (Fig. 25) or

concave in outline (Fig. 26), 0.40–0.48 times height of shell. Specimens over 60 mm long with 6.0–7.3 whorls. Suture moderately impressed; whorls evenly convex between sutures. Embryonic whorls 3.4–3.6, smooth. *Apex blunt; first whorl revolving in a plane* (Fig. 2), not raised as in *E. sowerbyana* (Fig. 1). Next two embryonic whorls conical with a weakly impressed suture. Following postembryonic whorls sculptured with strong growth striations and spiral striations (Fig. 12). Spiral striations strongest on upper half of whorls, weak near base. Spiral striations *decussating* growth striations to form *elongate granules that are slightly higher than wide*. Suture bordered by a band of nearly uniform-sized elongate beads that weakly crenulate the suture. Aperture about 0.52–0.60 times length of shell; narrowly auriculate in shape *with a nearly straight parietal wall*. Columella elongate, strongly twisted to the right to lie at an angle of 23–28° to the axis so as to form a long straight profile with the left base of the shell (Fig. 26). Outer lip arched forward in lateral profile. Color yellowish with darker orange longitudinal streaks irregularly spaced along lines of growth. Interior of aperture with a white tinge.

Measurements in mm based on five specimens selected to show maximum variation follow.

	length	width	aperture height	whorls	width/length	apert./length
UMMZ 48711	90	43	52	7.3	0.48	0.58
UF 20751	89	42	49	6.7	0.47	0.57
USNM 568778	81	36	42	7.3	0.44	0.57
UF 21138	72	34	43	6.0	0.47	0.60
MCZ 211237	62	28	42	6.3	0.45	0.68

TYPE LOCALITY.—*Euglandina gigantea*: "Salinas Bay, in southwestern Costa Rica." This is amended to Bahia de Salinas, near La Cruz, Guanacaste Provence, Costa Rica. No locality was given for *E. gigantea gabbi*. The holotypes of both are in the Academy of Natural Sciences, Philadelphia.

DISTRIBUTION (FIG. 27).—Widely distributed in Costa Rica from near sea-level to 2600 m altitude. Also known from Chiriqui Province, Panama.

SPECIMENS EXAMINED.—COSTA RICA—*Alahuela Prov.*: Rio Frio (UF 21138, 2 specimens). *Cartago Prov.*: Estrella, nr. Cartago, 1500 m alt (MCZ 211237); Tapanti, 1300 m alt (UF 39851, 39854). *Guanacaste Prov.*: Finca El Silencio, 850 m alt (UF 20751); Nicoya (MCZ 77614); Tilaran (USNM 568777, 568778). *Puntarenas Prov.*: Coto, 10 m alt (UNSM 522573, 522574); Rincon (UF 39855); 2.5 km NE of Monte Verde (UF

39853); Terraba, 700 m alt. (USNM 190272). "COSTA RICA" (no additional data): (AMNH 40405, FMNH 36297, MCZ 1777, UNSM 365585). PANAMA—*Chiriqui Prov.*: Boquete (UMMZ 48711).

OTHER RECORDS.—Martens (1890–1901:55, 601) gave the following records for this species as *E. sowerbyana*. COSTA RICA—*Alahuela Prov.*: San Carlos; Turubares, 250 m (Turrucares ?). *Cartago Prov.*: Cache (Cachi). *Guanacaste Prov.*: Rio Jesus Maria. *Heredia Prov.*: Sarapiqui (on Rio Sarapiqui); Puerto Viejo. *Limon Prov.*: Reventazon, 500 m (on Rio Reventazon). *San Jose Prov.*: San Jose, 1161 m. PANAMA—*Chiriqui Prov.*: Chiriqui; Volcan de Chiriqui, 3000 ft.

Pilsbry (1926:128) corrected earlier misidentifications for *E. gigantea*, and added Bahia de Salinas (see TYPE LOCALITY).

REMARKS.—*Euglandina gigantea* is most similar to *E. sowerbyana* in general appearance and size. It is characterized by the narrow shape of its aperture with a nearly straight parietal wall, its long columella that is twisted to the right to form a long straight profile with the left base of the shell, its blunt apex, and its relatively short granular sculpture. *E. sowerbyana* has a wide, tear-shaped aperture with a convex parietal wall, the columella is shorter and forms a weakly convex curvature with the left basal side, the apical whorl is raised and knob-like, and the granular sculpture is elongate, being about twice as high as wide.

Aside from the shape of the spire, *E. gigantea* shows little variation throughout its range. The shape of the spire does not seem to have any geographic or altitudinal correlations. Martens (1901:610), who discussed this species as *E. sowerbyana*, quoted Biolley as stating that specimens from the elevated central planes of Costa Rica are smaller than those from lower elevations. I have found no such correlation among the specimens I have examined. The largest specimen before me was collected at 850 m altitude (UF 20751).

Pilsbry (1926:129) differentiated *E. gigantea gabbi* from *E. g. gigantea* by having a smaller, thinner shell and weaker sculpture. These characteristics are typical for immature *gigantea*, and they have no taxonomic significance, especially in light of the fact that his specimens of *gabbi* came from an unspecified locality.

All specimens that I have examined for which ecological data are available indicate that this species is arboreal. It has been found among arboreal ferns and bromeliads and crawling on three trunks at night.

Euglandina pan, new species

Figures 28–29

DESCRIPTION.—Shell medium-sized, attaining a length of 70 mm.

Moderately obese and fusiform, being about 0.42–0.46 times as wide as high, with a moderatly inflated body whorl. Spire elongate and convex in outline, 0.44–0.53 times length of shell, but usually shorter than height of aperture. Whorls 7.0–7.4 (7.3 in holotype). Suture moderately impressed and wavy due to crenulate sculpture. Whorls weakly convex betwen sutures. Embryonic whorls 3.2, smooth forming a rounded apex (Fig. 5), first whorl planular, not raised as in *E. aurata*. Following two whorls broadly convex-conical and moderately convex between sutures. Postembryonic whorls with coarse axial striations that are irregular in intensity and form *large, white, coarse denticles along suture* (Fig. 13). *Denticles variable in size and unevenly distributed along suture: not demarcated as a subsutural band* as in *E. sowerbyana* or *E. aurata*. Axial striations crossed by finer spiral striations which form cancellate granules that are about half as wide as high. Spiral striations most conspicuous on shoulder of whorl; barely distinguishable near base of shell. Aperture narrowly auriculate in shape, about 0.47–0.56 times length of shell. *Columella relatively short, weakly twisted to the right at an angle of about 16-18° to shell axis* (Fig. 28). Color yellowish-white with darker, irregularly spaced longitudinal streaks.

Measurements in mm of four specimens follow.

	length	width	aperture height	whorls
Paratype (MCZ 2722)	61	27	34	7.0
Paratype (FMNH 72223)	64	27	30	7.4
Paratype (UMMZ 166643	65	30	36	7.2
Holotype (USNM 487385)	70	31	38	7.3

TYPE LOCALITY.—Guatemala, Departamento Guatemala, Finca Las Delicias, near Barillas. Holotype: UNSM 487385; collected by T. Burch October 8, 1946.

OTHER LOCALITIES.—GUATEMALA—*Departamento Guatemala:* Barillas (UMMZ 166643 - 1 paratype); Santo Catarina, 5 km from Guatemala City (FMNH 72223 - 1 paratype); Silvada Rd., 18 km from Guatemala City, 6000 ft alt (FMNH 72224 - 1 paratype); no data (MC2 2722 - 1 paratype).

DISTRIBUTION (FIG. 32).—Known only from moderate elevations in central and southern Departamento Guatemala, Guatemala.

REMARKS.—*Euglandina pan* is distinguished from other species by its coarse, irregular denticulate sculpture along the suture, which are not

demarked as a subsutural band, as in related species. The columella is twisted to the right to about the same extent as in *E. gigantea* Pilsbry, but it is shorter, imparting upon the aperture an auriculate shape as opposed to the nearly elliptical shape of *E. gigantea*. *E. pan* is most similar in sculpture, form, and color to *E. aurata* (Morelet). Differences between the two species are discussed under the latter.

Euglandina pan has been recorded erroneously in the literature as *E. sowerbyana*. Martens (1890:55) recorded a specimen from Guatemala City, and Jousseaume (1878:169) reported the species from Verapaz. These two records probably refer to *E. pan*.

ETYMOLOGY.—The species name *pan* is from the Classical Greek mythology, *pan*, a deity of the woodland.

Euglandina aurata (Morelet)

Figures 30–31

Glandina aurata Morelet 1849:12.—Fischer and Crosse 1870:106; pl. 3, figs. 7, 7a.—Martens 1890:57.

Oleacina aurata (Morelet) Gray 1855:33.—Pfeiffer 1859:642.—Tryon 1885:36; pl. 6, fig. 83.

Achatina lignaria Reeve 1849: pl. 8, fig. 27.—Pfeiffer 1853:517.

Oleacina lignaria (Reeve) Gray 1855:34.—Pfeiffer, 1859:642.

Euglandina aurata (Morelet) Pilsbry 1907:188.

DESCRIPTION.—Medium-sized, attaining a length of up to 94 mm. Elongate-fusiform in shape; about 0.41–0.44 times as wide as high. Spire equal to or less than height of aperture, being about 0.39–0.52 times length of shell. Whorls 6.6–7.5; weakly convex with a shallow suture. Embryonic whorls 3.7, smooth (Fig. 6). First whorl raised and nearly conical; following two whorls regularly descending. Postembryonic whorls sculptured with incremental striations that form moderately small white denticles that crenulate the suture (Fig. 15). Denticles demarked as a narrow band by a spire groove at their bases. Incremental striations crossed by weaker spiral striations that form a fine pattern of rectangular granules which are about half again as high as wide. Spiral sculpture continuous but diminishing in intensity near base of shell. Aperture elongate-auriculate in shape, about 0.48–0.61 times length of shell. *Columella relatively long compared to* E. pan, *straight and vertical, not twisted to the right* (Fig. 30) *or forward* (Fig. 31). Outer peristome nearly straight in lateral profile and recurved near base. Color yellowish with irregularly spaced darker orange streaks along line of growth. Interior of aperture yellowish-white.

Measurements in mm of four specimens follow:

	length	width	aperture height	whorls
UMMZ 136471	74	32	39	7.4
USNM 162302	61	27	37	6.6
MCZ 6752	65	27	35	6.5
AMNH 55140	78	34	38	7.5

TYPE LOCALITY.—"Woods of Vera Paz." Undoubtedly this is within the Departamento Alta Verapaz, near Coban, and not the small village of Verapaz in the Departamento Esquintla along the Pacific coast. Morelet visited Coban, and this area is within the known range of the species. The holotype is in the Museum National d'Histoire Natural in Paris.

DISTRIBUTION (FIG. 32).—This species is known only from higher elevations in the Departamentos Alta Verapaz and Chimaltenango, Guatemala.

SPECIMENS EXAMINED.—GUATEMALA—*Depto. Alta Verapaz*: no further data (UMMZ 136471). *Depto. Chimaltenango*: Santa Elena, near Tecpan (FMNH 13627). *Specimens with no data*: AMNH 55410(1), USNM 162302(1), MCZ 6752(1). Martens (1890:57) recorded the species from Coban and from mountain forests between Tepan (Tecpan?) and Totonicapan, 8000–9000 ft alt.

REMARKS.—*Euglandina aurata* is similar in size and general appearance to *E. pan*. *E. aurata* differs from the latter by its finer spiral sculpture which produces finer and shorter granules with the incremental striations. The two species differ conspicuously in the crenulate denticles along the suture. In *E. aurata* the denticles are nearly uniform in size and spacing, they are set off from below by a spiral incised line, and the suture follows a regular course in its descent. In *E. pan* the denticles are irregular in size and spacing, they are not demarcated as a band by a spiral groove, and the descent of the suture follows an irregular course. The columella margins of the aperture of the two species differ. *E. aurata* has a relatively long, straight columella that is aligned with the axis of the shell. &. L has a short twisted columella that is flexed to the right and forward. Both species differ from the other discussed in this paper by their relatively small size, details of the sculpture as are set forth in the descriptions, and aspects of the aperture shape and columella.

The names *Glandina aurata* Morelet 1849 and *Achatina lignaria* Reeve 1849 are based on nearly identical specimens. Both names were proposed at the same time but *aurata* has page priority over *lignaria*.

Euglandina titan, new species

Figures 23–24

DESCRIPTION.—Shell gigantic, reaching a length of over 110 mm. Obese, elongate ovate in shape, about 0.50 times as wide as high, with a corpulent body whorl. Spire elongate, almost as high as aperture; first five whorls of spire forming a concave outline; subsequent part of spire weakly convex. Whorls 8.0; suture moderately impressed; whorls evenly convex between sutures. Embryonic whorls 2.2, smooth (Fig. 4). First whorl protruding and conical; following whorls regularly descending. First two postembryonic whorls with low, evenly spaced riblets that terminate abruptly at suture. Sculpture on subsequent whorls smooth and glossy. *Suture weakly crenulate by a subsutural cord of enlarged irregular poorly defined beads* (Fig. 14). *Surface of whorls with weak growth striations and occasional minute papillae that may be aligned in short spiral or longitudinal series* (Fig. 14). *Spiral striations absent.* Aperture narrowly auriculate; columella weakly spiral, truncate, slightly curved to the right. Outer lip slightly sinuous in lateral profile. (The periostracum of the holotype is completely denuded from the exterior surface; a portion of the parietal callus 2 cm long was removed from deep within the aperture to expose the underlying periostracum.) Color light orange with occasional longitudinal reddish streaks such as occur in *E. sowerbyana*. Measurements of the unique holotype are: length, 112 mm; width 57 mm; aperture height 62 mm. Type Locality.—Guatemala, Departamento Izabel, Montanas del Mico, 4 km WSW of Puerto Santo Tomas at 800 m elevation in a tropical rain forest. Holotype: UF 35307; collected 2 May 1981 by Jonathan A. Campbell.

DISTRIBUTION (FIG. 32).—Known only from the type locality in the Montanas del Mico, Guatemala.

REMARKS.—This species is similar in shape and size to *Euglandina sowerbyana* (Pfeiffer) and *E. gigantea* Pilsbry. The three species are huge, exceeding 100 mm in length. The general shapes of the shell are similar. They also have similar coloration, although *E. titan* is darker. *E. titan* differs from the other two species by its more ponderous shape, larger number of whorls, smooth sculpture, and nearly straight columella. Both *E. sowerbyana* and *E. gigantea* are narrower, being about 0.40–0.48 times as wide as high, both have a maximum of 7.5 whorls, both have decussate sculpture consisting of coarse longitudinal and spiral striations, both have a distinct, beaded subsutural cord that crenulates the suture, and both have a spiral columella that is strongly flexed to the right. The sparce, weakly papillate sculpture of *E. titan* appears to be an extreme modification of the decussate sculpture of the other two species.

ETYMOLOGY.—*Titan* from the classical Greek mythological diety *Titan*, the neuter child of Uranus and Gaea, a symbol of large size and fearful nature, alluding to the snail's gigantic size. It is the largest known terrestrial carnivorous snail.

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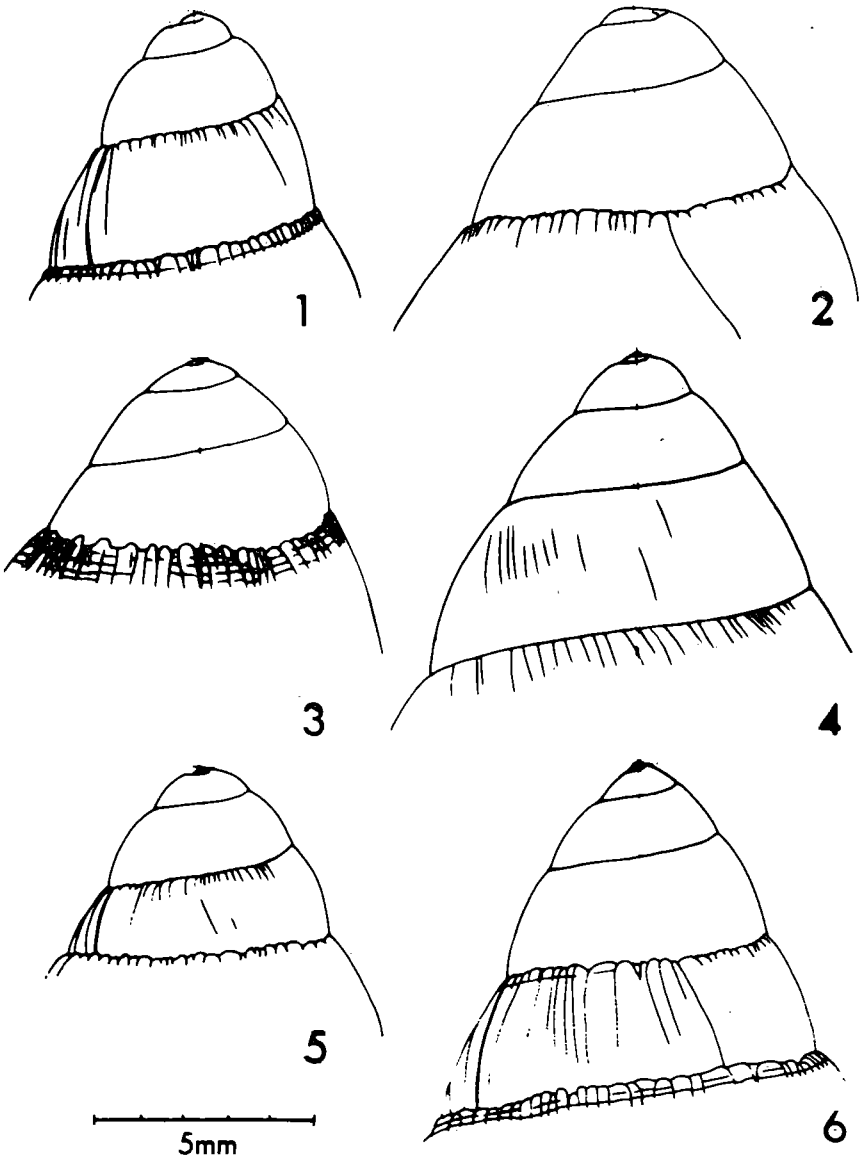
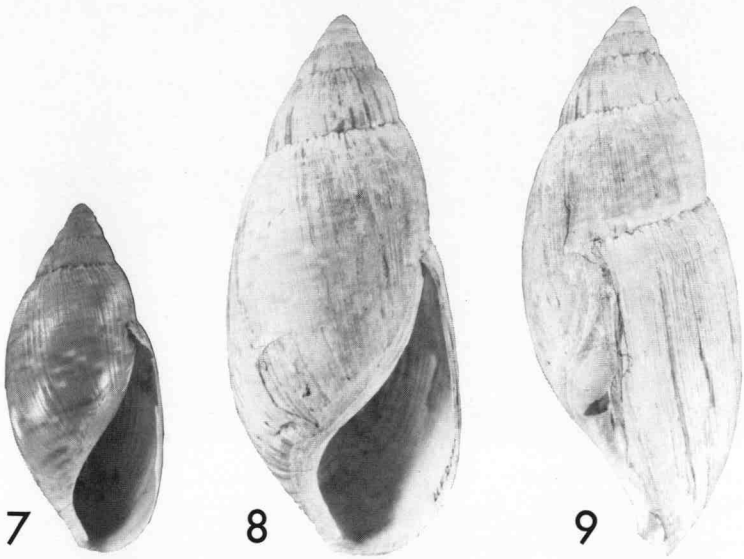
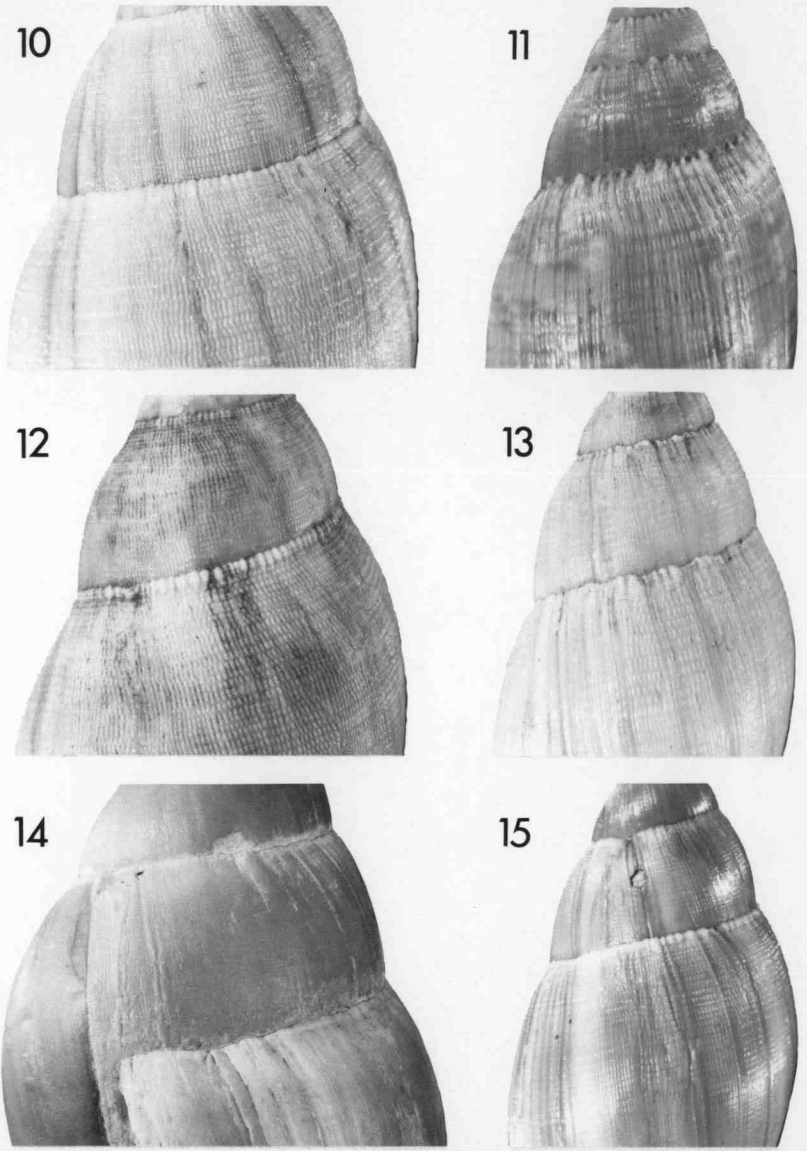


Figures 1–6.—Embryonic whorls of *Euglandina*. (1) *E. s. sowerbyana* (Pfeiffer) (UF 20807). (2) *E. gigantea* Pilsbry (UF 20751). (3) *E. vanuxemensis* (Lea) (UF 34571). (4) *E. titan*, n. sp. (UF 35307). (5) *E. pan*, n. sp. (USNM 487385). (6) *E. aurata* (Morelet) (UMMZ 136471).



Figures 7–9.—*Euglandina vanuxemensis* (Lea). (7) (UF 34909). (8–9) (UF 20808).



Figures 10–15.—Sculpture of *Euglandina*. *(10) E. S. sowerbyana.* (11) *E. vanuxemensis* (Lea) (UF 34709). (12) *E. gigantea* Pilsbry (UF 20751). (13) *E. pan*, n. sp. (UMMZ 467385). (14) *E. titan*, n. sp. (UF 35307, Holotype). (15) *E. aurata* (Morelet) (UMMZ 136471).

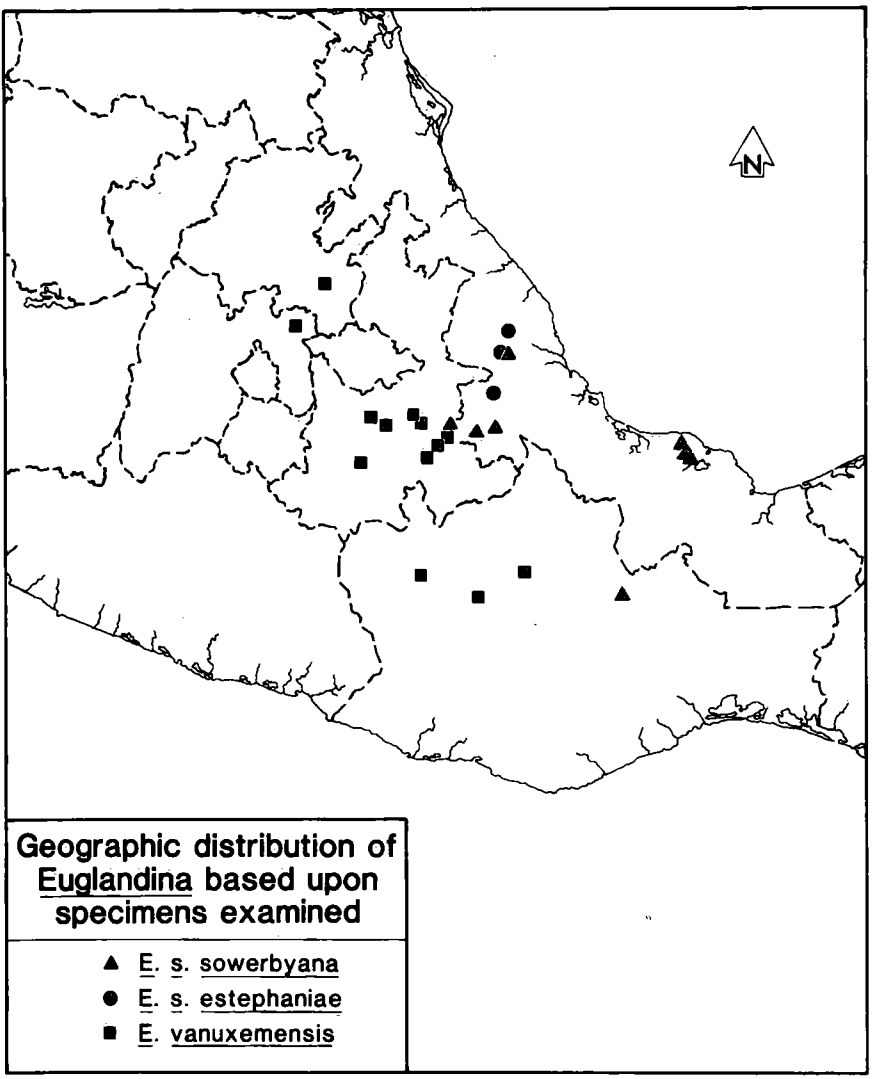
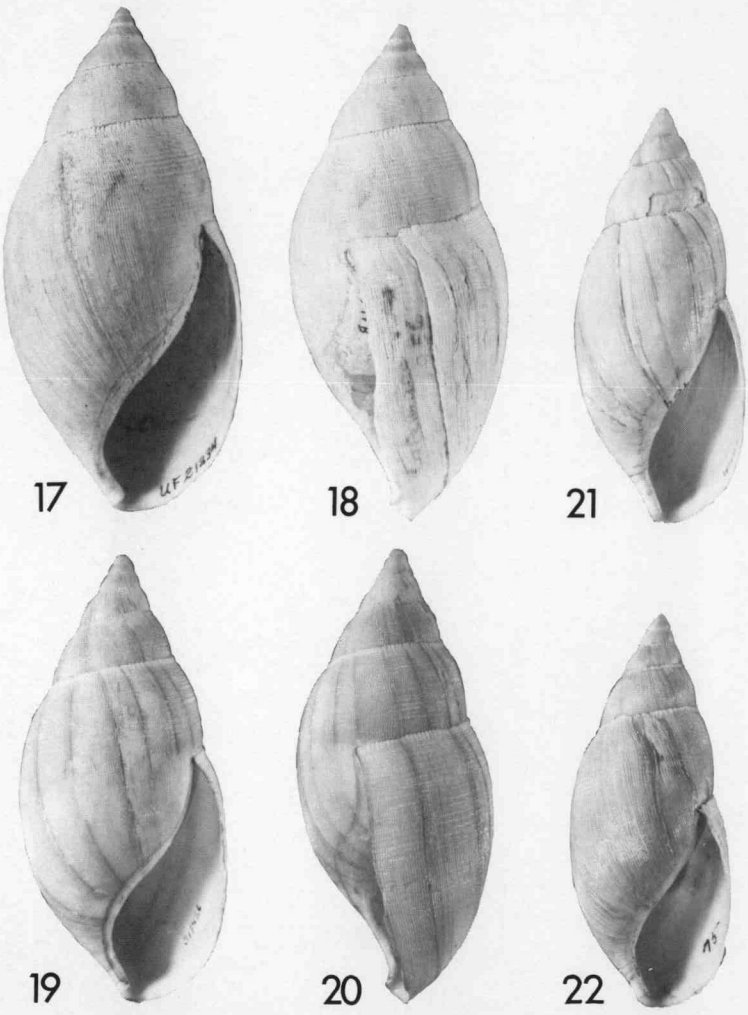
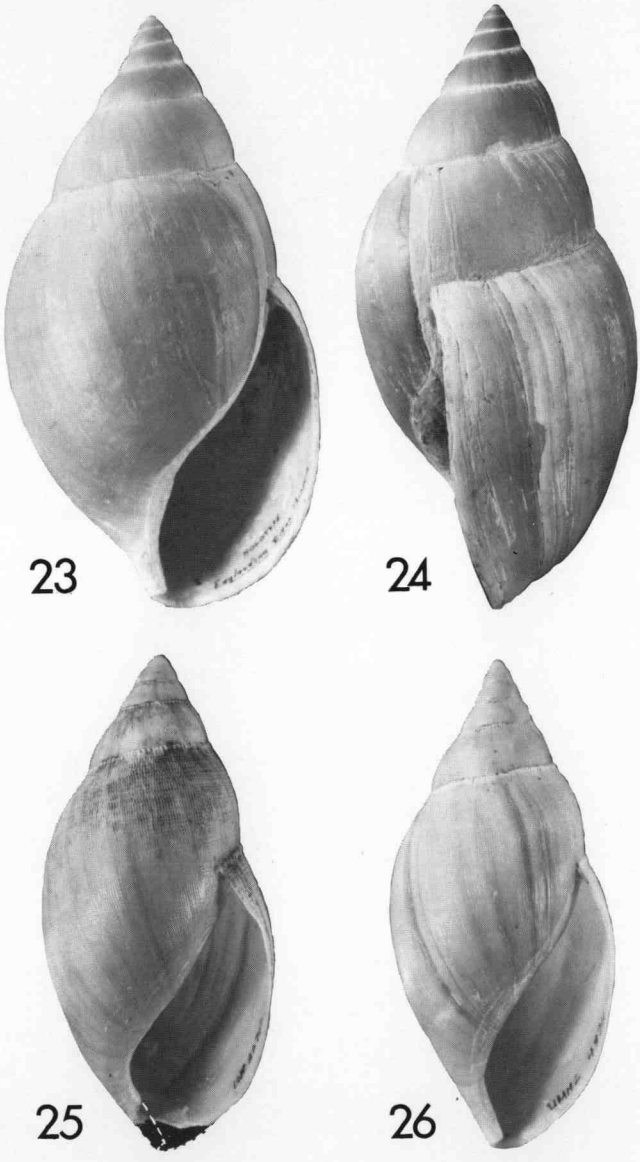


Figure 16.—Distribution of three species of *Euglandina* in Mexico. *E. vanuxemensis* (Lea). *E. s. sowerbyana* (Pfeiffer). *E. s. estephaneae* (Strebel).



Figures 17–22. *Euglandina sowerbyana* (Pfeiffer). (17–18) *E. s. sowerbyana* (Pfr.) (UF 21334). (19–20) *E. s. sowerbyana* (Pfr.) (USNM 317426). (21) *E. s. estephaneae* (Strebel) (UMMZ 10969). (22) *E. s. estephaneae* (Strebel) (FMNH 75).



Figures 23–26.—*Euglandina*. (23–24) *E. titan*, n. sp., Holotype (UF 35307). (25) *E. gigantea* Pilsbry (UF 20751). (26) *E. gigantea* Pilsbry (UMMZ 28711).

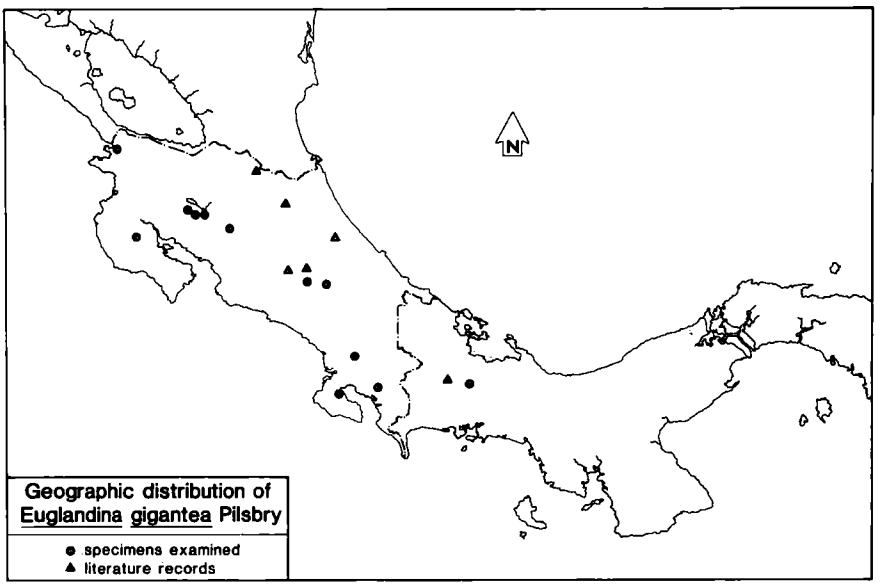
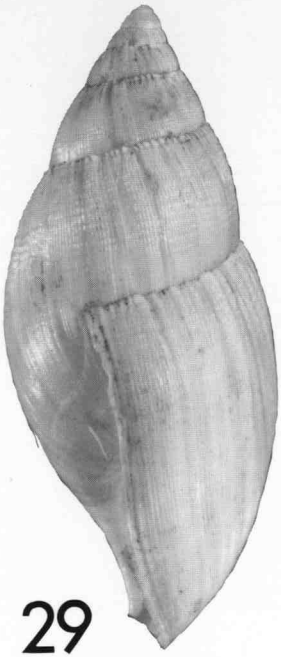
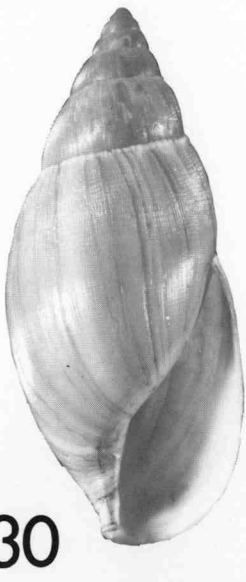
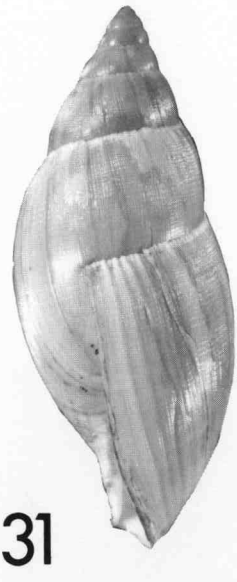


Figure 27.—Distribution of *Euglandina gigantea* Pilsbry in Costa Rica and Panama.







Figures 28–29.—*Euglandina pan*, n. sp. Holotype (USNM 467385). Figures 30–31.—*Euglandina aurata* (Morelet) (UMMZ 136471).

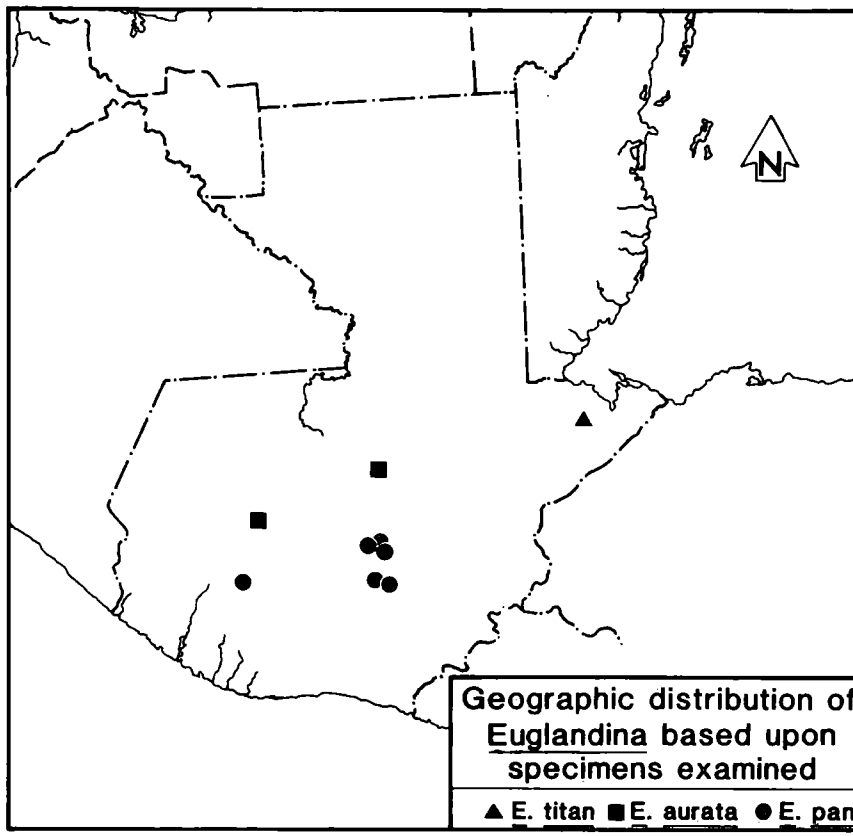


Figure 32.—Distributions of three species of *Euglandina* in Guatemala.

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