

POLYCLAD WORMS COLLECTED ON THE PRESIDENTIAL CRUISE OF 1938

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The material consisted of four vials of polyclads collected at various points along the shores of the Galápagos Islands and Old Providence and Clipperton Islands by Dr. Waldo L. Schmitt during the Presidential Cruise of 1938. Each vial contained a different species represented in three vials by a single specimen, in the fourth vial by two specimens. All of the worms were badly crumpled and folded and it was necessary to straighten them out forcibly before any work could be done on them. This has resulted in some distortion of parts and has produced folds and wrinkles in the body surface, but the material is adequate for the determination of the necessary points of anatomy. All of the specimens were stained as whole mounts with dilute acidified borax carmine and, after they were studied and drawn, the sexual region was removed in the case of three species and cut into sagittal serial sections. The study of the material has shown that it comprises two species of *Notoplana*, one of *Euplana*, and one of *Prosthiostomum*, all of which appear to be undescribed forms.

NOTOPLANA INSULARIS, n. sp.

Figs. 1-3

Description.—The single specimen, somewhat contracted and folded (fig. 1), is 9 mm. long and 3 mm. wide at the widest part, obviously much longer in life, of elongated oblong shape, tapering somewhat posteriorly. Color not determinable. Pharynx small with a few folds, embraced by the uteri which come to a point anteriorly behind the brain. Eyes (fig. 2) in paired elongated bands, tentacular clusters thus not separated from cerebral groups; tentacular groups evident as rounded group in each band at about the level of the middle of the brain. Eyes unusual in that cerebral eyes are of the same size as tentacular eyes. Posterior half of specimen made into serial sections. Copulatory apparatus (fig. 3) typical of the genus. Seminal vesicle oval, with thick muscular wall of fibers parallel to the surface contour. Ejaculatory duct curves backward and after a short course

enters the oval prostate vesicle, which is smaller than the seminal vesicle. This has a moderately thick muscular wall of fibers parallel to the surface contour, penetrated by the ducts of the extracapsular prostate glands. Ejaculatory duct projects into prostate vesicle for about three-fourths the length of the latter. No penis papilla. A relatively short stylet springs directly from the prostate vesicle; it lies in a moderately long tubular male antrum which curves gracefully ventrally and posteriorly to the male genital pore. Male antrum with a muscular wall of inner longitudinal and outer circular fibers. Female pore shortly behind male pore; canal leading in from surface probably artificial caused by straightening of the specimen. Vagina of moderate width with coating of circular muscle fibers; curves posteriorly and widens where it receives the uteri; beyond this, wide stalk of Lang's vesicle curves down, then posteriorly, and opens into the very long large Lang's vesicle.

Remarks.—*Notoplana insularis* does not closely resemble any of the known species from adjacent islands of the Caribbean and West Indies, but seems more nearly related to *N. stylifera* from Juan Fernandez, from which, however, it differs in several details, which will be apparent on comparison of my figures with those of Bock.

Differential diagnosis.—Tentacular and cerebral eyes in one band, cerebral eyes of same size as tentacular eyes, seminal vesicle larger than prostate vesicle, no penis papilla or penis sheath, penis stylet short, male antrum tubular, vagina widened at entrance of uteri.

Locality.—Shores, Old Providence Island. Collected by Dr. Waldo L. Schmitt, August 6, 1938.

Holotype.—Anterior half as whole mount; posterior half as sagittal serial sections, U.S.N.M. no. 20423.

NOTOPLANA CARIBBEANA, n. sp.

Figs. 4-8

Description.—One large specimen, 33 mm. long, 13 mm. wide at widest part, of elongated wedge form, widest anteriorly, tapering gradually to obtuse posterior end (fig. 4). Color not determinable. Eyes in paired bands in which the tentacular clusters are included (fig. 5). Some indications of tentacles in center of tentacular eye clusters; tentacular eyes obviously larger than cerebral eyes; cerebral eyes small, forming elongated group anterior to tentacular group and few scattered eyes behind tentacular group. Pharynx long, very narrow, with many small folds, embraced by uteri which come to a point in front of pharynx (fig. 4). Sexual region removed and cut into

sagittal serial sections. Male and female pores considerably separated, forming large oval openings. Crescentic seminal vesicle immediately behind posterior end of pharynx has very thin wall of muscle fibers paralleling its external contour. Seminal vesicle opens directly into large spherical chambered prostatic vesicle without the intervention of a duct; ejaculatory duct projects only a short distance into prostatic vesicle (fig. 6). Small penis papilla at beginning of male canal leading away from prostate vesicle. This canal, similar to penis pocket of other *Notoplanas*, is remarkably long and slender; runs backward above excessively muscular mass surrounding the male antrum and opens into posterodorsal angle of this antrum. Male antrum large with long anterior extension and lined by a tall epithelium filled with granules of glandular nature; male antrum surrounded by thick powerful muscle fibers running mostly lengthwise filling all space between antrum, prostate vesicle, and penis pocket. Posterior wall of antrum also muscular. Antrum opens below by large oval male genital pore.

Large oval female pore considerably behind male pore (relative positions shown in fig. 4). Pore opens into wide funnellike female antrum (fig. 7) with very folded walls; this appearance may be due to the straightening of the specimen. Tall lining epithelium of female antrum has glandular appearance. Vagina proceeds anteriorly from female antrum, makes sharp posterior bend, and some distance beyond the bend receives the uteri. Beyond uteri long slender stalk of Lang's vesicle runs backward and downward and opens into elongated oval Lang's vesicle. Vagina and stalk lined by ciliated epithelium, outside of which is a fibrous coat which does not appear to be muscular. Numerous cement glands open into vagina and beginning of vesicle stalk. Lang's vesicle lined by very tall epithelium, the distal two-thirds of which is filled with eosinophilous spherules (fig. 8). These suggest an eosinophilous secretion, but it is more probable that they are digesting material. Lang's vesicle probably serves to digest excess sex cells as well as for a seminal receptacle.

Remarks.—This species undeniably bears a very great resemblance in size, shape, and the details of the copulatory apparatus to *Notoplana binoculara* (Verrill) 1901 (syn. *Notoplana bahamensis* Bock 1913) of which Bock has given a good description, supplemented by some remarks in a recent paper of mine (Hyman, 1939). The similarity of *N. caribbeana* to *N. binoculara* is not surprising, in view of the proximity of Old Providence Island to the Bahamas, and there still remains a little doubt in my mind that I am justified in making a distinct species of *N. caribbeana*. The following differences may be

noticed between the two species. In *N. caribbeana* the cerebral eyes are much smaller than the tentacular eyes and on the same level, whereas in *N. binocularata* they are of nearly the same size as the tentacular eyes and so deeply buried that they were overlooked altogether by Verrill (whence the name *binocularata*). The seminal vesicle of *N. caribbeana* is much larger and thinner walled than that of *N. binocularata*, its male canal is longer and the male antrum is of different shape and lacks the two hillocks found in *N. binocularata* to which I have called attention. The female apparatus of the two species is very similar, but in *N. caribbeana* the vagina and stalk of Lang's vesicle appear to be longer than in *N. binocularata* (although these differences may depend simply on the size of the specimen) and the cement glands extend farther along the female apparatus than in *N. binocularata*. These differences seem to justify the separation of the forms as distinct species. Bock has placed *N. binocularata* in his group B, typified by *N. atomata*, but admits that it is not closely related to the members of this group. I suggest that *N. binocularata* and *N. caribbeana* be considered to constitute a separate group of the large genus *Notoplana*, characterized by the long male canal and the large extremely muscular male antrum.

Differential diagnosis.—*N. caribbeana* differs from other *Notoplanas* except *N. binocularata* in the long slender male canal, large male antrum with an anterior extension, and excessive muscularity of the anterior wall of the male antrum, whose muscle fibers fill all the space between antrum and seminal vesicle. Differences from *N. binocularata* are listed above.

Locality.—Shores of Old Providence Island. Collected by Dr. Waldo L. Schmitt, August 1, 1938.

Holotype.—Whole mount with sexual region removed; set of sagittal sections of sexual region, U.S.N.M. no. 20424.

EUPLANA CLIPPERTONI, n. sp.

Figs. 9-12

Description.—Two specimens, larger 17 mm. long, 7 mm. wide across widest part, not quite fully mature sexually, elongated, widest at about the level of the brain, tapering posteriorly, much folded and contracted, evidently much longer and more slender in life (fig. 9). Smaller specimen very young, 6.5 mm. in length, obovate, with no trace of sex organs. Color not determinable. With evident tentacular groups of eyes, consisting of 3 large eyes and 4-6 smaller ones (fig. 10). Cerebral eyes loosely arranged, scattered, radiating in a

linear arrangement along the principal nerve trunks (fig. 10). Of the cerebral eyes, there are two large ones close to the cerebral mass of granules characteristic of many Acotylea, and some large ones in a row along the bases of the main anterolateral nerve trunks (fig. 10). The smaller eyes are peripheral to the large ones, radiating along the nerve trunks. Small specimen (fig. 11) has same number and arrangement of large eyes as the larger specimen, but the smaller eyes have not yet appeared. Pharynx relatively small with small lateral folds. Sexual region of larger worm removed and sectioned. Conclusion from study of whole animal that sexual maturity had not quite been attained confirmed by study of sections, but essential parts appear to be present. Sexual apparatus close behind pharynx, far removed from posterior end of body. Sexual pores some distance apart (fig. 9). Male copulatory apparatus (fig. 12) typical of the genus, i. e., the male canal is not definitely divisible into seminal vesicle and prostatic vesicle, and may be considered to consist entirely of the seminal vesicle. Vasa deferentia enter separately the lateral angles of the seminal vesicle; seminal vesicle then turns dorsally, then bends posteriorly and extends as slender tube to penis papilla. Seminal vesicle has narrow lumen and thick muscular wall composed chiefly of circular fibers. No prostatic glands seen, probably because of immaturity of the specimen. Penis papilla small, rounded, armed with a short stylet in process of being secreted. Penis papilla lies in short penis pocket which forms a penis sheath where it joins the male antrum. Latter moderately large cavity, of moderate length. Female apparatus (fig. 12) has large genital pore, long muscular vagina bent into an S-shape, receiving cement glands along its course. Following entrance of uteri, female canal continues as a small Lang's vesicle, which may not yet be fully formed.

Remarks.—In an article on Atlantic coast polyclads (Hyman, 1939 b), I have shown that "*Prosthiostomum*" *gracile* Girard 1850¹ is not a *Prosthiostomum* at all, but fits into *Discoplana* Bock 1913. However, since Girard in 1893 himself removed this species from *Prosthiostomum* and created for it a new genus *Euplana*, *Discoplana* must become a synonym of *Euplana*. The copulatory apparatus of

¹In a recent publication Pearse (1938) has grossly misidentified *Euplana gracilis* (Girard) considering it a new species, type of a new genus, *Conjuguterus*. *Conjuguterus* becomes a synonym of *Euplana* and *C. parvus* a synonym of *Euplana gracilis*. Pearse's account of the male system of this species is also erroneous. These corrections are based on an examination of the type specimen of *C. parvus* and a number of other specimens labelled by Pearse with this name.

Euplana (= *Discoplana*) is very similar to that of the genus *Stylochoplana* and in fact it is difficult to distinguish between these two genera. The sole difference is that in *Euplana* there is no distinct prostatic vesicle, whereas one exists in *Stylochoplana*. *E. clippertoni* certainly resembles *Stylochoplana* in general external appearance, but has no definite prostatic vesicle and hence seems to fit better into *Euplana*. It differs from other known species of *Euplana* (= *Discoplana*) in the presence of a penis stylet. *Euplana gracilis* (Girard) is the most simplified member of the genus, having no penis papilla, stylet, or penis sheath.

Differential diagnosis.—Loosely arranged radiating cerebral eyes, small penis papilla, penis pocket, penis sheath and short stylet present, long muscular vagina with S-bend, small Lang's vesicle, genital pores well separated.

Locality.—Clipperton Island, under rocks to south of landing place. Collected by Dr. Waldo L. Schmitt, July 21, 1938.

Holotype.—Whole mount with sex region removed; set of sections of sex region, U.S.N.M. no. 20425. Young specimen on same slide with holotype.

PROSTHIOSTOMUM PARVICELIS, n. sp.

Figs. 13-15

Description.—One specimen, 6 mm. long, of usual slender shape typical of the genus, fully mature, bent in sexual region, part of anterior margin missing (fig. 14). Color not determinable. Eyes as usual in the genus, comprising paired cerebral groups, and band of eyes along anterior margin (fig. 13). Cerebral eyes consist of an irregular curved row of 7 eyes on one side, 8 on the other, with a single isolated eye lateral to the anterior end of the rows, on each side. Marginal row of eyes unfortunately imperfect because of missing anterior margin but obviously few in number compared to most other species of the genus, of about 2 rows in central part of band, thinning out around the sides to a few widely spaced eyes in a single row. Pharynx typical of the genus (fig. 14). Because of bend in body making good sagittal sections impossible, sexual apparatus was not sectioned. Because of eversion of the male apparatus, most of this apparatus can be seen in the whole mount. Male apparatus completely everted as in copulation (result of fixation?) (fig. 15). Inside the large cylindrical everted structure can be seen the oval seminal vesicle with thick muscular wall and Indian-club shaped lumen, the 2 spherical thick-walled accessory vesicles (of unknown function), and the

sinuous ejaculatory duct. The ducts of the accessory vesicles were not seen. At the distal end of the evert is the penis sheath; through its lumen extends the curved stylet typical of the genus, protruding from the penis end for about one-third of its length. The sperm form a club-shaped sharply defined mass in the lumen of the seminal vesicle and from this mass a stream of sperm can be followed along the ejaculatory duct and stylet and out of the tip of the stylet. The mode of entrance of the vasa deferentia into the seminal vesicle is shown in the figure.

Not much can be made out of the female apparatus in the whole mount; genital pore appears to lead into a cement pouch which receives the encircling cement glands (fig. 15).

The eversion of the male apparatus in this specimen is of great interest. It is undoubtedly normal since the same eversion was seen in a Bermuda *Prosthiostomum*, *P. cyclops* (Verrill) where, however, the specimen, through long preservation, was so dark and opaque that nothing could be discerned in the protruded apparatus. This Galápagos specimen indicates that in *Prosthiostomum* the entire male apparatus everts in copulation. This means that the male antrum must turn inside out, so that its lining becomes the surface epithelium of the evert, and the whole male copulatory complex, including the seminal vesicle and the 2 accessory vesicles, becomes pulled into the evert. It is further seen from figure 15 that the so-called penis sheath actually serves as penis papilla while the penis papilla remains inside and appears to function merely to anchor the stylet. One begins to wonder if these structures have not been misnamed and if the penis sheath should not be regarded as the penis papilla, and the projection at present considered the penis papilla should not receive some other name. Of course, many polyclads do not have a penis sheath. Whether it occurs only in those species with a stylet deserves investigation.

Remarks.—The species of the genus *Prosthiostomum* resemble each other so closely in external characters and details of the copulatory complex that separation into species is often difficult. As pointed out by Bock (1913) one must depend chiefly on the coloration and the eye arrangement. Some differences also appear to exist as regards the length and shape of the male antrum, shape of the seminal vesicle, and points of entrance of the vasa deferentia into the seminal vesicle. On the whole it is not advisable to omit the study of serial sections in determining the species of this genus. In the Galápagos specimen, the damage to the marginal set of eyes, the lack of data on the coloration in life, and the eversion of the male apparatus, preventing com-

parisons with other species where the male apparatus is known only in the resting condition, have increased the difficulties of deciding whether one is here dealing with a new species or not. The great resemblance, even almost the identity, of the eye arrangement of the present species with that of the common Mediterranean *Prosthiostomum*, *P. siphunculus* (Delle Chiaje) 1828, fully described by Lang, 1884, will not have escaped the notice of students of polyclads. On the other hand, it seems highly improbable that the same species would be found in two such widely separated localities as the Mediterranean and the Galápagos Islands. It further appears that *P. siphunculus* is very much larger than *P. parvicelis*. According to Lang, 1884, the former may reach a length of 30 mm. and the majority of the sexual individuals range from 12-18 mm. The specimen of *P. parvicelis* is already fully mature at a length which could not have been more than 8 mm. in the extended condition. The principal difference, however, between the two species, concerns the shape of the seminal vesicle and the points of entrance of the vasa deferentia. Lang, 1884, plate 30, figure 20, shows the seminal vesicle of *P. siphunculus* as curved, with a simple fusiform lumen and muscular wall of uniform width; the vasa enter at its proximal end. In *P. parvicelis* the wall of the seminal vesicle is very thick proximally and thins out distally, the lumen is of peculiar shape (fig. 15), and the vasa deferentia enter the sides and then turn proximally to join the beginning of the lumen. The shape of the cement pouch appears also to differ in the two forms. On these grounds I with some hesitation consider the Galápagos species distinct from the Mediterranean one.

Differential diagnosis.—Eye arrangement as in *P. siphunculus*; smaller than this species; seminal vesicle with thicker wall and small lumen proximally, thin wall and larger lumen distally, receiving the vasa deferentia into its sides.

Locality.—Sullivan Bay, James Island, Galápagos Islands, shore collecting. Collected by Dr. Waldo L. Schmitt, July 24, 1938.

Holotype.—One whole mount, U.S.N.M. no. 20426.

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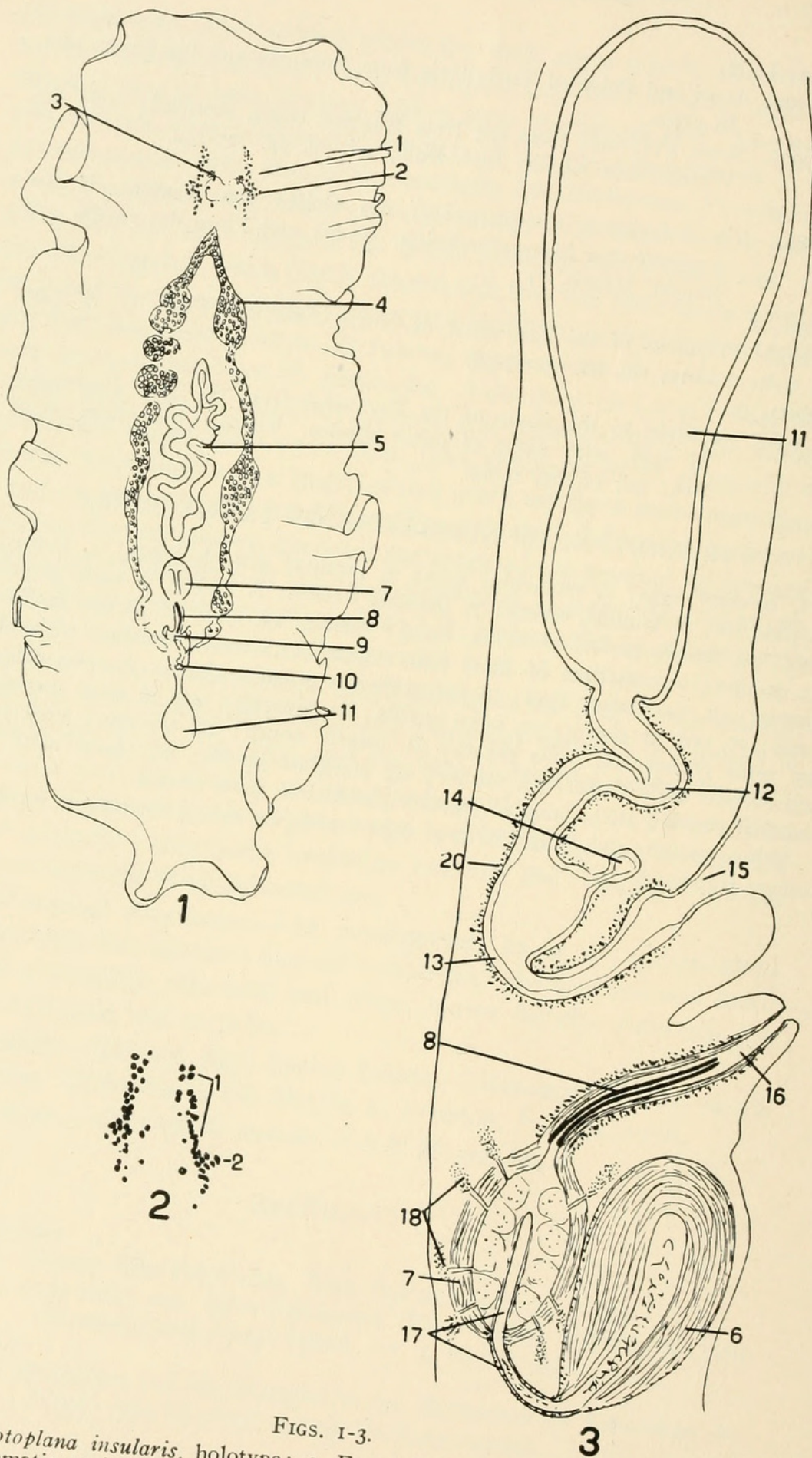
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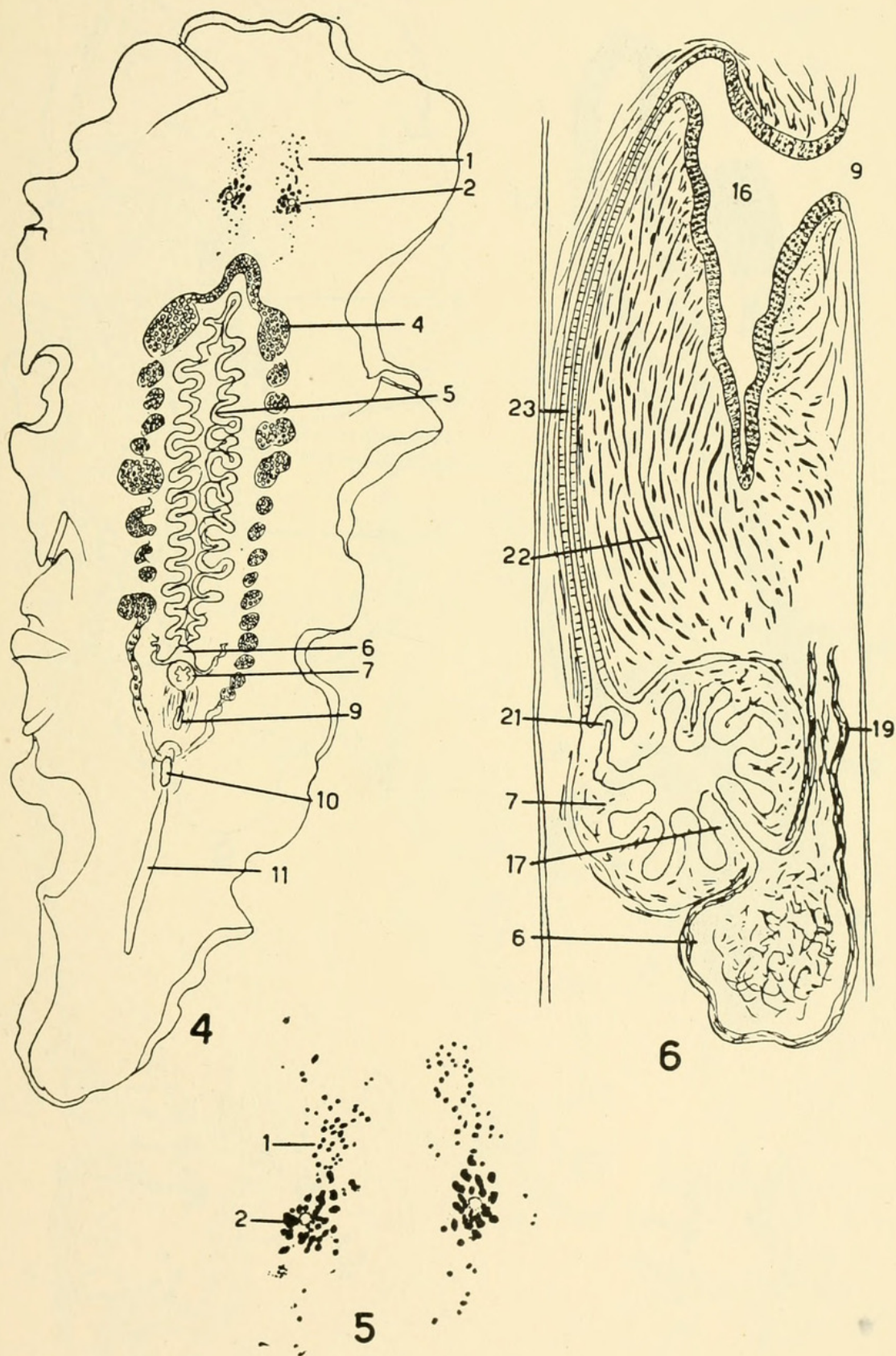
EXPLANATION OF NUMBERING OF TEXT-FIGURES

1, cerebral eyes; 2, tentacular eyes; 3, cerebral granule mass; 4, uterus; 5, pharynx; 6, seminal vesicle; 7, prostate vesicle; 8, stylet; 9, male genital pore; 10, female genital pore; 11, Lang's vesicle; 12, stalk of Lang's vesicle; 13, vagina; 14, entrance of uteri into vagina; 15, female antrum; 16, male antrum; 17, ejaculatory duct; 18, extracapsular prostate glands; 19, vasa deferentia; 20, cement glands; 21, penis papilla; 22, muscular wall of male antrum; 23, penis pocket; 24, penis sheath; 25, cement pouch; 26, accessory vesicles; 27, everted male organ; 28, sucker; 29, marginal glands; 30, sperm mass in seminal vesicle; 31, opening of prostate glands into penis pocket.

Whole mounts and figures of eyes drawn with the aid of the camera lucida; others free-hand.

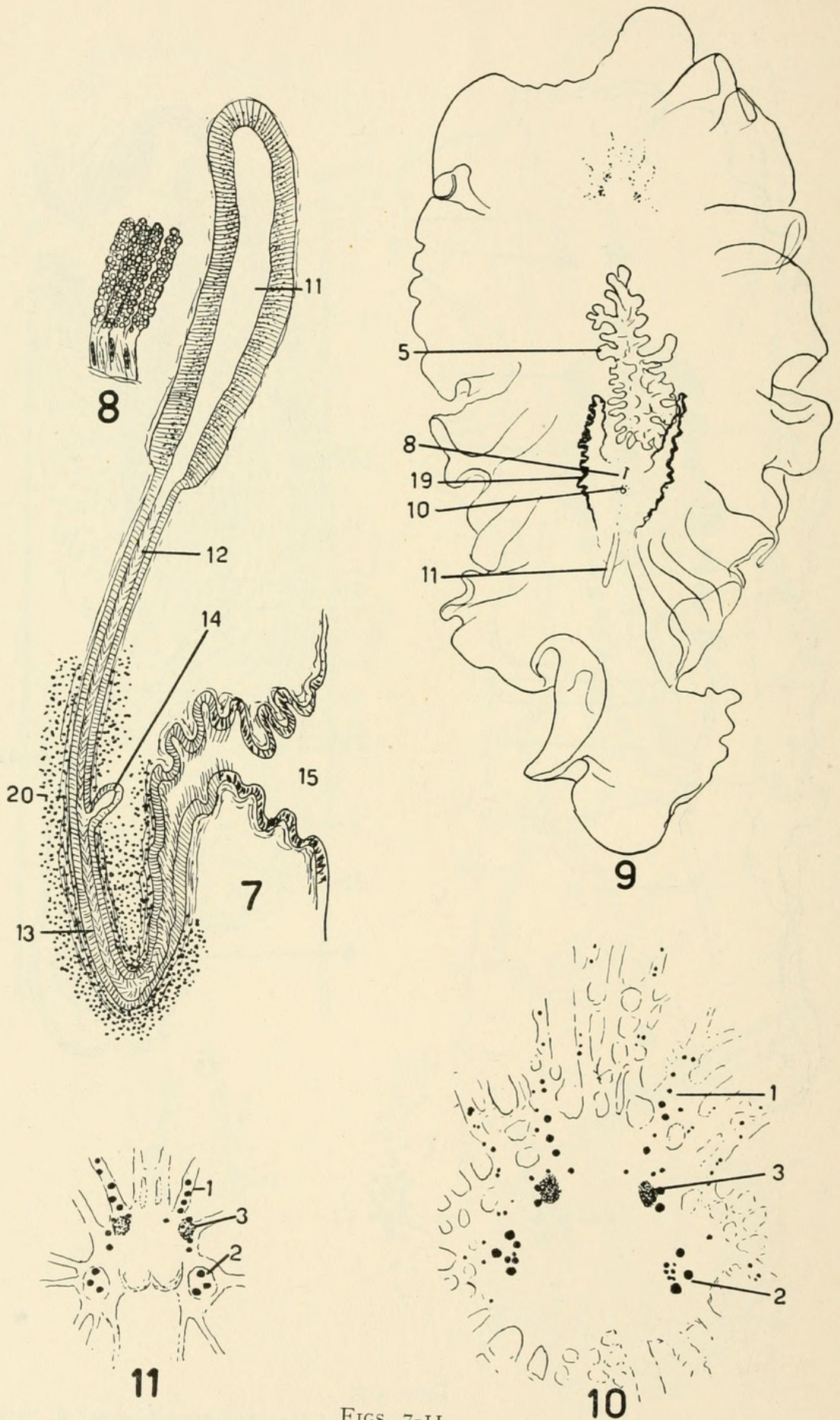


FIGS. 1-3.
 1, *Notoplana insularis*, holotype; 2, Eyes of *Notoplana insularis*; 3, Semi-diagrammatic sagittal view of the copulatory apparatus of *Notoplana insularis*, based on sagittal sections of the sexual region of the holotype.



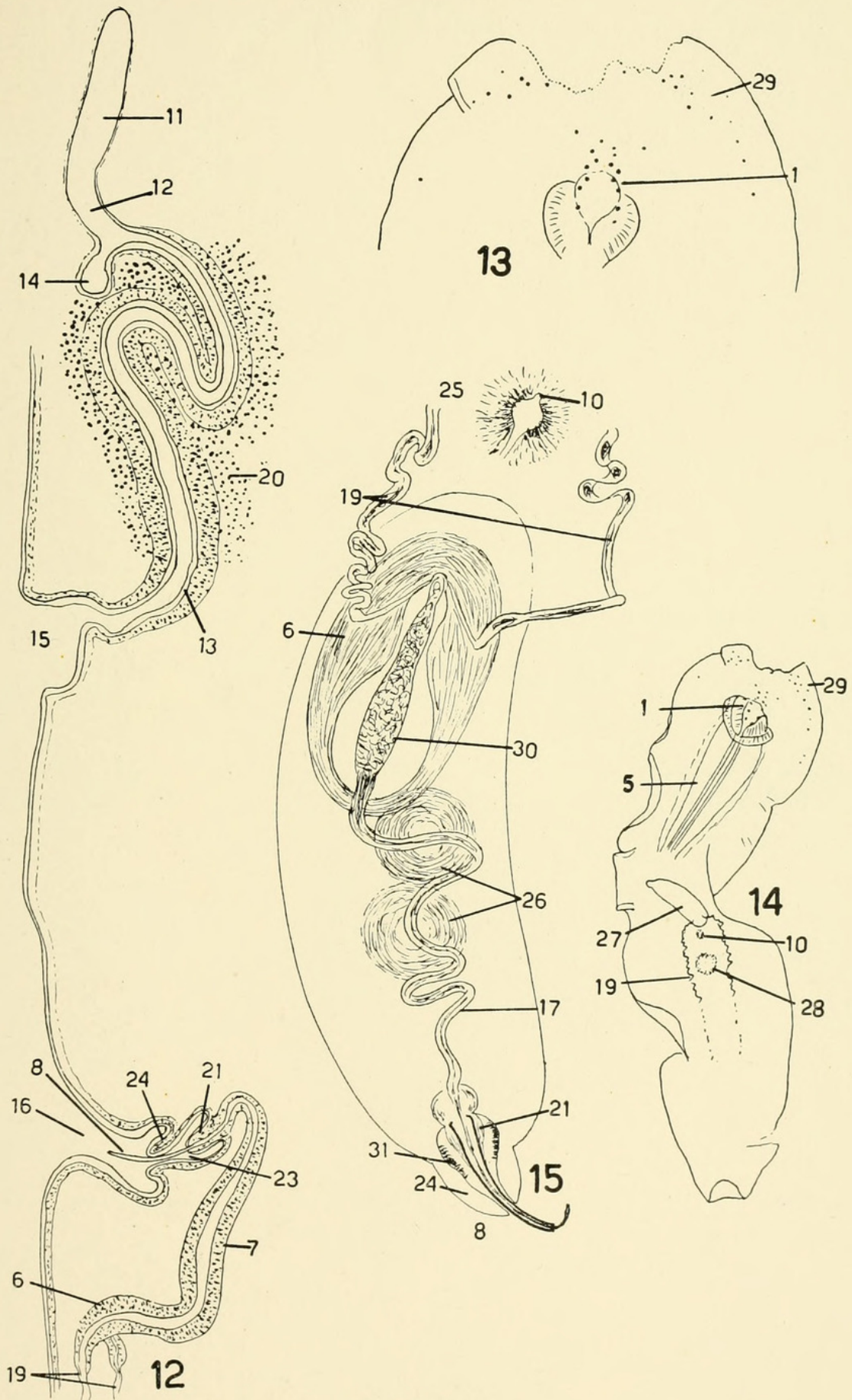
FIGS. 4-6.

4, *Notoplana caribbeana*, holotype; 5, Eyes of *Notoplana caribbeana*; 6, Semi-diagrammatic sagittal view of the male copulatory apparatus of *Notoplana caribbeana*, based on sagittal sections of the sexual region of the holotype.



FIGS. 7-II.

7, Sagittal view of the female apparatus of *Notoplana caribbeana*, from same set of sections as fig. 6; 8, A few cells from the lining epithelium of Lang's vesicle of *Notoplana caribbeana*, showing eosinophilous spherules; 9, *Euplana clippertoni*, holotype; 10, Eyes of *Euplana clippertoni*, holotype; 11, Eyes of a young specimen of *Euplana clippertoni*.



FIGS. 12-15.

12, Semidiagrammatic sagittal view of the copulatory complex of *Euplana clippertoni*, based on sagittal serial sections of the sexual region of the holotype; 13, Eyes of *Prosthiostomum parvicelis*, holotype; 14, *Prosthiostomum parvicelis*, holotype; 15, Everted male copulatory organ of *Prosthiostomum parvicelis* containing the male apparatus.

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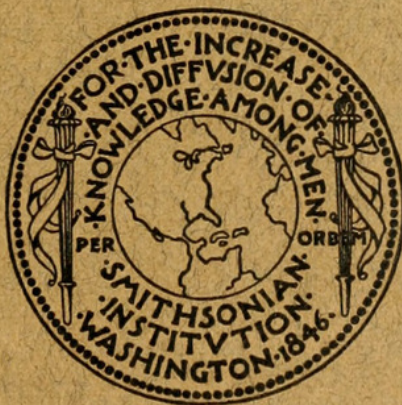
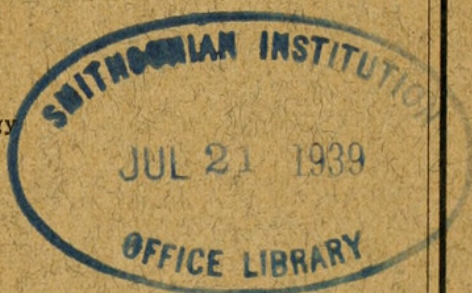
NOTES ON HILLERS' PHOTOGRAPHS OF
THE PAIUTE AND UTE INDIANS TAKEN
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OF 1873

(WITH 31 PLATES)

BY

JULIAN H. STEWARD

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INTRODUCTION

When, in 1869, Maj. John W. Powell made his first exploration of the Colorado River, he encountered Ute and Southern Paiute Indians in the territory that is now Utah and northern Arizona. Fascinated at finding them nearly untouched by civilization, he developed a deep interest in ethnology which led to extensive field studies and even ultimately to the founding of the Bureau of American Ethnology. During explorations, he took every opportunity to study their language, customs, and mythology, to collect specimens of their utensils, dress, and handicraft, and to procure photographs.

Few explorers in the United States have had a comparable opportunity to study and photograph Indians so nearly in their aboriginal state. The Ute, to be sure, had probably experienced something of a cultural revolution when they acquired the horse from the Spaniards in the Southwest long before the first white man visited their country. They were already hunters and warriors, in many respects resembling the tribes of the Great Plains, when Escalante passed through Utah in 1776. After the 1820's, when fur trappers began to penetrate their territory, the Ute acquired a few guns and other trade objects, but were little affected by their casual contacts with the white men. The Southern Paiute, meanwhile, living in the more arid country to the south and west, remained, without horses or guns, entirely in their aboriginal state. In 1847 the Mormon pioneers arrived at Great Salt Lake and within a few years planted settlements throughout much of the desert. The Ute resisted this settlement, especially in western Utah, and warfare began, reaching a climax about 1865. The Ute were subdued, however, by 1870, and many of them moved to the reservation which had been founded in the territory of one of their bands, the Uintah Ute, in northeastern Utah. There were thus

Ute from many localities in this region when Powell first passed through it in 1869. They had, however, been in close contact with the white man for only 20 years and had not lost their native customs.

Mormon settlement of Southern Paiute territory affected native life in varying degrees. In the vicinity of St. George and Kanab, in southern Utah, the Paiute were too poor and unorganized to offer effective resistance to settlement. They lingered in their original habitat in the vicinity of the newly founded Mormon villages and, as the destruction of their native foods by cattle, sheep, and farming made life difficult, they gradually attached themselves to these communities. The early 1870's, however, found their native culture still little affected by these contacts. Most isolated of all were the Paiute on the Kaibab plateau north of the Grand Canyon in Arizona. In 1869 many of them had scarcely seen a white man and, beyond a few objects which they traded or stole from the white man, they were quite untouched by civilization. When first visiting this group in September, 1869, Powell¹ wrote, "Altogether, these Indians are more nearly in their primitive condition than any others on the continent with whom I am acquainted. They have never received anything from the Government, and are too poor to tempt the trader, and their country is so nearly inaccessible that the white man never visits them." Fortunately, most of Powell's notes, collections, and photographs come from these people.

None of the results of Powell's ethnographic work have been published in systematic form. Brief remarks on language, customs, and mythology are found in many of his writings, and considerable remains scattered through unpublished manuscripts. The latter contain much that is of value, but the task of culling the ethnographic data from other miscellaneous material, of ascertaining the identity of Indians mentioned, and of eliminating repetitious notes is formidable. Powell's extraordinarily fine collection of Ute and Paiute specimens in the United States National Museum is largely unknown to the scientific world. But properly to describe and illustrate it would require enormous work and expense and would be handicapped by the inadequate data accompanying it. Like most collections made during that period, a catalog entry like "Ute" or "Pah Ute" was deemed sufficient to indicate the source of a specimen.

The most valuable ethnographic result of Powell's explorations are the photographs. On his second descent of the Colorado River in

¹ Powell, John W., *Exploration of the Colorado River of the West and its tributaries*, p. 126. Washington, 1875.

1871, he was accompanied by John K. Hillers. Hillers began as a general assistant but quickly mastered photography and remained with Powell during his explorations of the next few years making photographs of all types of subjects. His pictures are on glass negatives, each having two exposures 4 by 5 inches suitable for stereopticons. In spite of the cumbersome equipment and the difficulties of preparing and developing negatives in the field, most of these pictures are every bit as good as modern professional photography and put to shame the efforts of most ethnologists.

Unlike the collections of specimens and ethnographic notes, the photographs are carefully cataloged as to locality, leaving no doubt about which Indian groups are represented. The catalog does not indicate, however, precisely when or under what circumstances the pictures were taken. The date on all is 1873, but it is entirely possible that many were taken earlier, perhaps starting with the Colorado River trip of 1871. Presumably they were taken during the summer when the type of house, clothing, and other features of native life would have been somewhat adapted to the warm weather and to the nomadic life necessary when gathering seeds.

The present collection includes all of the Hillers photographs that have ethnographic value. A number of these were reproduced as steel engravings in some of the publications by Powell, Mason, and other persons, but are included here not only for the sake of completeness but to bring out detail not obtainable in the engravings and to call attention to features of ethnographic interest. A few photographs have been eliminated either because of the poor quality of the negatives or because they are virtually duplicates of those included.

It had been hoped that a description of the museum specimens, which include many objects similar to those shown in the photographs, might accompany these pictures. In view, however, of the dubious provenience of many of the specimens and of the magnitude of the task of describing them, the museum study must be postponed.

Identification of the objects illustrated in the photographs may be made with reasonable certainty. Until very recent years, the Ute and Southern Paiute and the very similar Shoshoni and Northern Paiute, all occupying the deserts between the Rocky Mountains and California, had been virtually ignored by ethnologists. Although detailed monographs by several field workers are now in course of preparation for publication, Lowie's pioneering study of these tribes²

² Lowie, Robert H., Notes on Shoshonean ethnography. Amer. Mus. Nat. Hist., Anthropol. Papers, 20, pt. 3, pp. 187-314, 1924.

remains the outstanding source on the Ute and Southern Paiute. It is possible, however, by using Lowie's monograph together with monographs on tribes farther west, shorter accounts of these tribes by explorers and ethnologists,³ and the writer's own experience in the area, to interpret most of the photographs in terms of their cultural significance and to add some comparative notes.

Before the settlement of the west, a great difference existed between the Ute and Southern Paiute, the two main groups represented in these photographs. The former were essentially horsemen, bison hunters, and warriors. For many years they had been traveling east to hunt bison in the Great Plains. Warfare with tribes in that area had given them a militaristic spirit. Cultural contacts had introduced many conspicuous Plains traits, such as tipis, use of rawhide, horse regalia, war equipment, and many others.

The Southern Paiute, more isolated in their deserts and lacking horses, resembled the Western Shoshoni and Northern Paiute, who lived in the Great Basin of Nevada and adjoining parts of California, Oregon, and Idaho. They relied mainly upon wild seeds and roots which they collected by means of a highly developed basketry complex. Large-game hunting was of secondary importance, though the great number of buckskin garments shown in the photographs suggests that it was not so unimportant as often believed. The Paiute's general poverty and the seminomadic existence required during the great part of the year by their simple hunting and gathering economy limited their material possessions. The photographs show them, probably most often at their temporary summer encampments, with their meager equipment.

Caution, however, is necessary in interpreting the pictures. Not only are many of the Indians obviously posed in artificial stances, but art seems often to have outweighed realism in the selection of objects represented. Thus, a woman in semidress may indicate Powell's and Hillers' idea of photographic art rather than actual use of garments. Poses with bows, baskets, and other objects may also misrepresent their actual use.

HABITATIONS

When Indian informants describe customs abandoned one or two generations ago, they are likely to remember only salient features and thus give the impression that native practises were more stand-

³ The main sources to date are listed in the writer's study of the Shoshoni, Basin-Plateau aboriginal socio-political groups, *Bur. Amer. Ethnol. Bull.* 120, 1938.

ardized than was actually the case. These photographs, taken when strictly aboriginal types of shelters still prevailed, correct such an impression and illustrate the great variability brought about by the adaptation of construction to various special conditions and circumstances.

The photographs of the Southern Paiute, however, were evidently taken during the warm season and thus throw no light on the winter house. Other tribes of these deserts used shelters comparable to these during the summer, but in winter, when they settled down near their stored foods to remain during the cold weather, they erected somewhat sturdier and larger conical lodges. During the summer, such lodges were not only unnecessary but inappropriate. The subsistence routine required continual movement from one locality to another as different foods became available. Shelters were, therefore, no more than temporary structures designed only for the few days or weeks that would be spent at any food camp. Powell⁴ wrote of the Kaibab Paiute, "During the inclement season they live in shelters made of boughs, or bark of the cedar, which they strip off in long shreds. In this climate, most of the year is dry and warm, and during such time they do not care for shelter. Clearing a small, circular space of ground, they bank it around with brush and sand, and wallow in it during the day, and huddle together in a heap at night, men, women, and children; buckskin, rags, and sand."

The extreme of simplicity in Kaibab shelters was to pitch camp beneath a tree, little or no effort being made to improve upon nature (pls. 11, 12, 13, *b*). When construction was undertaken, houses tended to be semiconical, erected either upon poles planted in the ground or upon interlocking poles (pl. 21, *a, b*) or almost completely conical (pl. 14, *a*). House poles were covered with various materials, no doubt those which were locally available, such as boughs (pl. 9, *a, b*) and willows (pl. 10, *b*). One house had a fire in the center and the roof open above (pl. 20, *a*).

The Ute had acquired the tipi through contact with the Plains tribes. Those shown in the photographs (pls. 23, *a, b*, 24, *a*, 25) are all undecorated. That in plate 24, *a*, was, according to the title of the picture, made of elkskin. When tipis could not be built or when they were unnecessary, a conical house, described by informants as similar to the brush house of the Paiute and Shoshoni, was used. That shown in plate 26, *b*, however, is larger and better constructed

⁴ Op. cit., p. 126.

than the Southern Paiute lodges, having longer, cleaner poles. It is, in fact, more a tipi covered with boughs and some canvas in place of skin.

CAMP ACCESSORIES

If these photographs truly represent aboriginal practise, the use of the tripod extended far south in the Intermontane area. The Kaibab used it to suspend the cooking pot (pl. 13, *b*), though the pot in question is evidently of iron, and the Uintah used it not only for cooking (pl. 25) but as a support on which goods were hung (pl. 24, *a, b*).

The backrest, consisting of a tripod supporting horizontal slats, is shown in a Uintah Ute lodge (pl. 26, *b*). These Ute also used horizontal bars for supporting dried maize (pl. 26, *b*).

Of special interest is the tree platform (pl. 23, *b*) and the two-story construction (pl. 25). It is not clear whether the title of the first, "tree lookout" or "the watch tower," designates the pose of the boy on the platform or the purpose of the platform. The second structure, called "shelter," seems actually to have served as a shelter and storage place. Note the notched log which serves as a ladder.

BASKETRY

The basketry of the groups represented here has an interesting place in western American basketry. It is generally believed that both the coiled and twined basket weaves originated at some place on the Pacific coast and spread inland, the former being invented first and attaining a wider distribution than the latter. Thus, only coiling was known to the Basket Makers, the oldest known weavers in the Southwest, and to the Ute, who are on the eastern fringe of the basket area. West of the Ute, however, tribes used both coiling and twining. The latter, being more easily made, was used by Shoshoni and Northern Paiute for such utility baskets as conical seed baskets, winnowing trays, seed beaters, hats, and water jugs, whereas coil was employed only for the somewhat more ornamental trays and bowls. A few Shoshoni of central Nevada appear even to have abandoned coiling entirely in favor of twining.

The photographs suggest that among Southern Paiute, both types of weave were used for all kinds of baskets except possibly hats. Thus it would appear that strict cultural tradition did not entirely determine the weave used, but that the choice in each case depended somewhat upon individual or perhaps family taste. The Kaibab group shown in plate 11, for example, coiled all their baskets—conical

seed basket, water jug, circular trays, and receptacles—though other Kaibab Indians used twining for many of these vessels.

The Uintah Ute baskets in these photographs resemble those in a large collection at the University of Utah. All are coiled, being extremely crudely made and limited in range of forms. A problem still to be solved by anthropology is whether the Ute had, in prehorse days when they depended more upon seed gathering than upon hunting, the full range of basketry forms known to the other Shoshonean tribes. It seems certain, though it has not been proved, that the radical change wrought in their economy by the introduction of the horse would have caused them to abandon many traits connected with seed gathering in favor of things pertaining to hunting.

Basketry forms are clearly shown in the photographs. They include hats, conical seed or burden baskets, seed beaters, winnowing or parching trays, flat trays, water jugs or ollas, and receptacles or bowls. (Cradles, though often made with a basketry technique, are treated separately.) The distinction between twining and coiling is usually clear, especially if the photograph is examined with a glass. Illustrations of the uses of baskets are in most cases probably accurate, though posing the subjects seems to have misrepresented a few. The woman in plate 1, *c*, for example, is gathering seeds in a basketry hat, a dubious procedure.

Hats.—Basketry hats, which are widespread throughout the West and on the Pacific coast, are shown in all groups here except the Uintah Ute. All hats appear to be twined. Two somewhat distinct, though similar, forms are illustrated. One is hemispherical, either with a rounded top, like the Moapa Paiute specimens (pl. 1, *c*, 3, *b*) and the Las Vegas hat (the girl on the right, pl. 6, *c*) or with a pointed top, like the Kaibab specimens (pls. 10, *b*, 11, 15, *b*, 16, *b*). The other form is a somewhat truncated cone, the Las Vegas example (pl. 6, *b*, *c*). These hats are either undecorated or bear one or two bands of geometric figures (pls. 1, *c*, 3, *b*, 6, *b*).

Among Shoshonean tribes, basketry hats were worn only by women, serving the double purpose of protecting the head from carrying straps attached to burdens and from pitch when gathering pine nuts.

Conical baskets.—These are large, conical baskets used by women both for gathering seeds and for carrying burdens. Powell⁵ states that for gathering seeds, "they have large, conical baskets, which hold two or more bushels. The women carry them on their backs, suspended from their foreheads by broad straps, and with a smaller

⁵ Op. cit., p. 127.

one in the left hand, and a willow woven fan in the right [the seed beater], they walk among the grasses, and sweep the seed into the smaller basket, which is emptied, now and then, into the larger, until it is full of seeds and chaff . . .” Conical baskets, similarly used throughout the Intermontane area, were of vital importance in native economy.

All the specimens illustrated in the photographs are twined with the exception of the Kaibab specimens, plate 11. Whether they were tightly or loosely woven depended upon the size of the seed to be gathered. Open-twine baskets, having a slight space between the weft elements, were more quickly made than those which were tightly woven and were equally serviceable for holding large seeds such as pinyon nuts.

The photographs show a Moapa Paiute open-twine basket (pl. 1, *c*), a Kaibab basket in the process of manufacture (pl. 9, *a*), several close-twine Kaibab specimens (the edge showing in pl. 13, *a*; two in the foreground of pl. 13, *b*; two specimens being carried in pl. 16, *b*), and a St. George open-twine specimen (pl. 20, *a*).

Seed beater.—Only one example of a seed beater is illustrated. It is the Kaibab specimen, shown on the house in plate 9, *a*. It is open-twine and has the service edge reinforced with a wooden rim.

Winnowing or parching trays.—As most of the seeds available in Southern Paiute territory are small and hard-shelled, a special technique was required to separate the seeds from the chaff and, after the seeds were ground, to remove the coarse particles. For this purpose, a flat fan-shaped or circular tray was constructed. But it also served another purpose. Having little pottery in which to boil seeds and no doubt finding it too difficult to boil them in water in tight baskets into which hot rocks were dropped, they generally roasted them. Powell⁶ observed, “they put the seeds, with a quantity of red hot coals, into a willow tray, and, by rapidly and dexterously shaking and tossing them, keep the coals aglow, and the seeds and tray from burning. As if by magic, so skilled are the crones in this work, they roll the seeds to one side of the tray, as they are roasted, and the coals to the other.”

Three specimens of twined winnowing or parching trays are illustrated. Whereas such trays are usually fan-shaped among Shoshoni and Northern Paiute, one of the Kaibab specimens (pl. 16, *b*) is circular. The shape of the other, which was placed so as to catch the meal ground on a metate (pl. 13, *a*), cannot be ascertained. It appears to be fan-shaped.

⁶ Op. cit., p. 127.

Of the five, flat, circular, coiled Kaibab trays (pls. 10, *b*, 11, 12, 13, *a*, 16, *b*), it is probable that some are winnowing trays, especially that shown in plate 11.

Ollas or water jugs.—Some means of carrying water was an absolute necessity on the long trips through the deserts. Tightly-woven, pitch-coated ollas or jugs solved the problem quite adequately.

Whereas Shoshoni and Northern Paiute ollas are twined and generally have bottoms which taper to a point, Ute and Southern Paiute specimens are predominantly coiled and spherical in shape, like those of the early Basket Makers. The photographs show several specimens among the Kaibab (pls. 11, 12, 9, *a*, *b*, 13, *b*, 16, *a*) and the Ute (pl. 26, *b*, with the handles) all of which appear to be coiled. The necks of these baskets are somewhat wider than those of the Shoshoni and Northern Paiute, for example, plate 9, *a*. The neck in plate 9, *b*, is even flaring.

Receptacles.—Pottery has been recorded among both Southern Paiute and Shoshoni Indians. It seems, however, to have been of minor importance and no specimens appear in the photographs. For general purposes requiring receptacles and even for boiling water, basketry bowls were used.

Several Kaibab and Ute coiled basketry bowls are illustrated. The Kaibab examples (pls. 9, *a*, 10, *b*, 11, 12) range in form from exceedingly shallow containers, approximating trays, to nearly hemispherical bowls. Plate 12 shows a woman weaving a coiled bowl. The Ute bowls (pl. 26, and, hanging from the tree, pl. 23, *a*) are very crudely woven, narrow-mouthed, and deep.

WEAPONS

Bows.—Although the evidence of these photographs is insufficient to postulate important local differences in bow types, several styles appear to have been restricted to certain groups.

Two Moapa bows in plate 1, *b*, are notable for their great length, though a shorter Moapa bow appears in plate 2, *a*, *b*. None of these have recurved ends.

Bows with recurved ends are shown only among the Las Vegas (pls. 5, *a*, *b*, 4, *a*, 6, *b*). That in the left foreground of plate 4, *a*, is clearly sinew-backed. The bow of extraordinary width in plate 5, *c*, appears to be made of two pieces, joined at the grip, and is probably of mountain sheep horn, which was widely used for bows among these people.

The Kaibab bows are comparatively short and lack the recurved ends (several hanging on the right side and in the center of the house

in plate 10, *b*; one leaning against the house in plate 11; one by the child in plate 12; those in plates 17, *a*, *b*, 18, 19, *a*). Powell⁷ said of Kaibab bows, "Most of their bows are made of cedar, but the best are made of the horns of mountain sheep. These are taken, soaked in water, until quite soft, cut into long thin strips, and glued together, and are then quite elastic."

Quivers.—Quivers are represented in several photographs, some of which, if correctly posed, show the manner of carrying them. The fur quiver of the Moapa (pl. 1, *b*) was slung over the right shoulder and under the left arm, so that the arrow had to be pulled over the right shoulder. The Moapa fur quivers in plate 2, *a*, *b*, were hung across the chest, or, more accurately, around the neck with the openings to the right.

A fur Kaibab quiver is shown on the ground in plate 22, *e*.

A Uintah Ute quiver (pl. 29, *a*, *b*) has a bow case attached. A flap, ornamented with a striped border, symmetrical floral designs and metal studs, hangs from it.

Shooting.—Though posed, the Las Vegas man (pl. 5, *a*) and the Kaibab man (pl. 18, *a*) probably hold their bows in accordance with native usage, for this slanting position was common throughout the area.

Clubs.—A Moapa club of the "potato masher" type, similar to that used by the Colorado River tribes, appears in plate 2, *c*.

Knives.—Several hafted flint knives are shown in the photographs. Though these cannot be studied in detail, even with the aid of a glass, all appear to be essentially the same. A chipped flint blade is fitted into the end of a short wooden handle, which is wrapped just below the blade. Two knives appear on the ground near the right end of the bow in the left foreground of the Las Vegas picture, plate 4, *a*. Several similar knives lie on the ground in the Kaibab photograph, plate 10, *a*. The Kaibab man in plate 9, *b*, is retouching the blade of a knife. He holds it on a pad in his left hand and works with a flaker held in his right hand. The last photograph has also been reproduced and described in Bureau of American Ethnology Bulletin 60, figure 175 and page 309 ff.

Rodent hook.—Shoshonean tribes commonly used long sticks with either hooked or slightly forked ends which they inserted into rodent burrows and twisted in the fur of the animals so as to pull them out. Each of the two sticks held in the hand of the Las Vegas man in plate 5, *c*, is equipped with a short hook at one end and may have

⁷ Op. cit., p. 128.

been intended for this purpose. Or, they may have been used to pull chuckwallas, a large species of lizard, from rock crevices. Death Valley Shoshoni made similar hooked sticks for this purpose.

FIRE MAKING

Fire making is illustrated among the Kaibab Paiute in plate 19, *a*, though the pose of the man in the background is irrelevant to the main subject. The fire drill is compound, as shown by the wrapping near its lower end. That is, it consisted of a main shaft and a fore-shaft. The nature of the hearth cannot be ascertained. The fire maker twirls the drill between the palms of his hands while an assistant holds bark tinder in which to catch the spark.

METATES

Metates, or flat stone grinding slabs, were of crucial importance in the preparation of the small, hard-shelled seeds of this country. Powell⁸ observed of the Kaibab, "For a mill they use a large flat rock, lying on the ground, and another small cylindrical one in their hands. They sit prone on the ground, hold the large flat rock between the feet and legs, then fill their laps with seeds, making a hopper to the mill with their dusky legs, and grind by pushing the seeds across the larger rock, where it drops into a tray. I have seen a group of women grinding together, keeping time to a chant, or gossiping and chatting . . ."

Two quite unlike specimens of metates appear in the Kaibab Paiute photographs, plates 10, *b*, and 13, *a*. The first, though shallow, has a trough and kind of platform encircling the trough on all but one end where it is open. As this is very similar to the metates used by the early Basket Makers of this region, it is not impossible that it was taken from some ancient site. The other specimen is more like the type commonly used by Shoshoneans, being flat and without any trough. The woman has placed it between her legs with a twined winnowing basket under the far end to catch the flour. She grinds with a thick mano or muller which evidently was used with something of a rotary motion.

CRADLES

Two types of cradles are illustrated: the semibasketry type of the Kaibab and the buckskin-covered board (?) of the Ute.

⁸ Op. cit., p. 127.



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