

THE LECYTHIDACEAE OF CENTRAL AMERICA

By H. PITTIER

INTRODUCTION

Up to 1908, only four species, belonging to three genera of the family Lecythidaceae, and ranging from the Canal Zone to Nicaragua, had been reported from Central America. They were *Gustavia superba*, *Grias fendleri*, and *Couroupita odoratissima* and *C. nicaraguensis*. In the course of that year three new species and two genera (*Lecythis costaricensis*, *Eschweilera collinsii*, *E. calyculata*) were added to the list, and the southward extension of *Couroupita nicaraguensis* along the Pacific coast was reported.¹ Northward, Nicaragua seems to remain the extreme limit reached by the family.

The botanical explorations of Panama undertaken under the auspices of the Smithsonian Institution and started in 1909, led me to the magnificent forests of the southeastern parts of that country, in the district of Port Obaldía on the Caribbean side, and in the Sambú and Tuyra valleys of the Pacific watershed. The study of the flora of these extraordinarily rich plains and hills was only started, though with wonderful glimpses of its composition. The presence in our collections of representatives of genera such as *Brownea*, *Centrolobium*, *Mimusops*, and *Lucuma*, hitherto considered as almost exclusively South American, and, above all, the abundance of undescribed forms of Lecythidaceae, of which no less than 11 are here described for the first time, revealed the existence in that region of a real miniature of the Amazonian silva, miniature in extension but quite as majestic in the dimensions of its elements. In fact, the forests of the Panamanian Darién are the most perfect type of tropical rain forests which it has been my privilege to contemplate in forty years of neotropical exploration. This is not the place to discuss the causes which have given rise to the development of such a remarkable flora, or its relationships with that of the central and eastern sections of the South American continent. The facts at hand are not sufficient. In the first place, the study of the forests in question has only been initiated and they reserve innumerable sur-

¹ Contr. U. S. Nat. Herb. 12: 95-104. 1908.

prises; moreover, our knowledge of the flora of the plains along the western Caribbean seaboard and the Pacific coast of Colombia is too scanty to allow even tentative conclusions.

The present paper contains the descriptions of all the species, pertaining to five genera, hitherto reported from Central America, including Panama. I do not consider the subject as exhausted. More species of the genera already represented will be found, and at least one genus, *Cariniana*, abundant in the forests of the Sinu and Atrato valleys, is likely to exist also in Darién.

SYSTEMATIC TREATMENT

KEY TO GENERA

Androecium equally expanded all around, so forming a sort of regular cup or ring, with the terminal part of the stamens involuted. Fruit indehiscent, the whole intrastaminal disk flat, more or less impressed and limited by a circular ridge.

Anther cells free, rounded, splitting longitudinally. Seeds 1 in each cell; funicle about the length of the seed; sepals 2.....1. **GRIAS.**

Anther cells connate, more or less elongate, opening by apical pores. Seeds 6 in each ovary cell, suspended by long fleshy twisted funicles; calyx very short and entire, or 5 or 6-lobate.....2. **GUSTAVIA.**

Androecium expanded on one side as a hood-shaped plate.

Stamens all fertile; fruits cannon-ball-like, indehiscent, with only the innermost part of the intrastaminal disk marked out as a domelike opercule. Septa and placentas turning into a semiliquid pulp.

3. **COUROUPITA.**

Stamens of the hood mostly sterile; fruit dehiscent, the opercule formed by the whole intrastaminal disk.

Seeds large, fusiform, hanging from a fleshy funicle; fruit large, with very thick, woody walls; giant trees, with small serrate leaves.

4. **LECYTHIS.**

Seeds small, rounded, sessile and erect in the coriaceous fruit; middle-sized trees with entire leaves.....5. **ESCHWEILERA.**

1. GRIAS I.

1. *Grias fendleri* Seemann, Bot. Voy. Herald 126. 1854.

A tree 8 to 12 meters high; trunk about 33 cm. in diameter, divided almost from base; limbs erect, dark grayish.

Leaves densely fasciculate on new wood, sessile, obovate-spatulate, long-cuneate, acute, entire or obscurely serrate toward the apex, 25 to 65 cm. long, 4 to 11 cm. broad; costa and primary veins prominent on both faces but more so underneath; primary veins about 35 on each side, anastomosed along the margin of the blade.

Inflorescence racemose, simple, entirely glabrous; rachis very short; floral pedicels 5 to 7 mm. long, each with one diminute basal bractlet. Calyx ovoid, about 6 mm. long and 5 mm. in diameter, 4-lobulate and with a dark margin; lobules obtuse. Petals 4, concave, ovate-elliptic, obtuse, smooth, white, 12 to 14 mm. long, 9 to 10 mm. broad. Androphore cup-shaped, white, about 3 mm. broad, multi-appendiculate, the interior appendices about 2 mm. long, the

exterior ones involute, 6 to 8 mm. long; anthers sessile or subsessile; ovary ovoid-turbinate, 4-celled, the cells pluriovulate; stigma subsessile, 4-lobulate.

Pyxis 1-celled, 1-seeded, ovoid, green on the outside, about 3 cm. long and 2.5 cm. in diameter, borne on a pedicel nearly 1 cm. long and bearing at the apex the enlarged stigma. Pericarp thin, fleshy; mesocarp membranous, 8-costulate. Seed ovoid, 28 to 30 mm. long, 17 mm. in diameter, smooth, suspended from the top of the cell by a thin funicle. Embryo almond-like, but very bitter and not edible.

PANAMA: In forests near Chagres, flowers, Feb. 12, 1850, *Fendler* 185 (type), 187. Below Pinogana, Darién, on the right margin of Tuyra River, flowers, April 18, fruits, June 15, 1914, *Pittier* 6652.

Our specimens differ from the type in the number of the pairs of primary veins (35 instead of 38), in the ovoid shape of the alabastrum, in the mostly 4-lobed calyx, and in having the ovary smooth and rounded instead of tetragonous; but these particulars are so insignificant that there is hardly a doubt as to our tree being identical with the one collected by Fendler. The full description of the species is based on better and more complete material than that distributed by the last collector.

2. GUSTAVIA L.

KEY TO SPECIES

Fruits small, regularly winged or costate; leaves small, entire or almost so; calyx 6-lobulate.

Fruits winged.....1. *G. brachycarpa*.

Fruits costate.....2. *G. pleurocarpa*.

Fruits large, more or less smooth; leaves long, spatulate and narrow, more or less sinuate or toothed; calyx entire.

Leaves sessile or almost so; middle-sized tree with large showy flowers.

3. *G. superba*.

Leaves long-petiolate; cauliflorous tree.....4. *G. nana*.

1. *Gustavia brachycarpa* Pittier, sp. nov.

A tree 12 to 15 meters high, 30 to 35 cm. diameter at the base; trunk straight, about 6 meters high. Bark grayish, smooth. Branching diffuse, forming a rounded crown, the long boughs more or less hanging. Young branchlets green, smooth, finely striate longitudinally.

Leaves alternate, membranous, petiolate, glabrous, dark green above, paler beneath; petioles 8 to 10 mm. long, subulate; leaf blades obovate or ovate-elliptic, attenuate at base to narrow wings, acuminate at tip, 10 to 20 cm. long, 3.5 to 7 cm. broad; margin slightly sinuate-dentate on the upper half of the blade, entire on the lower half; costa prominent on the lower face, hardly so on the upper one; primary veins 14 or 15, arcuate and twice anastomosed along the margin; veinlets inconspicuous; stipules triangular, acute, about 4 mm. long, early caducous.

Flowers not known, apparently single or few together at the ends of the branchlets.

Pyxis small, ovoid, flat or slightly depressed at the top, 5 or 6 celled, dehiscent, sessile, but attenuate at the base as a (2.5 cm. long) 4-winged pseudo-pedicel. Body of the pyxis about 2.5 cm. long, 2 cm. in diameter, 6-winged, the (5 mm. wide) wings alternating with the persistent erect triangular-acute sepals, these 10 to 12 mm. long and 10 mm. broad at the base; pericarp about 2 mm. thick, woody and hard; interzonal band flat, 2.5 mm. wide. Operculum about 1.5 cm. in diameter, not seen. Fertile seeds 2

or 3 in each fruit, the remaining cells occupied by aborted seeds; funicle fleshy; seed ovoid, about 12 mm. long, with a brown perisperm, paler and torulose around the large apical micropyle.

Type in the U. S. National Herbarium, no. 715480, collected in woods around San Felix, eastern Chiriquí, Panama, December 23, 1911, by H. Pittier (no. 5269).

This species has the smallest fruits observed heretofore in the genus. Its nearest ally is *G. pterocarpa* Poit. of Guiana.

2. *Gustavia pleurocarpa* Pittier, sp. nov.

A tree up to 20 meters high and about 40 cm. in diameter; trunk straight; bark brownish, slightly roughened; branching radiate, forming an elongate crown; branchlets slender, flexible, with a smooth, finely striate, brownish bark.

Leaves petiolate, membranous, entirely glabrous; petioles 1.5 to 2 cm. long; leaf blades ovate-elliptic, 8 to 19 cm. long, 3.5 to 7 cm. broad, attenuate and decurrent on two-thirds of the petiole length at base, subacuminate and more or less acute at tip; margin entire; costa prominent on both sides of the blade, the more so beneath; primary veins about 8, slightly arcuate, arcuately anastomosed along the margin, prominent beneath, with the interspaces minutely reticulate.

Flowers terminal, single or geminate, about 6 cm. in diameter when spread, the peduncle, bracts, receptacle, and calyx lobes furfuraceous; peduncles 2 cm. long, rather thick, provided at the middle with a pair of ovate acute bracts 4.5 mm. long; receptacle 6-costate, about 7 mm. in diameter; calyx lobes 6, triangular or ovate, acute, nearly 7 mm. long with about the same basal breadth, persistent; petals 6, the 3 exterior ones larger, ovate, rounded at tip, 3 to 3.5 cm. long, about 2 cm. broad, yellowish white, more or less furfuraceous without, glabrous within; androecium equally expanded all around, about 22 mm. in diameter; anthers ovate, subacuminate, emarginate at base, 1.8 mm. long; ovary 6-celled, each cell pluriovulate; style very short; stigmas 6, erect and adhering.

Young fruits crowned with persistent calyx lobes and more or less 6-costate.

Type in the U. S. National Herbarium, no. 678933, collected on Loma de la Gloria, back of Fató, Province of Colón, Panama, altitude 100 meters or less, July, 1911, by H. Pittier (no. 3857).

The following collections also belong here:

PANAMA: Loma de la Gloria, August, 1911, *Pittier* 4104 (flowers); Sept. 12, 1911, *Pittier* 4426 (young fruits).

This species seems to differ from all the *Gustavias* of the Isthmus and adjacent South America by its small leaves and flowers, the latter exclusively terminal, and by the general habit of the tree, which looks much more like an *Eschweilera*.

3. *Gustavia superba* (Kunth) Berg, *Linnaea* 27: 444. 1854. PLATES 1, 2.

Pirigara superba Kunth, *Syn. Pl. Aequin.* 3: 426. 1824.

A tree, up to about 20 meters high and 35 cm. diameter at the base, sparingly ramified, the limbs erect or ascending, usually unbranched, glabrous, covered with the leaf scars, the younger part fistulous.

Leaves congested at the ends of the limbs, entirely glabrous, membranous; petioles thick, 2 to 9.5 cm. long; blades oblong-lanceolate, long-cuneate and sub-decurrent at base, acutely long-acuminate at apex, 25 to 100 cm. long, 8 to 18 cm. broad, light green on both sides, the margin coarsely and remotely serrate with acute teeth; costa thick, prominent on both sides; primary veins 20 to 25 on each half of the blade, prominulous above, prominent beneath, united by slender transverse veinlets and a dense prominulous reticulation of lesser thickness.

Flowers congested on the old wood just below the lower leaves, the racemes 2 to 12-flowered, glabrous; peduncles thick, 2 to 6 cm. long; pedicels 5 to 9 cm. long, puberulous, provided at the base with an ovate obtuse bract about 5 mm. long, articulate at the middle, with a pair of clasping, more or less adnate bractlets, these very short and broad; open flowers 8 to 12 cm. in diameter; receptacle discoid, flat, about 2 cm. in diameter; calyx short (not over 1 cm. broad), minutely puberulous-pubescent, the margin entire; petals 8 (4 slightly larger), obovate, slightly attenuate to the base, rounded-obtuse at apex, 5 to 7 cm. long, 2 to 3 cm. broad, glabrous, yellow at base, turning to pink dotted with white toward the apex; androphore pinkish white, discoid, about 4.5 cm. in diameter; stamens and staminodes yellow at base, turning to pink toward the tip; ovary turbinate, 6-celled, velvety-pubescent on the upper face; style obtuse and very short.

Pyxis large, subglobose.

Type collected at Turbaco, near Cartagena, Colombia, by Humboldt and Bonpland. Common in the Canal Zone and in its immediate vicinity, but not reported from farther west and apparently not found in south Darién or in the rainy parts of the San Blas Coast.

PANAMA: Chagres Valley, Pittier. Empire, May 2, 1912, Christopherson 197. Monte Lirio, March 2, 1912, Christopherson 128. Hospital grounds at Ancón, February 14, 1911, Pittier 2746; March, 1910, C. F. Mason. Gatuncillo, Stevens 1159. Gamboa, Stevens 1090; Standley 28389. Obispo, Standley 31709. Tapia River, Mazon & Harvey 6746a. Gorgona, Mazon 6787. Chagres arm of Gatún Lake, Mazon 6554. Barro Colorado Island, Standley 31447, 31253. Darién Station, Standley 31553. Fort Sherman Standley 30955. Taboga Island, Standley 27934. Río Paraíso, above East Paraíso, Standley 9917. Las Cascadas Plantation, Standley 25716, 29591. Hills north of Frijoles, Standley 27443.

According to Miers,² this species has been collected in Ecuador by Sinclair, which would mean a considerable extension of its area to the south. Seemann³ states that in Panama it forms entire woods in the central districts, a fact which lacks confirmation. According to my personal experience, even small groves of the tree are of rare occurrence and it is found mostly scattered as single individuals. Seemann refers this species to *G. angustifolia* Benth., but in that the leaves are almost sessile and comparatively narrow, the flowers smaller and terminal with the pedicellar bractlets near their base, and the petals mostly 6.

The fruit of *Gustavia superba* Berg is edible, but in no way distinguished by its flavor or nutritive properties. The usual vernacular name applied about the Canal Zone to the tree is "membrillo."

EXPLANATION OF PLATE 1.—*Gustavia superba*. Inflorescence, about one-tenth natural size. PLATE 2.—A flower. Natural size.

4. *Gustavia nana* Pittier, sp. nov.

PLATES 3, 4.

A small single-stemmed cauliflorous shrub about 1.5 meters high, the trunk not over 6 cm. in diameter at the base.

Leaves dense at top of stem, alternate or subverticillate; petioles 3 to 15 cm. long, slender, terete; leaf blades narrow-elliptic, attenuate at both ends, hardly decurrent but extending along the petiole in two almost imperceptible keels, 21 to 40 cm. long, 5 to 8 cm. broad; margin slightly sinuate-dentate, the teeth distant about 1.5 cm. in the middle part of the blade; costa and veins prominent on both sides but more so on the lower face; primary veins about

² Trans. Linn. Soc. 30: 177.

³ Bot. Voy. Herald 126. 1854.

17, straight and anastomosed along the margin, the transverse veinlets well marked on both faces.

Flowers not seen, appearing near the base of the trunk.

Pyxis rather large, borne on a pedicel 3 cm. long, globose-subpyriform, the body 7 cm. long and 7 cm. in diameter, 5-celled, obsolete costate; calycinal zone prominent and bearing the remnants of the calyx; interzonal band flat, 2.5 mm. broad; operculum slightly convex, apiculate-umbonate, smooth and lustrous, bright yellow; pericarp coriaceous, about 5 mm. thick, smooth and light brown outside; inner pulp yellow. Seeds 1 to 3 in each cell, angulose, irregularly shaped and compressed, 2 to 3 cm. long and broad; testa membranous, brownish.

Type in the U. S. National Herbarium, no. 679189, collected on Loma de La Gloria, back of Fató, Province of Colón, Panama, in fruit, August 4, 1911, by H. Pittier (no. 4093).

This differs from all other described species in its reduced size and in the petiolate leaves.

EXPLANATION OF PLATE 3.—*Gustavia nana*. A fruit on branch. About seven-eighths natural size. PLATE 4.—Fruits and seeds; above an operculum, below cross section of fruit. Natural size.

3. COUROUPITA Aubl.

Owing to the scarcity of the cannon-ball trees, it has been found difficult to obtain satisfactory specimens. For this reason the three following species are incompletely described.

KEY TO SPECIES

Flowers 4 to 5 cm. in diameter; anther cells divaricate from the base; petals pink; low spreading savanna tree, branched almost from the base.

1. *C. odoratissima*.

Flowers 7 to 8 cm. in diameter; anther cells connate; petals white, pink, or reddish-tinged; high forest trees.

Petals 1.8 to 2.2 cm. broad; filaments of the anthers 1 mm. long; corolla reddish white.....2. *C. nicaraguensis*.

Petals 2.2 to 3 cm. broad; filaments of the anthers 2 to 2.5 cm. long; corolla pinkish white.....3. *C. darienensis*.

1. *Couroupita odoratissima* Seem. Bot. Voy. Herald 126. 1854.

A large tree, divaricate from the base; crown spreading, domelike; branchlets thick, rounded, striate, verruculose.

Leaves oblong, attenuate at both ends, abruptly acuminate, sparsely hairy, the pubescent petiole thick, 1 to 1.5 cm long, the lamina 15 to 19 cm. long, 6 to 8 cm. broad; margin entire, obscurely sinuate, or minutely ciliate-denticulate; venation hardly prominent above, more so beneath, the costa and primary veins here densely hairy-puberulent; stipules small, subcordate, puberulous, early caducous.

Floral racemes issuing from the trunk and larger limbs, also terminal (?); rachis thick, about 18 cm. long, angulose-sulcate, glandulose-verruculose, tomentose, many-flowered. Flowers large, fragrant; pedicels 13 to 19 mm. long, at first brown-tomentellose and then subglabrous; sepals obtuse, ciliate; petals oblong-obtuse, fimbriate on the margin, pink with yellow lines; androphore of a rich yellow color; stamens short, crowded on both the ring and the hood; anther cells divaricate at the base.

Fruit large, globose, single or in clusters.

PANAMA: Forests of Río de Jesús, between Santiago and Puerto Mutis, Veraguas, *Seemann* 1151, in herb. Hook., type. Forests of Hato de San Juan, between San Lorenzo and San Felix, eastern Chiriquí, *Otto Lutz*, photograph.

The first locality was believed to be the only one in which the species occurred. The discovery by Dr. Lutz is consequently of great interest, so much the more so in that he found the tree loaded with fruits.

2. *Couroupita nicaraguensis* DC. Prodr. 3: 294. 1828.

Trunk high and straight, bearing a subglobose crown.

Leaves large, coriaceous, obtuse; flowers large, clustered on trunk and larger limbs, their greatest diameter 7.5 cm.; calyx lobulate; petals 6, obovate, obtuse, the 3 exterior ones slightly smaller, 2 to 3.5 cm. long, 1.8 to 2.2 cm. broad, reddish white; stamens numerous upon both ring and hood; filaments about 1 mm. long, swollen at the tip on the ring, attenuate on the hood; anthers ovoid, 0.5 mm. long and broad, the cells connivent.

Fruits large, globose, single or 2 to 8-clustered.

NICARAGUA: Cited from that country without precise locality by de Candolle. Vicinity of Paso Real, road from Rivas to Granada, near Río Ochomogo, *Oersted*. Along the Ochomogo River, north of Rivas, *Shannon* 5004.

COSTA RICA: Salinas Bay, *Pittier* in 1891; Nicoya, *Pittier* in 1903.

The above description is based upon the original description in the Prodr. upon *Oersted*'s notes, upon the incomplete specimens collected by *Shannon*, and upon the writer's own observations. It is more complete than the one given in my former paper on the subject, but yet far from satisfactory.

3. *Couroupita darienensis* Pittier, sp. nov.

PLATE 5.

A very large, deciduous tree, the trunk straight, up to 30 meters high and 1.25 meters diameter at the base; main limbs radiating horizontally from the apex of the trunk and forming a flat, sparsely branched crown; bark of the trunk and limbs thick, scaly, brownish gray, that of the branchlets fibrous, the fibers strong; wood brownish, ill-scented.

Leaves unknown, undeveloped at time of flowering.

Floral racemes short, growing from the limbs and larger branchlets. Corolla pinkish white, 7 to 8 cm. in diameter; petals 6, fleshy, unequal, ovate, rounded at base, broadly rounded at apex, 2.5 to 4 cm. long, 2.2 to 3 cm. broad, glabrous; androphore pinkish white, broadening from the ring (1.8 cm. in diameter) to the galea (2.8 to 3 cm. broad); stamens very numerous and entirely covering the inner surface of the androphore, the ones on the ring and ligule small, with clavate (1.2 to 1.5 mm. long) filaments and subglobose anthers, the ones on the galea with broad attenuate (2 to 2.5 mm. long) filaments and larger anthers. Other details of the flower not known.

Pyxis very large, globose or slightly depressed, 15.5 to 18 cm. in diameter, 6-celled, the calycinal zone apical and obsolete, the seeds few, orbiculate, depressed, hairy, surrounded by the pulpy dissepiments of the endocarp and columella.

Type (fruit, seeds, parts of flower in alcohol, and photograph) in U. S. National Herbarium, collected in forests around Pinogana, southern Darién, Panama, April 20, 1914, by H. Pittier (no. 6563).

This species was tentatively compared first with *Couroupita peruviana* Miers, which differs in the coloring of the flower, and in the larger fruit with the calycinal zone much more distant from the apex, and then with the little-known *C. nicaraguensis* DC., also distinct in the mode of branching, the smaller flowers, and the details of the stamens.

This is one of the tallest trees in the forests of Darién. The trunk is always clean to a considerable height and the limbs spread horizontally at a great distance from its apex. The flower racemes appear on the latter or on smaller

branchlets, but never on the trunk, at a time when the leaves are not yet developed. The wood is characterized by its fetid smell.

The tree is known among the natives as "coco zapote" or "coco de mono."

EXPLANATION OF PLATE 5.—*Couroupita darienensis*. A tree in forest.

4. LECYTHIS Loefl.

KEY TO SPECIES

Leaves large (12 to 36 cm. long), coriaceous, ovate-oblong or elliptic, the margin entire or obscurely crenate.

Blade of the leaves decurrent on the petiole, rounded at the apex; pyxis 15 to 16 cm. high, the basal band 5.5 cm. high, the interzonal band 7 to 7.5 cm. broad. South Darién.....1. *L. melliana*.

Blade of the leaves rounded at the base, acuminate at the apex; pyxis 12 to 14.5 cm. high, the basal band 6 to 8 cm. high, the interzonal band 4 to 5 cm. broad. South Darién.....2. *L. tuyrana*.

Leaves small (not over 10 cm. long), membranous, ovate, crenulate-serrate.

Base of the operculum distinctly conical, with a smooth surface, about 7 cm. in diameter; calycinal zone continuous, the individual sepals hardly distinct. San Blas Coast.....3. *L. armilensis*.

Base of the operculum more irregular and broad (not under 9 cm. in diameter).

Leaves rounded or subcuneate at the base; pyxis ovoid, about 20 cm. high; basal band 11 to 12 cm. high, the interzonal band 4 to 7 cm. broad. San Blas Coast.....4. *L. ampla*.

Leaves cordate at the base; pyxis subglobose, 15.5 to 22 cm. high, the basal band 8 to 14 cm. high, the interzonal band 6 to 9 cm. broad. Costa Rica.

5. *L. costaricensis*.

1. *Lecythis melliana* Pittler, sp. nov.

PLATE 6.

A large tree, up to 40 meters high and 80 cm. in diameter, the trunk straight, covered with a grayish rimose bark, the branching radiate, beginning about 8 meters above the ground.

Leaves coriaceous, glabrous, the petioles thick, canaliculate, 1.5 to 2.5 cm. long, the blades ovate-oblong, rounded and decurrent on the petiole at the base, rounded at the apex, 12 to 35 cm. long, 10 to 14 cm. broad, the costa thick, impressed above, very prominent beneath, the primary veins about 33, prominent on both faces, with short intermediate parallel venules forming a striate zone on both sides of the costa; margin entire, sometimes slightly repand.

Inflorescence paniculate, few-branched, the rachis thick, angular, glabrous. Flowers sessile, sulphur or orange-yellow, 5 to 6 cm. in diameter when fully open; calyx tube 5 to 6 mm. long, salver-shaped, the 6 lobes (imbricate in bud) broadly ovate, obtuse, coriaceous, 9 to 11 mm. long and broad, the margin entire and revolute; petals ovate or obovate, obtuse at apex, more or less attenuate and adnate together and with the androphore at the base, about 4 cm. long and 2 cm. broad; androphore yellow, the basal ring 7 to 8 mm. broad, the ligule about 2 cm. long and 1.5 cm. broad, the hood ovate, shortly fimbriate on the margin; ovary 4-celled.

Pyxis subglobose, grayish brown and rough without, 15 to 16 cm. high, the walls 2 to 2.5 cm. thick, woody; basal part obconical, 5.5 cm. high; calycinal zone more or less continuous and even; interzonal band 7 to 7.5 cm. high, 15 cm. in diameter; operculum 3 cm. thick and 11.5 cm. in diameter; seeds 6.5 to 7 cm. long, 2.5 cm. broad, about 10 in each pyxis.

Type in the U. S. National Herbarium, no. 716604, collected in forest between Pinogana and Yavisa, southern Darién, Panama, in flower and fruit, April 17, 1914, by H. Pittier (no. 6538).

EXPLANATION OF PLATE 6.—*Lecythis melliana*. Two views of a pyxis. About three-eighths natural size.

2. *Lecythis tuyrana* Pittier, sp. nov.

PLATE 7.

A tree 25 to 30 meters high; trunk straight; bark brownish, rimose; branchlets verruculose; covered with a white, longitudinally reticulate film. Crown ovate-elongate, densely leafy.

Leaves petiolate, large, coriaceous; petiole thick, clasping at the base, then winged and broadly canaliculate, 10 to 15 mm. long, darkish in color; lamina long-elliptic or lanceolate, rounded at base, acuminate at tip, entirely glabrous, glossy above, paler and dull beneath, 20 to 36 cm. long, 6 to 12 cm. broad; costa carinate on the upper side of the lamina, thick, rounded and prominent beneath; primary veins about 35, hardly salient on the upper face, rather prominent beneath; margin entire or obscurely crenate.

Inflorescence racemose, terminal, ample, erect, single-branched, 35 to 40 cm. long, the rachis thick, subangulose, puberulous. Flowers numerous, sessile; sepals 6, ovate, obtuse, coriaceous, the exterior ones a little broader, 6 to 8 mm. long, 6 to 9 mm. broad, glabrous, fimbriate-denticulate on the margin, persistent; corolla sulphur-yellow, caducous; petals 6, ovate to elliptic, concave, obtuse, 26 to 32 mm. long, 14 to 17 mm. broad, entire on the margin; androphore yellow, the basal ring rather narrow (5 mm.), the ligule about 20 mm. long and 1.2 mm. broad, the hood ovate, the marginal appendages about 5 mm. long; ovary 4-celled.

Pyxis subglobose, chocolate-brown and squamulose without, 12 to 14.5 cm. high, the walls 1.5 to 2 cm. thick, woody; basal part cupulate, 6 to 8 cm. high; calycinal zone continuous or obscurely lobate; interzonal band 4 to 5 cm. high, 11 to 13.5 cm. in diameter at the base, narrowing to the apex; operculum wanting; seeds about 6 cm. long, 2 to 2.5 cm. broad.

Type in U. S. National Herbarium, no. 716630, collected on the hills at Quebrada Honda, southern Darién, Panama, in flower and fruit, April 21, 1914, by H. Pittier (no. 6567).

EXPLANATION OF PLATE 7.—*Lecythis tuyrana*. Two views of a pyxis. About three-eighths natural size.

3. *Lecythis armilensis* Pittier, sp. nov.

PLATE 8.

Very large tree, with straight trunk covered with a rimose fibrous bark, and a depressed spreading crown.

Leaves, flowers, and seeds unknown.

Pyxis large (17 cm. long and 15 cm. in larger diameter), ovoid, urn-shaped, rounded at base; calycinal zone high, distant 11 to 12 cm. from the base, continuous, the individual sepals hardly marked; interzonal band 4 to 7 cm. broad, slightly concave along the calycinal zone, and then straight to the rim of the mouth; operculum small, convex, smooth, 7 to 8 cm. in diameter, 2.5 to 3 cm. thick; pericarp thick, woody, showing within the remnants of the 4 original septa.

Type, consisting of old fruits only, in the U. S. National Herbarium, collected on hills between Puerto Obaldía and Armila, San Blas Coast, Panama, September 5, 1911, by H. Pittier.

The fruits here described are undoubtedly distinct from those supposed to belong to *Lecythis ampla*, from which they differ by their narrow mouth and the characters of the calycinal band. They resemble somewhat those of *L.*

densa Miers, a Brazilian species, the area of which is not likely to extend as far as Panama.

EXPLANATION OF PLATE 8.—*Lecythis armillensis*. Two views of a pyxis. About three-eighths natural size.

4. *Lecythis ampla* Miers, Trans. Linn. Soc. 30: 204. 1874.

PLATE 9.

Very tall tree, 30 to 40 meters high, 1 to 1.5 meters in diameter. Trunk straight, 20 to 30 meters long, branching at the top only and forming a broad depressed crown; bark blackish, fibrous, rimose; branchlets virgate, dark purplish and verruculose.

Leaves small, membranous, petiolate, reticulate, glabrous and light green, stipulate; petioles slender, 6 mm. long; leaf blades orbicular, ovate, or ovate-elliptic, often sublobate, rounded or subcuneate at base, usually acuminate, sometimes rounded or obtuse at the tip, 3.5 to 9 cm. long, 2.5 to 4 cm. broad; margin finely sinuate-toothed, except at the base and on the acumen; costa prominent and dark-colored beneath, hardly so above; primary veins 12 or 13, straight, several times anastomosed along the margin, the intermediate spaces beautifully reticulate.

Flowers not known.

Pyxis large (20 cm. long and 15 cm. in larger diameter on calycinal zone), urn-shaped, rounded and hardly turbinate at the base; calycinal zone prominent, formed by 6 broad subacute protuberances, from 10 to 14 cm. above the petiolar insertion; interzonal band more or less concave around the calycinal and upper bands, 2.5 to 4.5 cm. broad; operculum convex, obscurely umbonate, 4 cm. high, about 10 cm. in diameter; pericarp thick, woody, showing within the remnants of a 4-celled division. Seeds not seen.

PANAMA: Hills of Sperdi, near Puerto Obaldía, San Blas Coast, leaves and old fruits only, September 3, 1911, *Pittier* 4343.

The above description of the pyxis of this species agrees in a general way with that of Miers' specimen from Antioquia. In our specimens the segments of the calycinal zone are more prominent and distinctly acute, and the upper part of the interzonal band is decidedly concave on account of the rim of the very broad mouth overflowing a little. The measurements agree only in a general way, but there is also a broad margin between those of the several specimens collected under the tree which was felled to obtain leaf specimens.

This *Lecythis*, which always grows on low hill ridges, is certainly one of the most conspicuous giants of the primeval forests of San Blas. Its crown always towers above the general dome of the forest. In its fall the individual sacrificed to obtain specimens opened a wide gap in the surrounding forest, thus giving an opportunity to collect several other interesting species.

EXPLANATION OF PLATE 9.—*Lecythis ampla*. Two views of a pyxis. About three-eighths natural size.

5. *Lecythis costaricensis* Pittier, Contr. U. S. Nat. Herb. 12: 99. pl. 6-8. 1908.

PLATE 10.

A large tree, up to about 40 meters high, the straight trunk 25 meters high, about 1 meter in diameter at the base, the crown depressed and spreading.

Leaves submembranous, glabrous, the petioles about 5 mm. long, the blade oblong or ovate-oblong, subcordate at base, long-acuminate, crenulate-serrate on the margin.

Inflorescences terminal; flowers not seen.

Pyxis ovoid-globose, 4-celled, brownish and smooth without, 15 to 22 cm. high, the walls 2.5 to 3 cm. thick, woody; basal band more or less semiglobose, 8 to 14 cm. high; calycinal zone continuous, with 6 distinct protuberances corresponding to the sepals; interzonal band 6 to 9 cm. high, conical, 16 to 17 cm.

in diameter at the base, 10 to 11 cm. at the apex; operculum domelike, 2 to 3 cm. high; columella thick and 4-winged. Seeds fusiform, sulcate, 4 to 5 cm. long, 1.7 to 2 cm. thick, 6 to 9 in each cell; funicle fleshy, thick, and white.

Type from La Sedina, plains of San Carlos, Costa Rica.

Since the first and incomplete description of this species in 1908 very little new information has been obtained. It is incorporated above. For more details see the original description.

It is interesting to note that the three species found on the Atlantic watershed (*L. armilensis*, *L. ampla*, *L. costaricensis*) all are very large trees with umbraculiform crown and small ovate serrate leaves, while the two found on the Pacific side of the continental divide are of lesser dimensions, have radiating branches beginning low on the trunk, and have leaves relatively larger and always entire. This may indicate that the representatives of both groups have reached the Isthmus by distinct routes and not simultaneously.

EXPLANATION OF PLATE 10.—*Lecythis costaricensis*. Two views of a pyxis. About three-eighths natural size.

5. ESCHWEILERA Mart.

KEY TO SPECIES

Pyxis woody, thick-walled, obconical, with the cavity rim projected outside.

Leaves stipulate; petiole and base of costa sparsely hairy...1. *E. reversa*.

Pyxis coriaceous, thin-walled, more or less rounded or globose-depressed.

Seed 1 in each cell of the fruit.....2. *E. panamensis*.

Seeds several in each cell.

Floral racemes axillary. Seeds 3 or 4 in each cell.....3. *E. garagarae*.

Floral racemes terminal.

Sepals free at base of fruit.....4. *E. calyculata*.

Sepals concrete with fruit.

Fruit rather large; calycinal zone little prominent; seeds 4 cm. long, 1 to 3 in each cell.....5. *E. collinsii*.

Fruit small, with well-developed calycinal protuberances; seeds small, more than 3 in each cell.....6. *E. verruculosa*.

1. *Eschweilera reversa* Pittier, sp. nov.

A large tree, nearly 80 cm. in diameter. Trunk straight; bark grayish, almost smooth; crown elongate; new growth slender, with purplish bark sparsely covered with long appressed hairs; buds quite hairy.

Leaves rather small, short-petiolate, stipulate, smooth except on the petiole and costa, light green above, paler beneath, the young ones deep pink at first on both sides and then only on the lower one; petioles thick, 3 mm. long, sparsely hairy; leaf blades ovate-elliptic, rounded and narrowly emarginate at base, acute at tip, 9 to 13 cm. long, 2.5 to 4.5 cm. broad; margin entire; venation prominent on both sides, more so beneath, the costa and primaries here pink; costa covered at base with whitish appressed hairs; primary veins 8 or 9, twice anastomosed along the margin; upper face of blade finely reticulate; stipules geminate, needle-like, hairy, about 4 mm. long.

Flowers not seen.

Pyxis small (3 to 3.5 cm. high, 6 cm. in diameter on calycinal zone), broadly turbinate, thick-walled, the 6 sepals grown into 6 thick prominences; interzonal band very narrow (not over 0.5 cm. broad) and forming a deep furrow; internal cavity smooth, widening toward the orifice, the margin of this rounded and projected outward; operculum arched or conical, depressed, the stigmatic remnants obscurely visible at the center. Seeds 2.

Type in the U. S. National Herbarium, no. 679550, collected on plains of Sperdi, near Puerto Obaldía, San Blas Coast, Panama, leaves and old fruit only, September, 1911, by H. Pittier (no. 4394).

In the absence of flowers and seeds, the place of this species remains doubtful. The pyxis is quite distinct from any described heretofore. There is a faint indication of a two-celled cavity in several of the specimens at hand, and the lower side of one of the only two opercula found under the tree bears the impression of two large seeds; but, since there were trees of *Eschweilera panamensis* scattered in the forest all around, the source of that lid is not absolutely certain.

2. *Eschweilera panamensis* Pittier, sp. nov.

A large tree, up to 25 meters high and 40 cm. in diameter. Trunk straight, covered with a gray, slightly rimose bark. Crown elongate; branchlets slender.

Leaves alternate, petiolate, coriaceous, glabrous, entire; petioles thick, broadly canaliculate, 5 to 8 mm. long; leaf blades ovate, rounded and sub-decurrent at base, narrowed at the tip into a short acumens, light green above, paler beneath, 9 to 14 cm. long, 3.5 to 8 cm. broad; costa slightly salient above, quite prominent and obscurely 3-sulcate beneath; veins and veinlets obsolete above, beautifully marked beneath, the former 8 to 11, arched and distinctly anastomosed along the slightly revolute margin.

Inflorescences racemose, terminal or in the axils of the upper leaves, the axillary racemes short (4.5 cm.) and hardly branched, the terminal ones longer than the leaves (15 cm. or about), with well-developed alternate branchlets (10 cm. long); rachis minutely pubescent, with green verruculose bark. Flowers numerous, alternate, pedicellate, entirely glabrous, bractless, white; pedicels 7 to 8 mm. long; calyx lobes 6, rounded-triangular, obtuse, about 1 cm. long and broad; petals 6, uneven, 11 to 15 mm. long, 7 to 11 mm. broad, obovate and broadly rounded at tip, the 3 exterior ones larger, thicker, and conchoid; androphore with small ring, nearly 6 mm. in diameter and supporting numerous anthers; connecting blade of the hood 13 mm. long, 9 mm. broad; hood proper transversely ovate, 10 mm. long and 13 mm. broad, covered with numerous staminodes; filaments not over 0.5 mm. long; anthers ovate, emarginate at both ends, about 0.4 mm. long and broad, each cell splitting longitudinally; staminodes narrow and acute, 4 to 5 mm. long; ovary almost entirely superior, glabrous, 2-celled, with several ovules in each cell; style none; stigma obscurely divided.

Ripe pyxis globose-depressed, about 4 cm. long and 5 cm. in diameter, 2-celled, slightly attenuate at base, with rather thin walls; calycinal zone bearing the persistent enlarged lobes of the calyx, the interzonal band 1.5 to 2 cm. broad; operculum convex, depressed at the center with the stigma persistent, accrescent; cells 1-seeded, the seeds ovoid-oblong, 2.7 cm. long, 1.6 cm. in diameter.

Type in the U. S. National Herbarium, no. 679481, collected on hills back of Puerto Obaldía, San Blas Coast, Panama, flowers and fruits, September 2, 1911, by H. Pittier (no. 4338).

3. *Eschweilera garagarae* Pittier, sp. nov.

A small tree, the trunk straight and continuous; branching radiate, the crown pyramidal; bark smooth, grayish; branchlets slender, flexible.

Leaves membranaceous, glabrous, lustrous above, paler and opaque beneath, finely reticulate on both faces; petioles 1 cm. long, canaliculate; leaf blades elliptic or elliptic-lanceolate, 12 to 20 cm. long, 3.5 to 7 cm. broad, subcuneate at base, acuminate at tip; venation very prominent beneath; primary veins about

10, subimpressed above, arcuate and twice anastomosed along the obscurely sinuate margin.

Racemes axillary, simple, about 5 cm. long. Rachis verruculose; pedicels about 2 mm. long.

Pyxis coriaceous, thin-walled, 2-celled, globose-depressed, subturbinate at base, about 5 cm. long and 5.5 cm. in diameter on the line of dehiscence; calycinal zone very close to the base of the fruit, with the 6 prominences of the sepals little pronounced; interzonal band 16 mm. broad; operculum about 1 cm. high, convex, hardly umbonate. Seeds 6, sometimes 7, more or less ovate, compressed laterally, the two planes meeting toward the center of the fruit, rounded outside, about 3 cm. long.

Type in the U. S. National Herbarium, no. 715891, collected in the foothills of Garagara Mountain, south Darién, Panama, in fruit, February 6, 1912, by H. Pittier (no. 5616).

This species is characterized mainly by its globose-depressed fruits with the calycinal zone placed very low. In the absence of more complete material it is hardly possible to define its nearer affinities, but it certainly differs from all other Panamanian and Central American species.

4. *Eschweilera calyculata* Pittier, Contr. U. S. Nat. Herb. 12: 97. pl. 1, 2. 1908.

PLATE 11.

COSTA RICA: Atlantic plains in the vicinity of Limón.

PANAMA: Marragantí, south Darién, in clearings, fruits and leaves only, April 22, 1914, Pittier 6596.

EXPLANATION OF PLATE 11.—*Eschweilera calyculata*. Leaves and pyxis. Natural size.

5. *Eschweilera collinsii* Pittier, Contr. U. S. Nat. Herb. 12: 97. pl. 3. 1908.

COSTA RICA: Plains of San Carlos.

6. *Eschweilera verruculosa* Pittier, sp. nov.

PLATE 12.

A middle-sized tree with straight trunk, radiate branching, and elongate crown; bark grayish, almost smooth; branchlets obscurely 4-angled, slender and flexible, covered with a brownish, more or less striate and verruculose bark.

Leaves rather large, petiolate, coriaceous, reticulate on both sides, entirely glabrous; petioles thick, dark-colored (when dried), canaliculate, 0.8 to 1.8 cm. long; leaf blades elliptic or elliptic-ovate, rounded and subcuneate at base, acuminate at tip, 12 to 30 cm. long, 5 to 11 cm. broad; margin entire (with black glandular dots); costa and veins prominent on both sides, more so beneath; primary veins 12 to 15, arcuate, anastomosed along the margin; stipules absent or early deciduous.

Racemes terminal, 2 to 5 cm. long, 3 to 8 flowered; rachis simple, stiff, geniculate, verruculose. Flowers alternate, subsessile; receptacle and base of sepals densely covered with brownish verruculose excrescences, the former narrow at base; sepals 6 (imbricate in bud), ovate-obtuse, coriaceous, smooth except at base without, about 1 cm. long and 7 to 9 mm. broad; petals 6, large, pale yellow or yellowish white, obovate or oblong, rounded at tip, 2.4 to 3.2 cm. long and about 1.5 cm. broad; androphore large, the blade connecting the narrow fertile ring with the hood about 2 cm. long and 1.7 cm. wide, the hood orbicular and about 1.3 cm. in diameter; stamens only on ring; filaments 2 to 2.5 mm. long, broad at base, thinner at middle, claviform and apiculate at the upper part; anthers broadly ovate, 0.6 mm. long, 0.8 mm. broad; staminodes lanceolate, acute, broader at the margin of the hood, 5.5 to 6.5 mm. long; ovary superior, 2-celled (?), with many ovules in each cell.

Pyxis middle-sized (3.5 to 4.5 cm. high, about 5 cm. diameter), globose-depressed, thick-walled, verruculose, the 6 sepals grown into 6 thick protu-

berances extending toward the conical base of the fruit; interzonal band about 6 mm. broad; operculum rounded, with a prominent tip, the overgrown stigma, at the center. Seeds numerous, small.

Type in the U. S. National Herbarium, no. 715506, collected in forests around San Felix, eastern Chiriquí, Panama, in fruit, December 24, 1911, by H. Pittier (no. 5290). Flowering material was obtained at the same locality September 8, 1912, Pittier 5738.

This is the "ollito" or "olleto" of the natives, so named because the fruit resembles a small earthen cooking pot. It seems to be nearly related to *Eschweilera verrucosa*, and was so identified, with doubt, by Seemann. The flowers, however, are much larger in our species and the shape of the fruit is quite distinct.

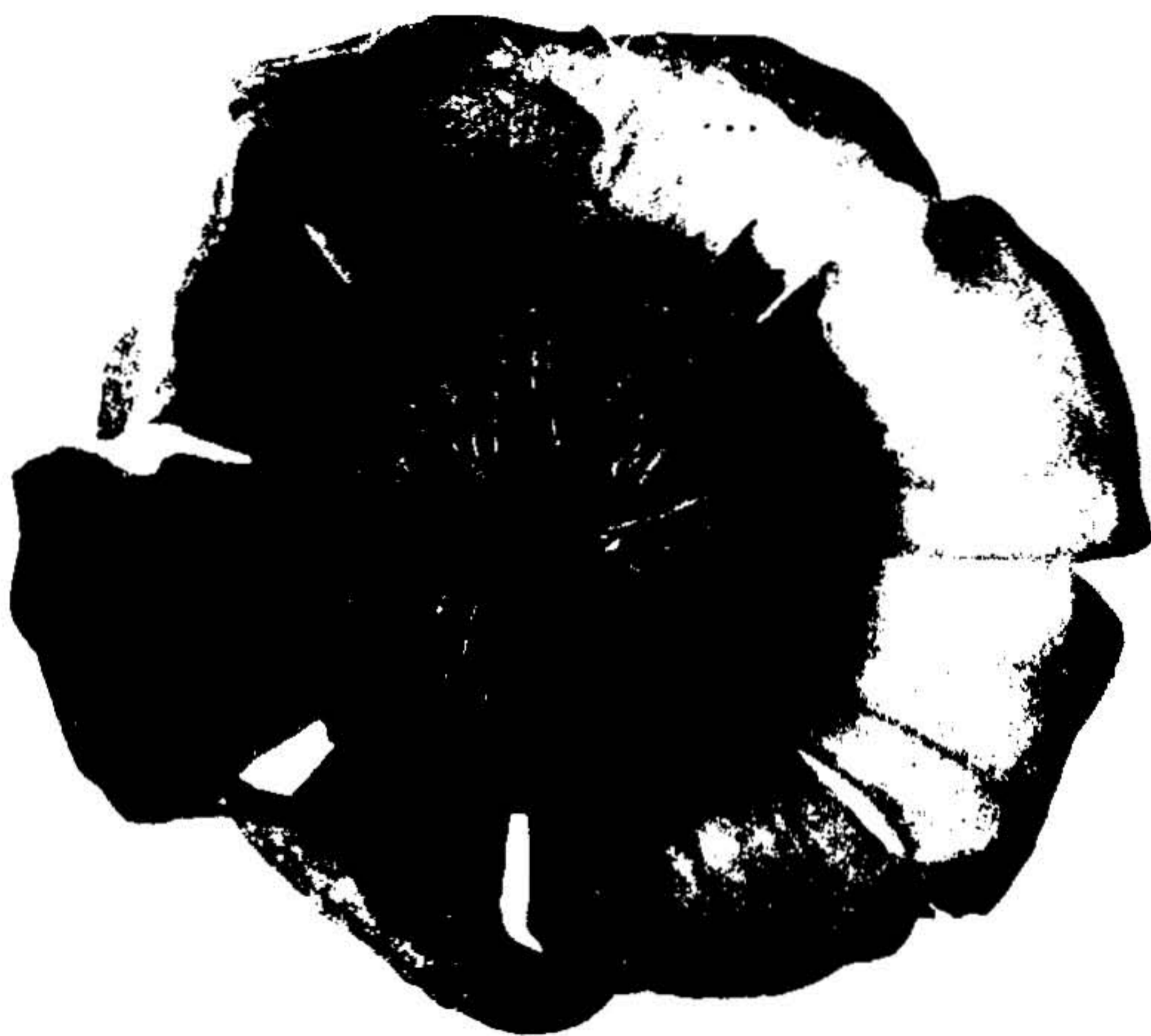
Eschweilera verruculosa is one of the most common trees of the lower belt of eastern Chiriquí.

EXPLANATION OF PLATE 12.—*Eschweilera verruculosa*. Leaves and pyxis. Natural size.





GUSTAVIA SUPERBA (KUNTH) BERG



GUSTAVIA SUPERBA (KUNTH) BERG



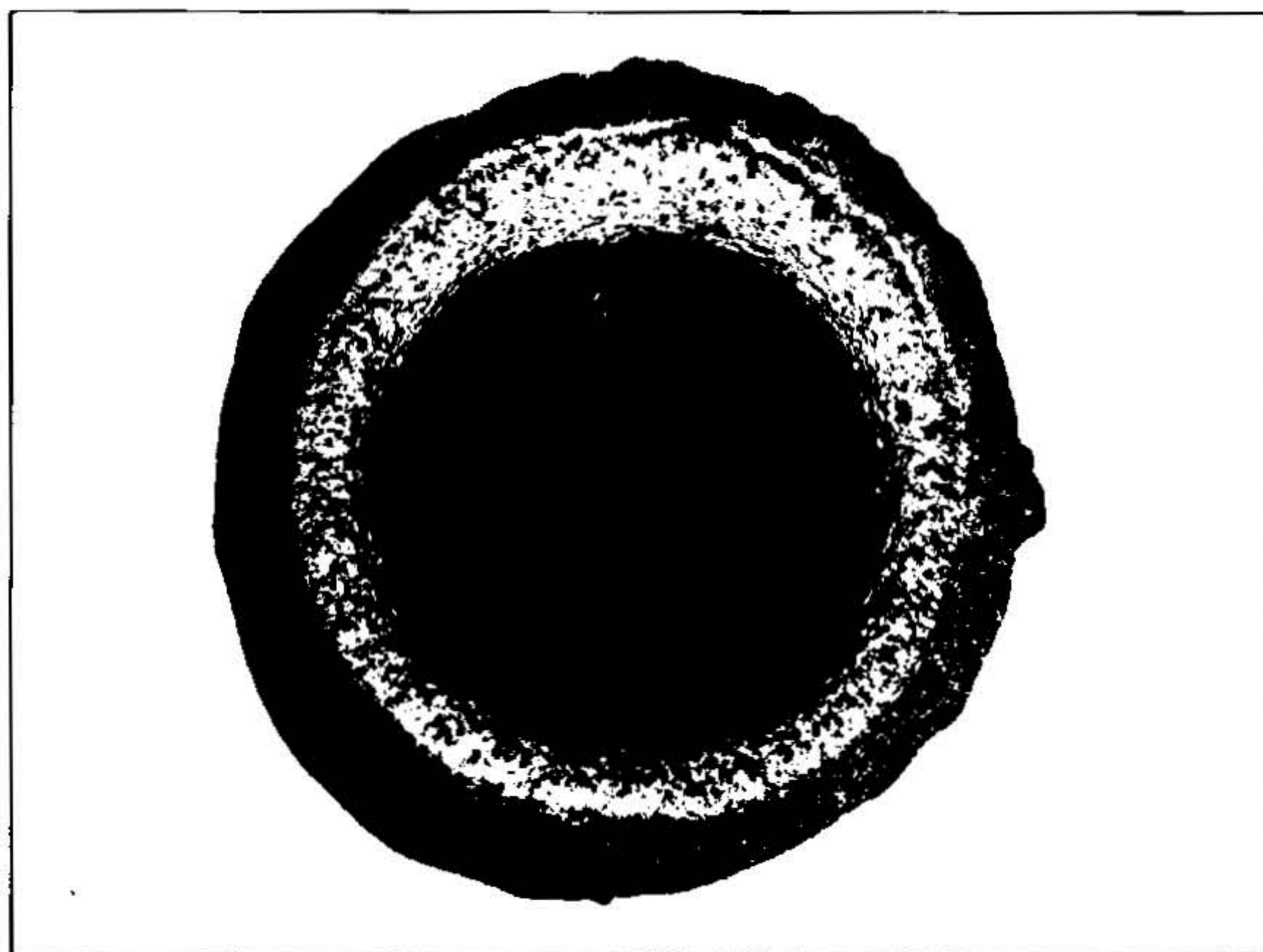
GUSTAVIA NANA PITTIER



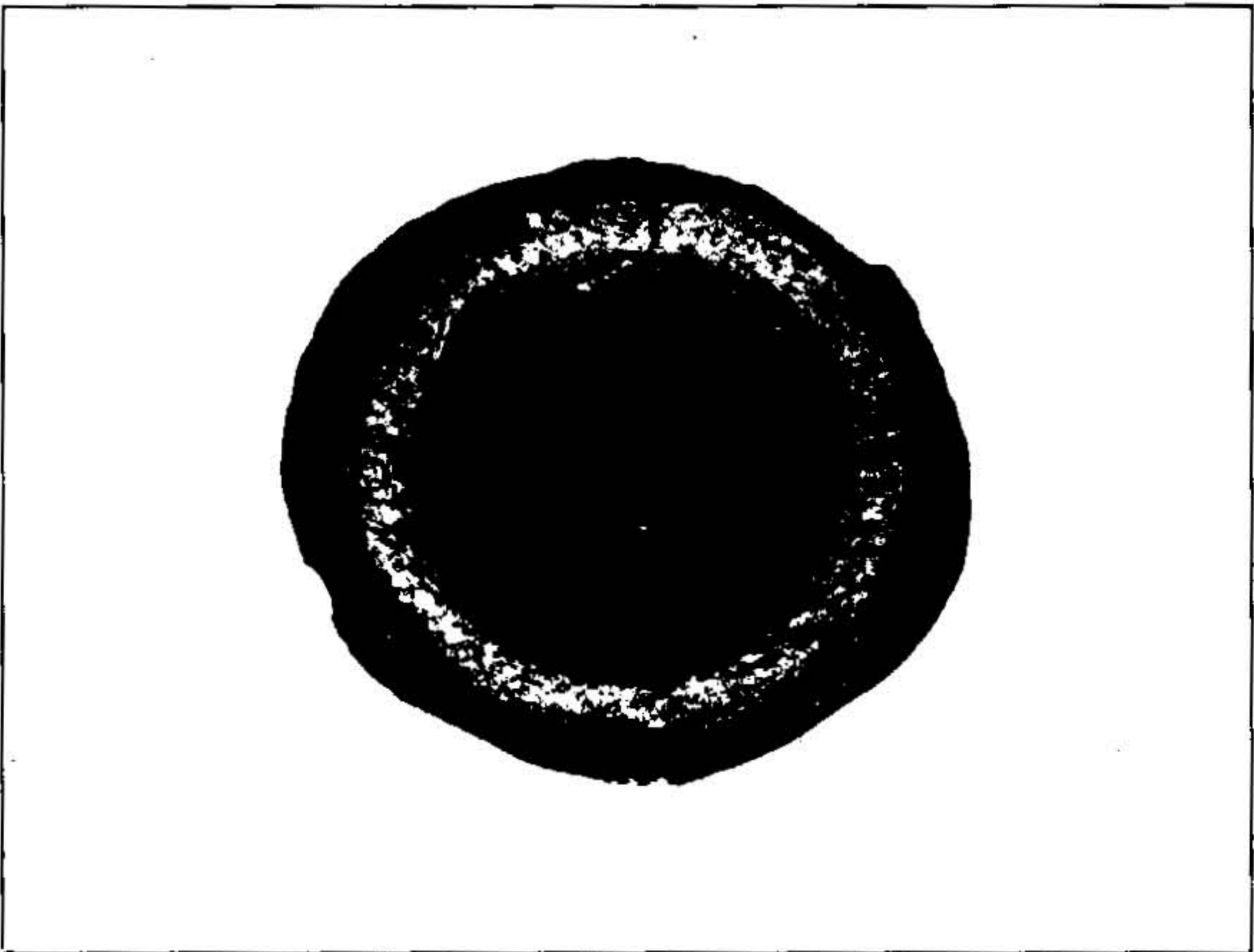
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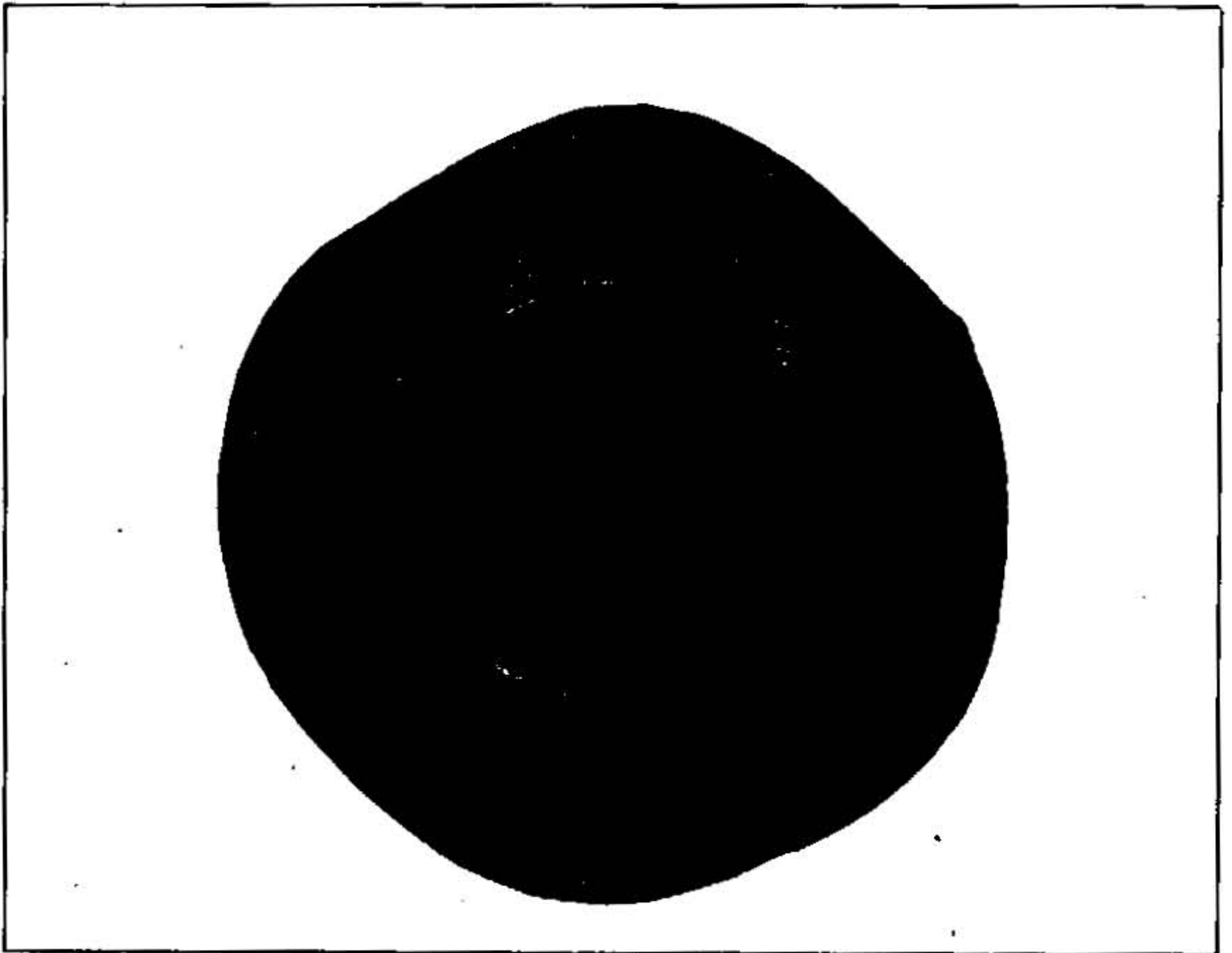
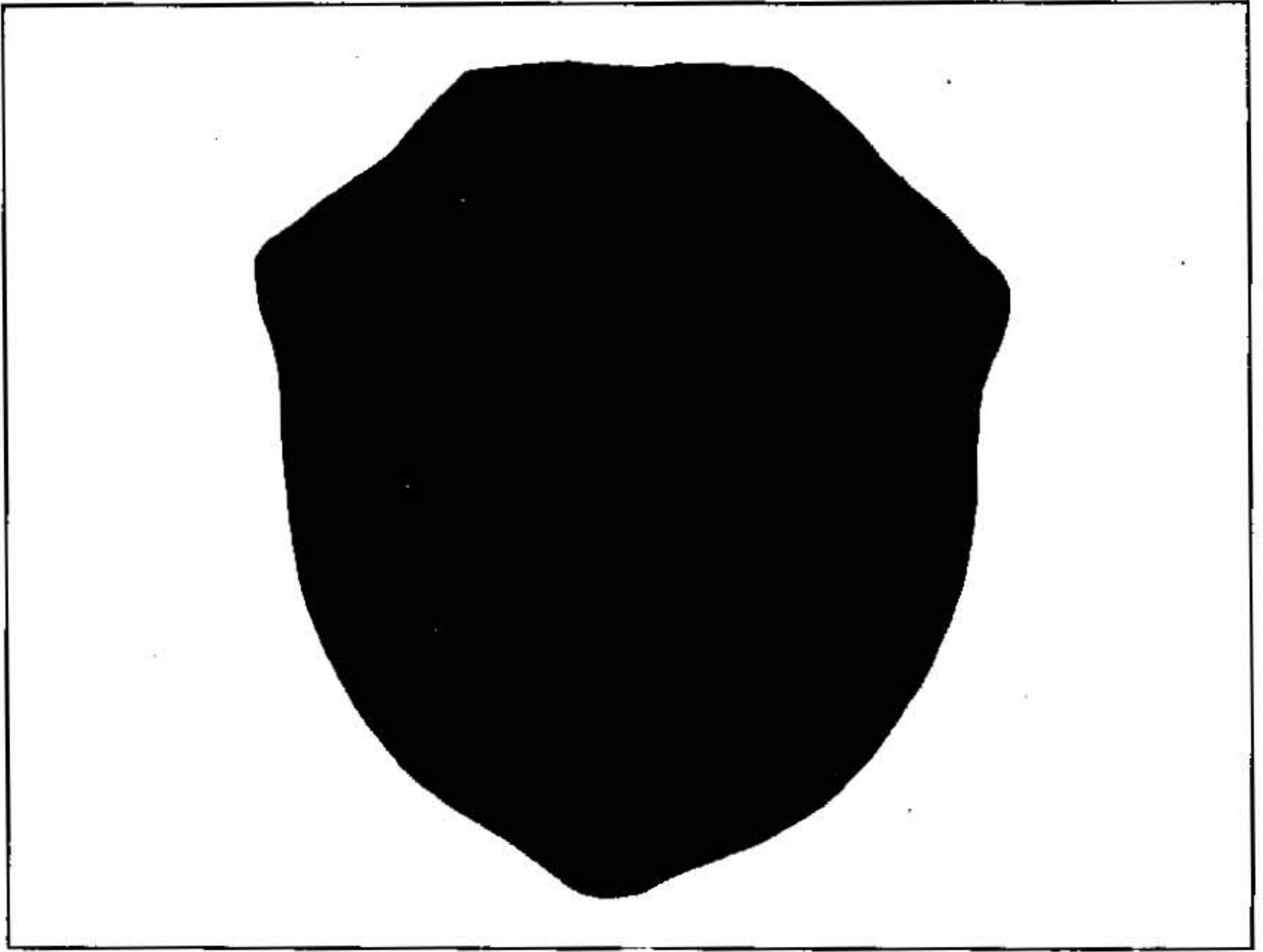
COUROUPITA DARIENENSIS PITTIER



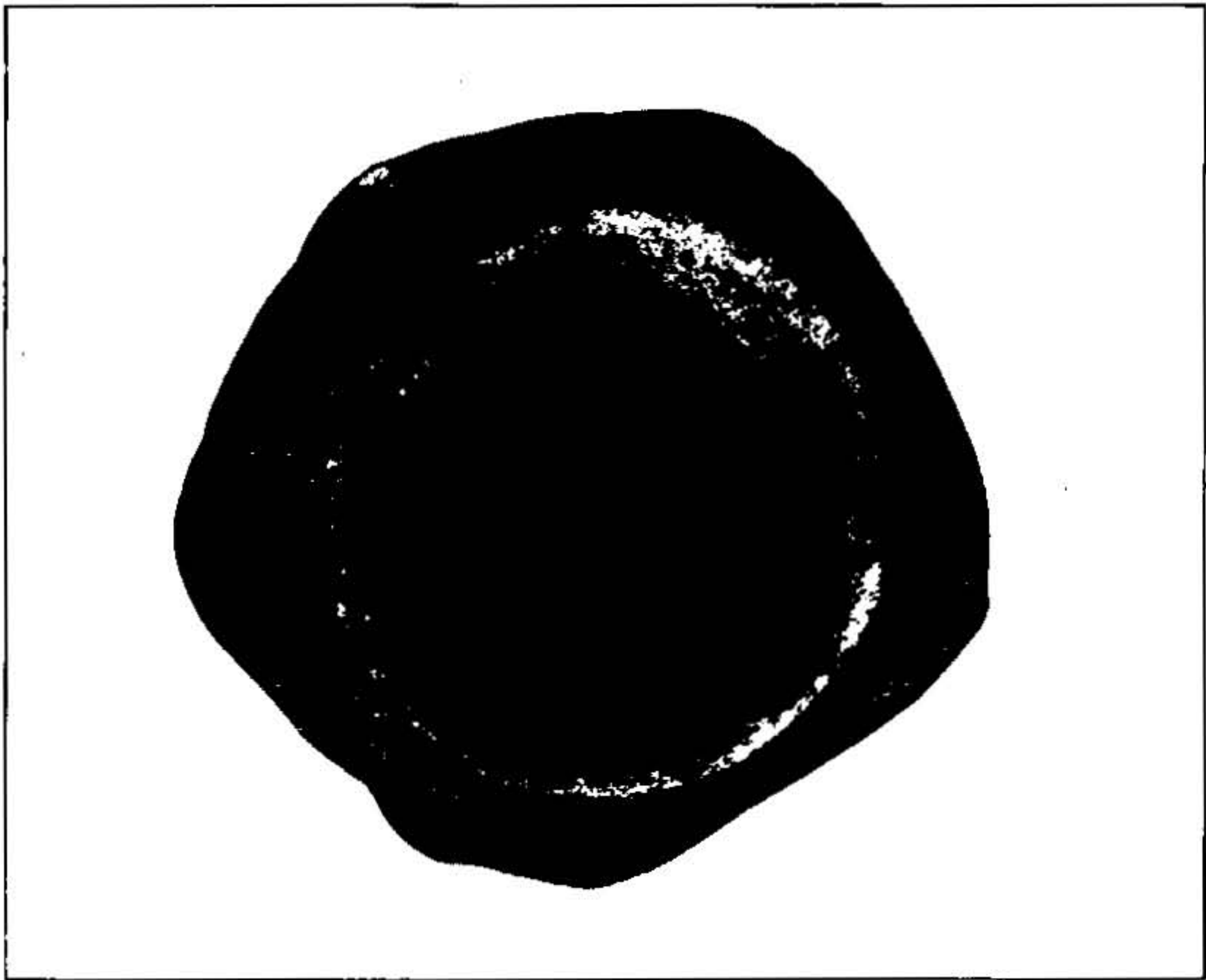
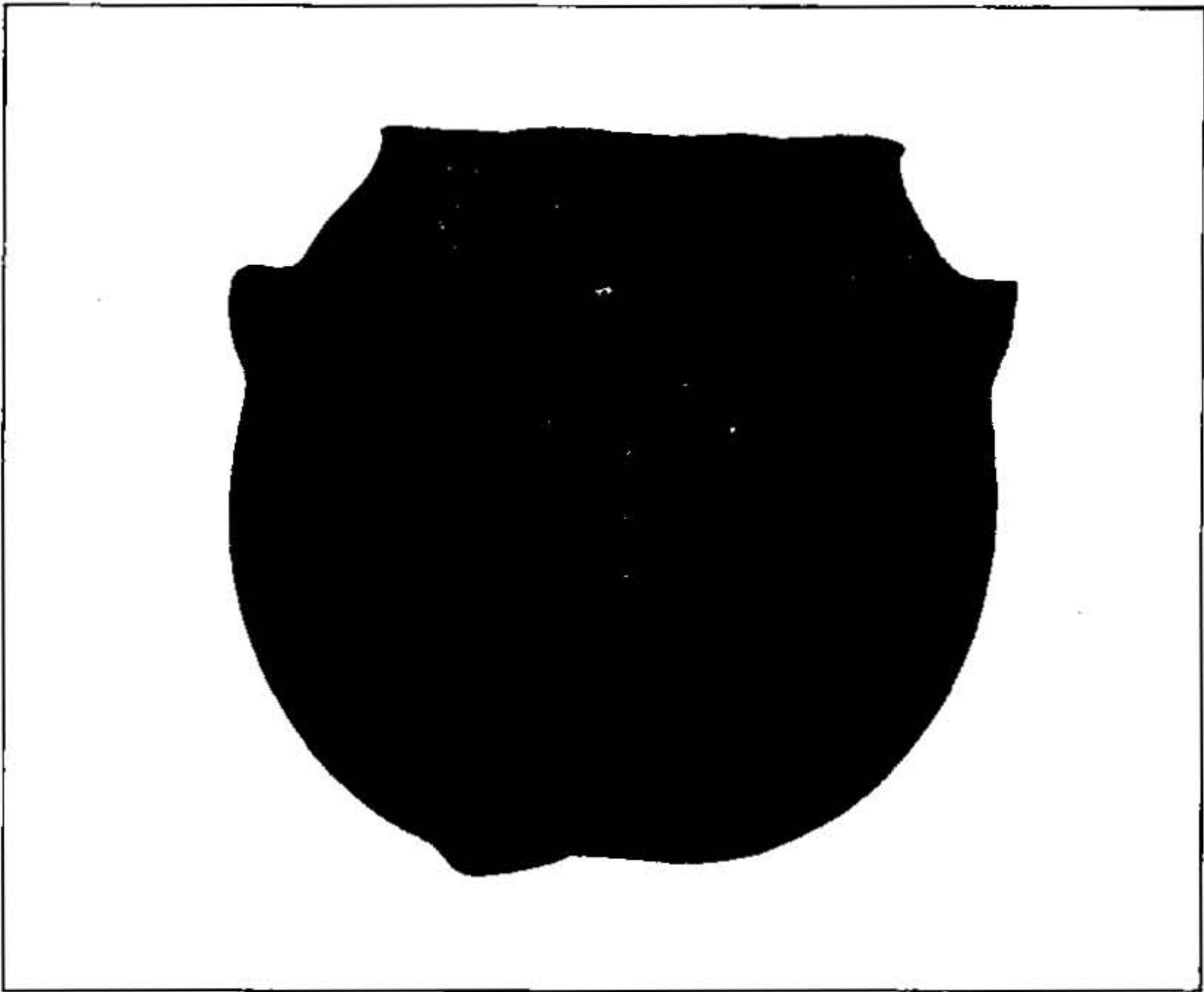
LECYTHIS MELLIANA PITTIER



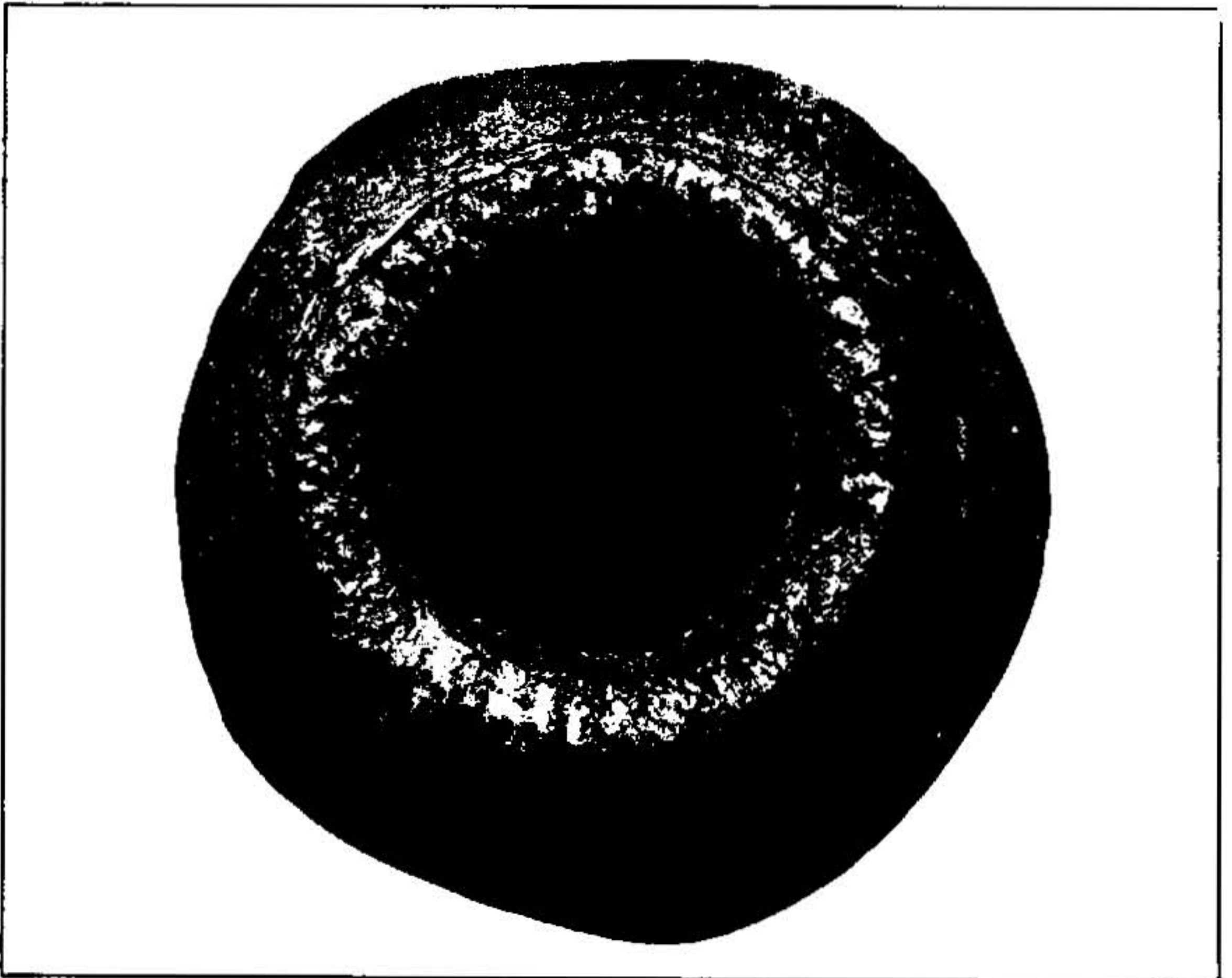
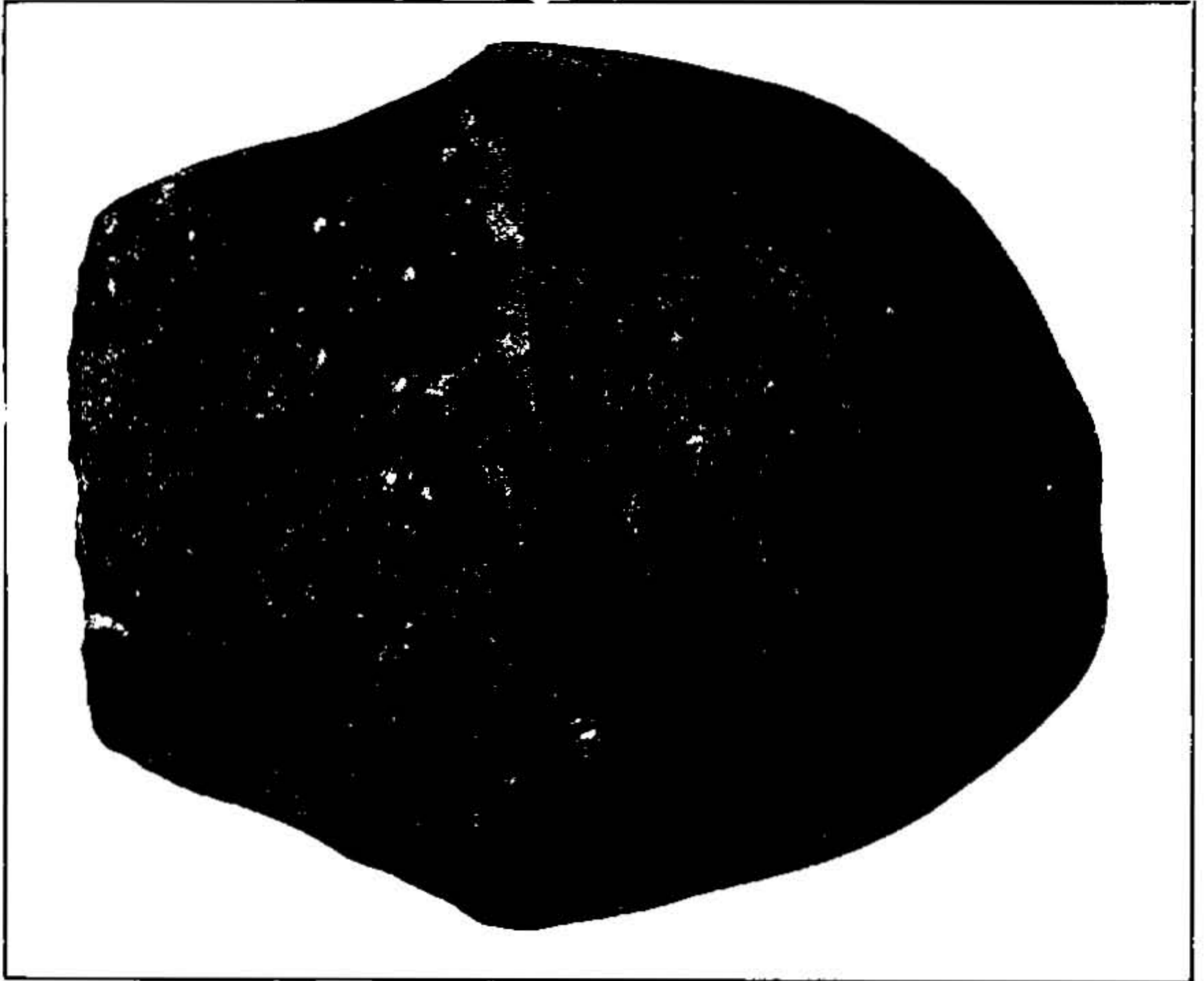
LECYTHIS TUYRANA PITTIER



LECYTHIS ARMILENSIS PITTIER



LECYTHIS AMPLA MIERS



LECYTHIS COSTARICENSIS PITTIER



ESCHWEILERA CALYCVLATA PITTIER



ESCHWEILERA VERRUCULOSA PITTIER