ILLUSTRATED CATALOGUE

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY,

AT HARVARD COLLEGE.

No. VII.

REVISION OF THE ECHINI.

BY

ALEXANDER AGASSIZ.

IN FOUR PARTS.

PLATES.

UNIVERSITY PRESS, CAMBRIDGE,
WELCH, BIGELOW, & CO.
1872–1873.

CONTENTS.

(NINETY-FOUR PLATES.)

ERRATA.

On p. 242, to Explanation of *Pl. D*, add ECHINOTHRIX.

" " " " " " *E*, " METALIA.

On *Pl. C*, for MOERA read MOIRA.

On *Pl. D*, under MARETIA add ECHINOTHRIX.

On *Pl. E*, under BRISSUS add METALIA.

Add, in Explanation of *Pl. VI.*,

15[a] **Diadema setosum** (juv.).

24 **Toxopneustes pileolus.**

In Explanation of *Pl. VIII.*,

for **Temnopleurus Reynaudi**, *f. 22 – 25*, read *f. 22 – 24'*.

" " **Hardwickii**, *f. 26*, read *f. 25 – 28*.

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OF THE PLATES OF PARTS I.–IV.

* The numbers refer to the Synonymy and descriptions in the text, Parts I. – III.

* Omitted in Lists of *Pl. D*, p. 242, also at bottom of *Pl. D*. This genus has the same geographical distribution as Pseudoboletia, Phyllacanthus, ... Maretia.

* Omitted in List of *Pl. E.*, p. 242, also at bottom of *Pl. E.* This genus has the same geographical distribution as Brissus.

† Spelled Moera on map.

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PART I.

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PART II.

PLATES I, I^{b}, I^{d}, II, II^{a}, II^{b}, II^{c}, III, IV, IV^{a}, V, VI, VI^{a}, VII, VIII, IX, X, X^{a}, XI, XI^{a}, XI^{b}, XI^{c}, XI^{d}, XI^{e}, XI^{f}, XII, XII^{a}, XII^{b}, XII^{c}, XII^{d}, XIII, XIV, XIV^{a}, XV, XVI, XVII, XVIII, XIX, XX, XXI, XXII, XXIII.

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PART III.

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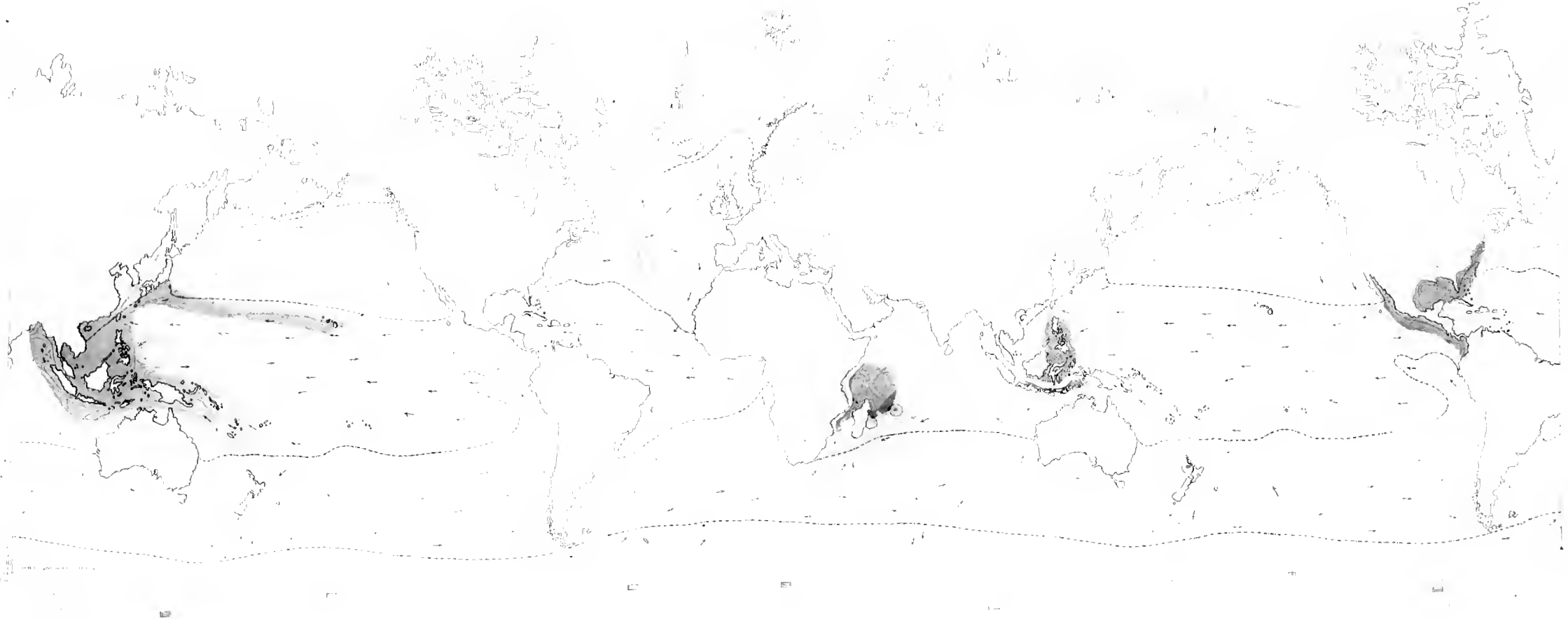
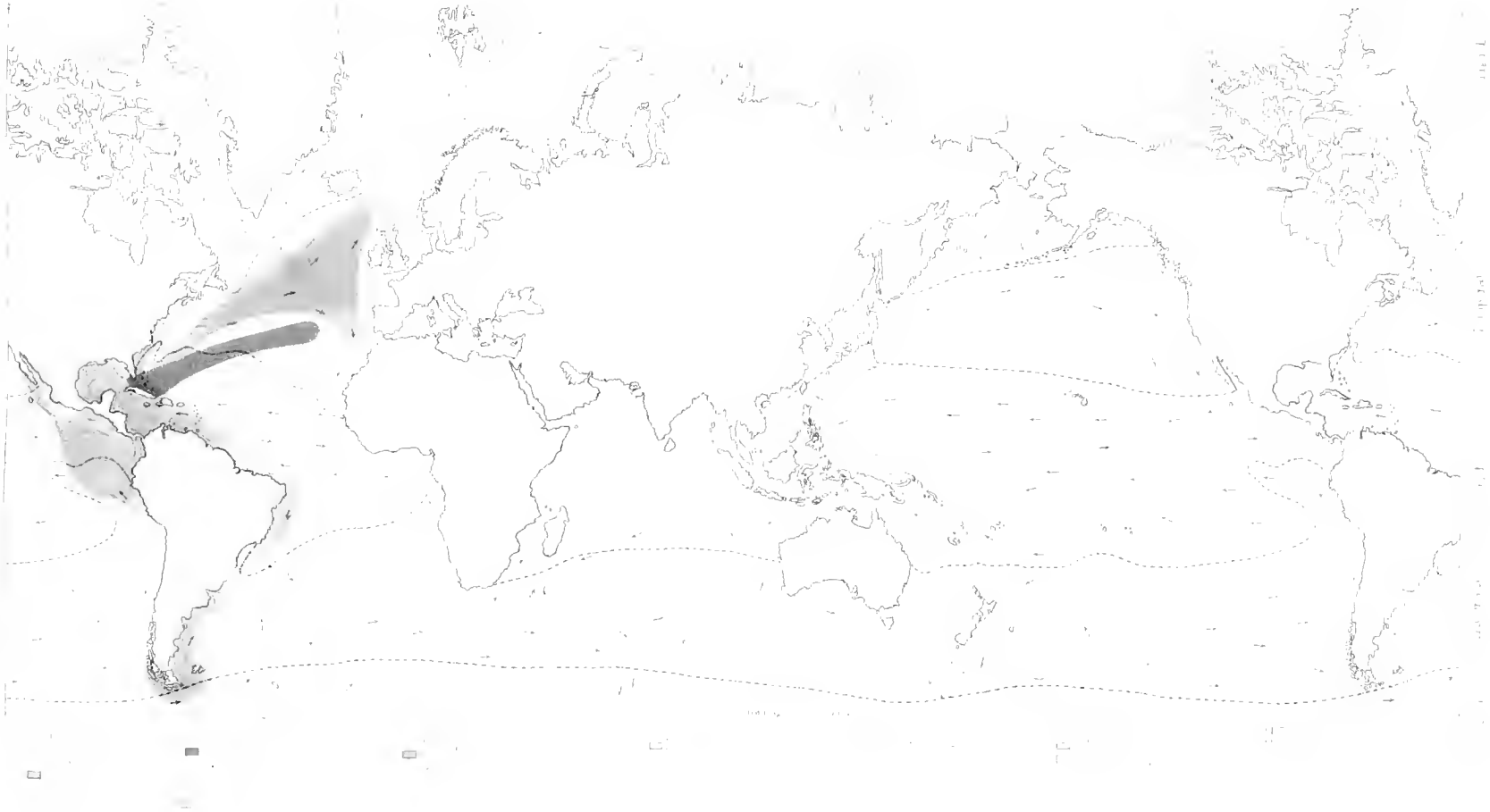




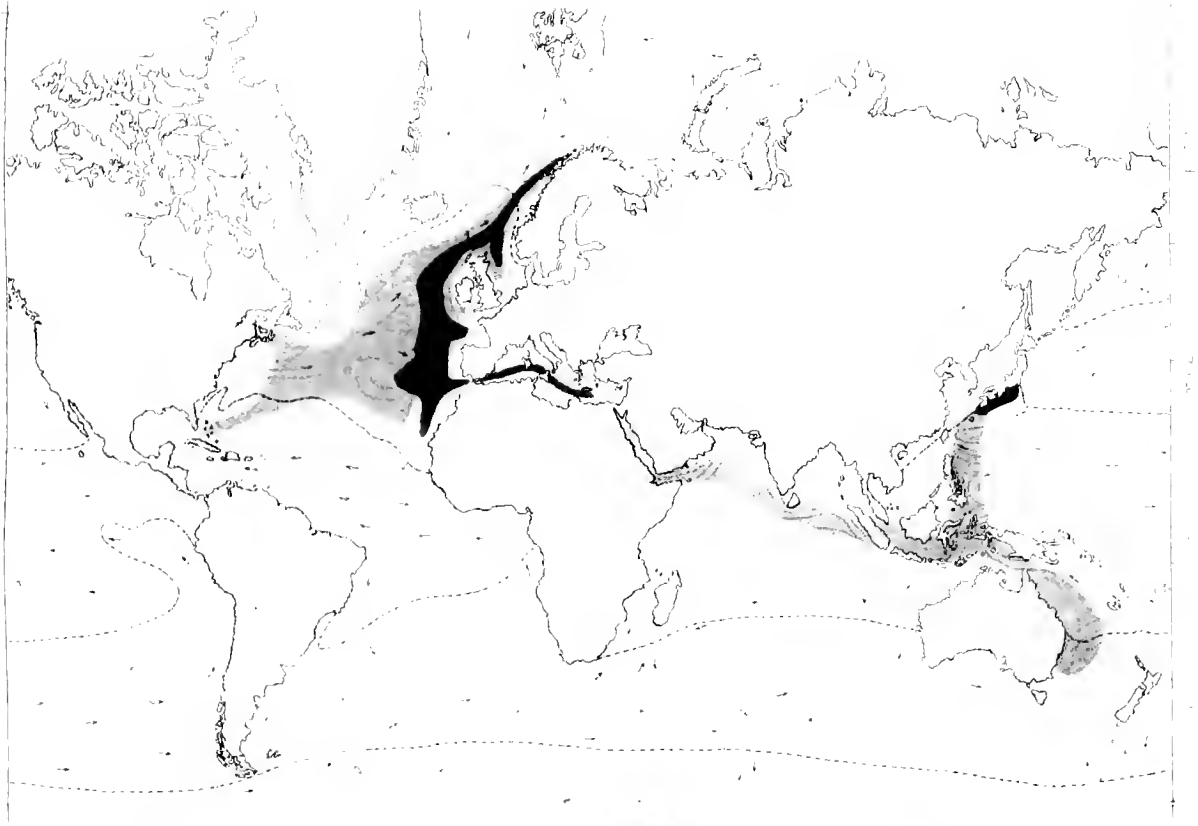
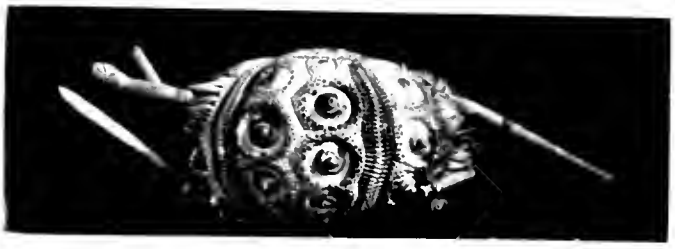


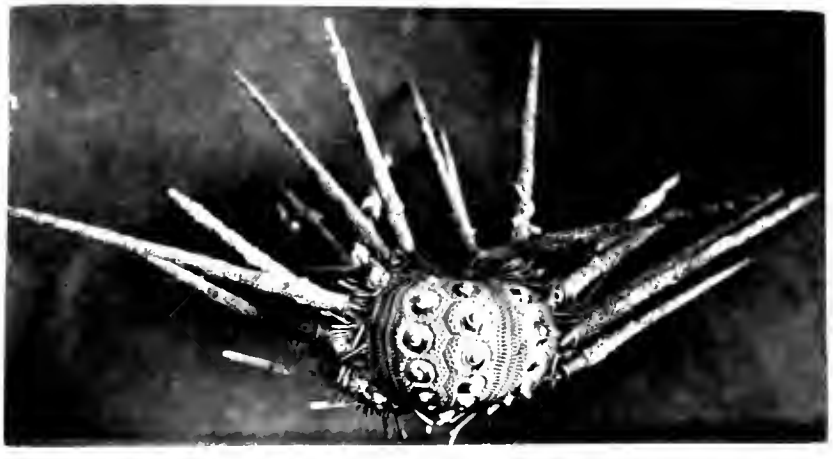
PLATE I.

Dorocidaris papillata.

1. Seen from abactinal side, with smooth spines.
2. Somewhat larger specimen, denuded to show abactinal system.
3. Same from the actinal side.
4. Same in profile.
5. Profile of specimen with serrated spines.

(*All figs. natural size.*)





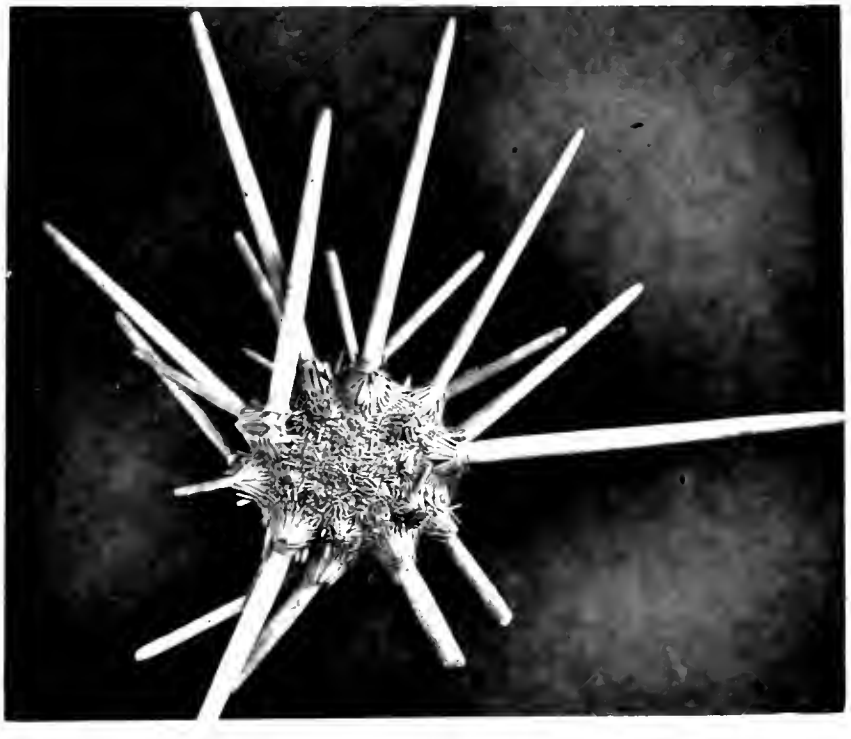


PLATE I[a].

Phyllacanthus gigantea,

(*Two thirds natural size.*)

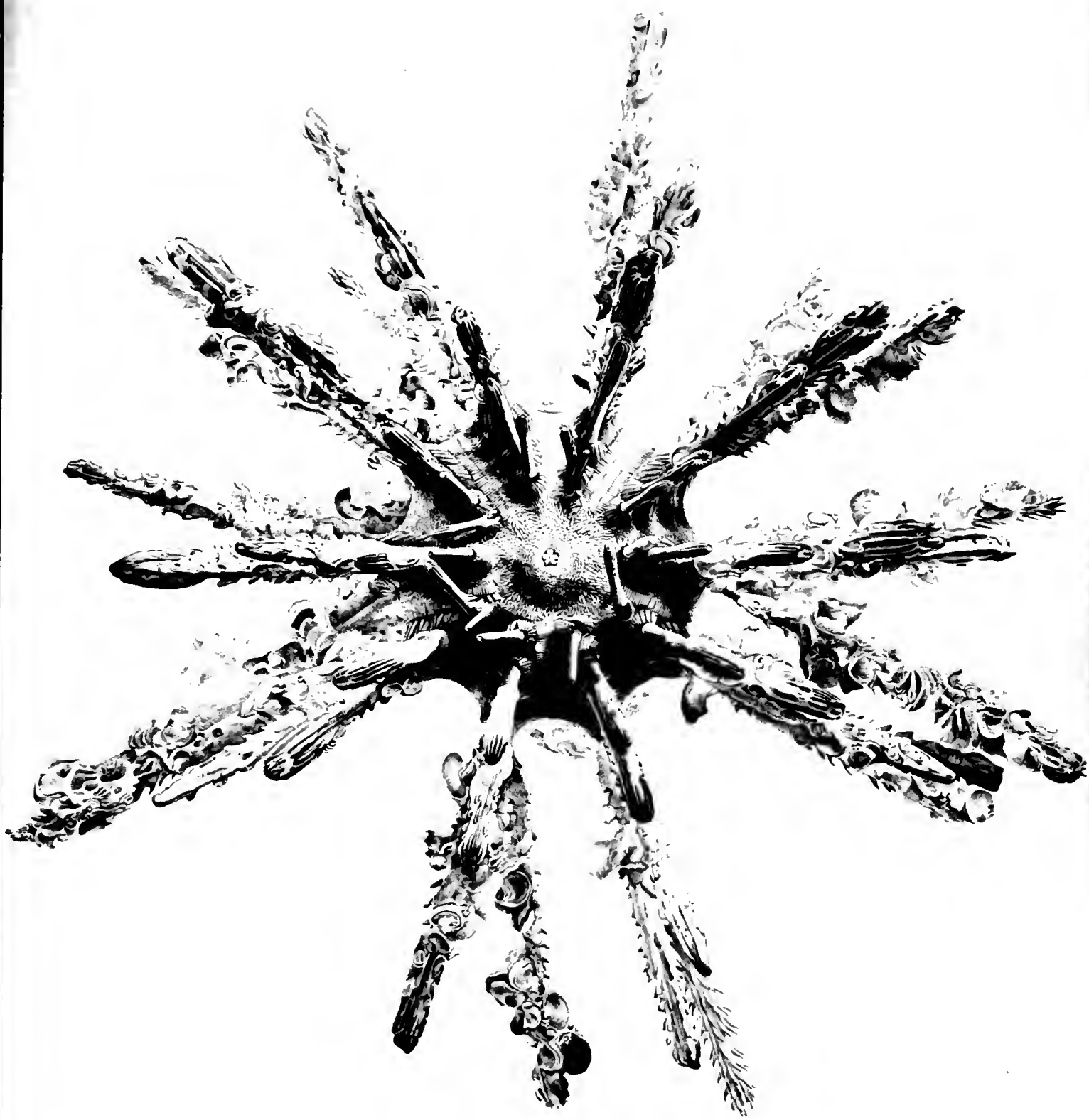
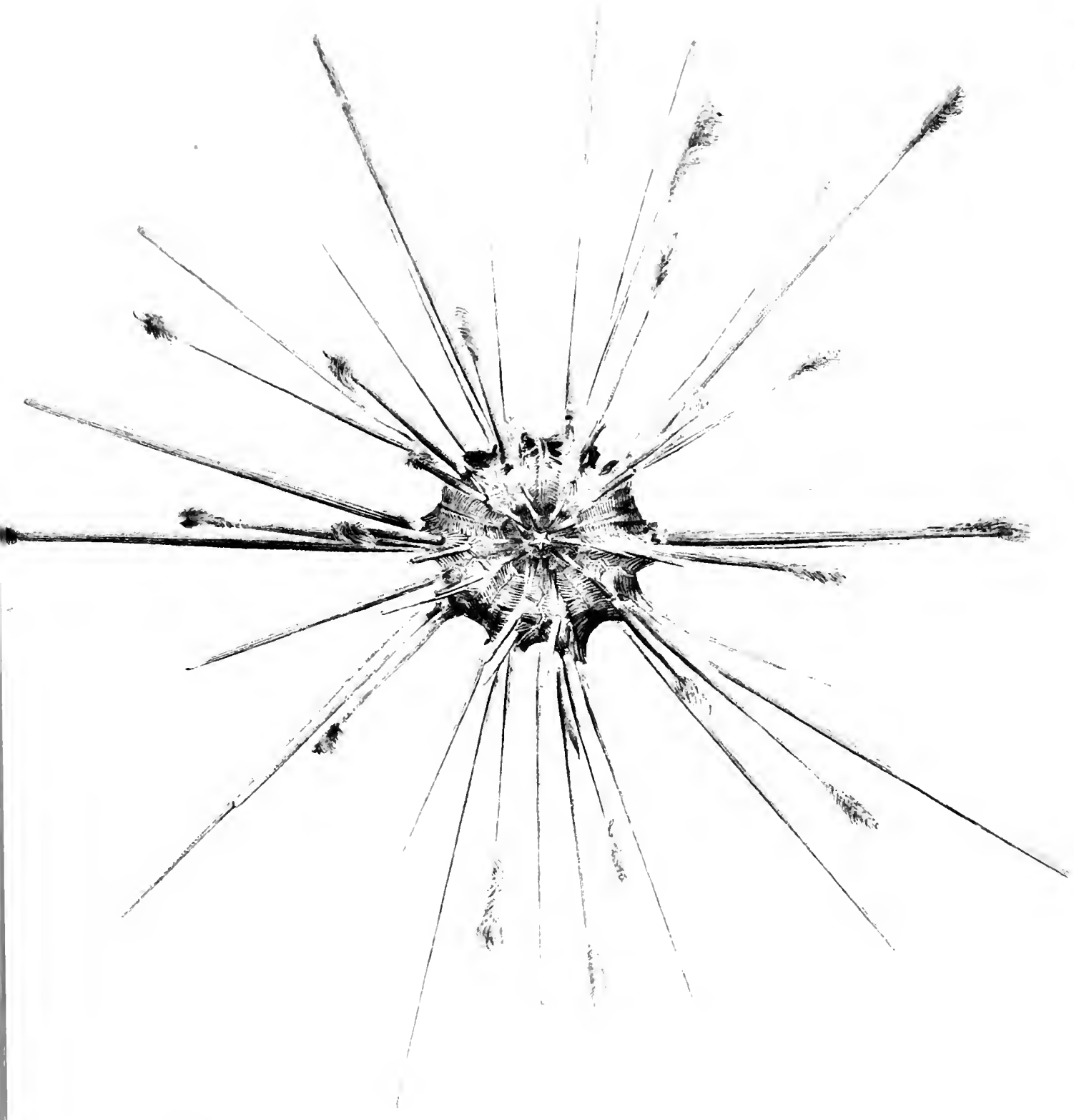


PLATE I^{b}.

Dorocidaris papillata.

Mediterranean. Nat. size.



Phyllacanthus baculosa, *f. 34–38.*

34. Short, stout abactinal interambulacral spine, coarsely serrated, flaring at tip.
35. Short, pointed, smooth, abactinal interambulacral spine.
36. Short actinal interambulacral spine.
36ª. Still shorter actinal interambulacral spine, flaring at tip, with lamellar fluting, magnified.
37. Long, pointed, fluted, and serrated interambulacral abactinal spine.
38. Short interambulacral abactinal spine, with lamellar serration towards tip.

Phyllacanthus dubia, *f. 39.*

39. Large abactinal interambulacral spine.

Phyllacanthus verticillata, *f. 40–42.*

40, 41. Large interambulacral abactinal spines.
40ª. Fig. 40 magnified, to show the granular structure of the shaft, and the mode of formation of the annular swellings from large disconnected lamellæ.
42. Smaller interambulacral actinal spine.

Stephanocidaris bispinosa, *f. 43.*

43. Large abactinal interambulacral spine.

(*All Figs. natural size unless otherwise stated.*)

PLATE Ic.

Cidaris Thouarsii, *f. 1 – 5b.*

1. Large interambulacral spine, very coarse granulation.
1a. Tip of spine of Fig. 1 seen endways.
2. Somewhat smaller interambulacral spine, granulation less distinct than in Fig. 1.
3. Pointed interambulacral spine, nearly smooth.
4. Pointed interambulacral spine near actinostome.
5. One of the flat triangular papillæ (ambulacral spines).
5a. Part of test, nat. size.
5b. Part of test of older specimen, showing the broad bare median interambulacral space.

Goniocidaris canaliculata, *f. 6 – 8b.*

6 – 8b. Interambulacral spines.

Goniocidaris tubaria, *f. 9 – 14.*

9, 10. Large abactinal interambulacral cupuliform spines.
11, 12. Smaller interambulacral actinal spines.
13. Large, pointed interambulacral abactinal spine.
13a. Large, cupuliform, spiny interambulacral abactinal spine magnified.
14. Smooth, pointed interambulacral abactinal spine.

Goniocidaris geranioides, *f. 15 – 17.*

Three different kinds of abactinal interambulacral spines.

Cidaris tribuloides, *f. 18 – 22.*

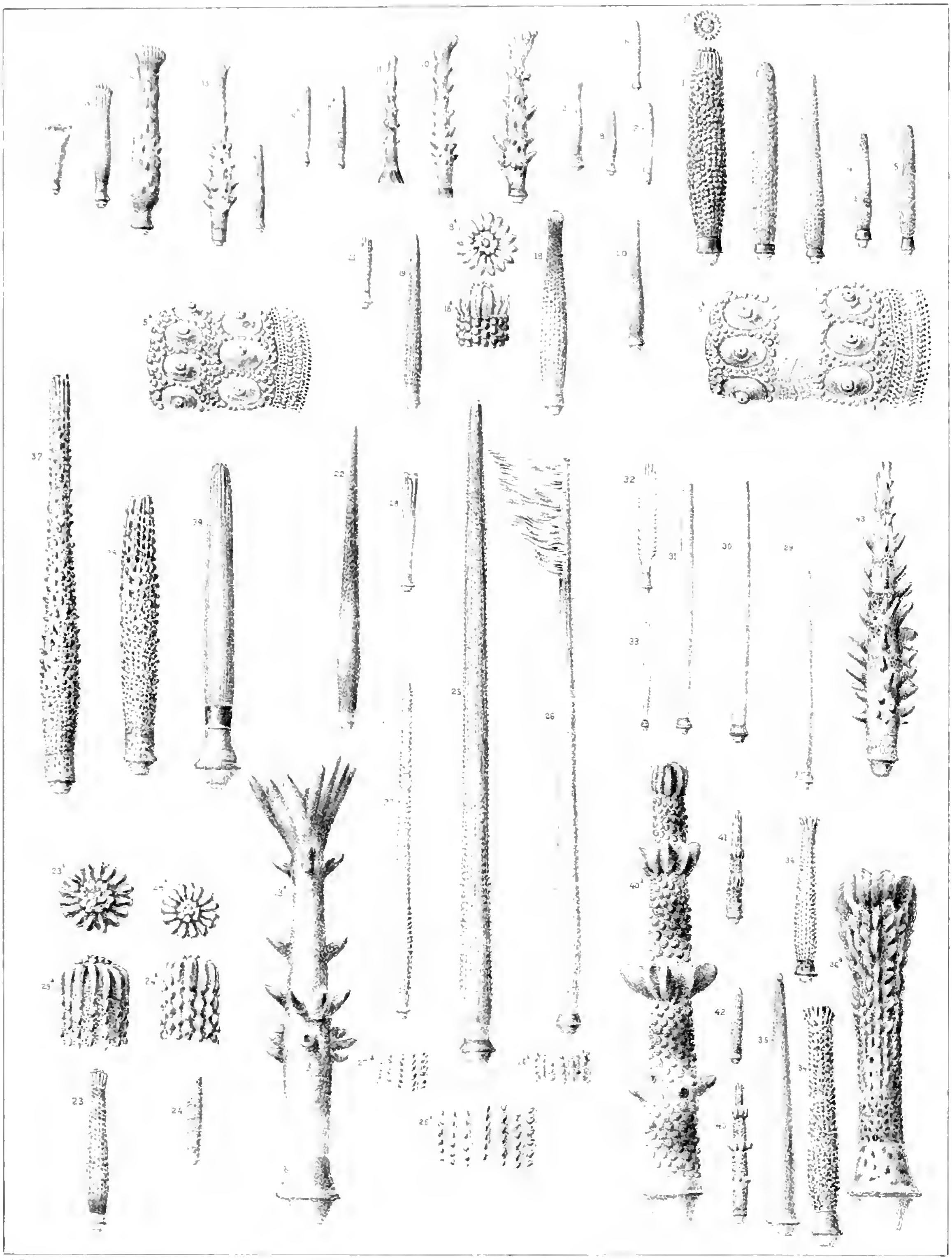
18. Large, coarsely granular abactinal interambulacral spine.
18a. Tip of Fig. 18 magnified, in profile.
18b. Tip of Fig. 18 magnified, end view.
19. Smaller, pointed, and less granular abactinal spine.
20. Smaller, smooth, pointed abactinal spine.
21. Short, actinal, slightly granular spine.
22. Large, pointed, smooth abactinal spine.

Cidaris metularia, *f. 23 – 24b.*

23. Large abactinal fluted spine.
23a, 23b. Profile and end view of same magnified.
24. Small, short, coarsely granular actinal spine.
24a, 24b. Profile and end view of same magnified.

Dorocidaris papillata, *f. 25 – 33.*

25. Large, pointed abactinal interambulacral spine.
26. Somewhat smaller, less distinctly serrated spine.
27. Small, pointed interambulacral spine near ambitus, with sharp serrations.
25a, 26b, 27a. Magnified parts of Figs. 25, 26, 27, to show serration.
28. Small, short actinal interambulacral spine.
Figs. 25 – 28 from the Mediterranean.
29, 30, 31. Different, smooth, abactinal interambulacral spines.
32, 33. Flat, short, actinal interambulacral spines, with serrated edges.
Figs. 29 – 33, Florida Straits.



P. Roetter del. et lith.

Print by H.W. Longfellow

PLATE I[d].

Cidaris tribuloides.

Cape Verde Islands. Nat. size.

Goniocidaris tubaria, *f. 32 – 36.*

32, 33. Large abactinal interambulacral spines.
34, 35. Short, cupuliform, abactinal interambulacral spines.
34ª. Magnified end view of Fig. 34.
36. Small actinal interambulacral spine.

Porocidaris purpurata, *f. 37 – 41.*

37. Large abactinal interambulacral pointed serrated spine, with the collar reaching half the length of the shaft.
38. Shorter, pointed, smooth interambulacral abactinal spine.
39. Flattened, fluted, and serrated interambulacral abactinal spine, near ambitus.
40, 41. Large and small, flattened, pointed spines, with serrated edges, from the actinal side.
40ª. Flat actinal spine, somewhat magnified.

PLATE I^{e}.

Phyllacanthus imperialis, *f. 1 – 6.*

1. Large abactinal interambulacral spine, fluted at tip.
1^{a}. Small abactinal interambulacral spine, fluted and banded.
2. Magnified end view of Fig. 1.
3. Large abactinal interambulacral spine, fluted at tip and banded.
4. Small actinal interambulacral spine.
5, 6. Magnified profile and tip of Fig. 3.

Phyllacanthus dubia, *f. 7 – 10.*

7. Long, smooth, abactinal interambulacral spine, slightly fluted at tip.
8. Short abactinal interambulacral spine, fluted half-way from tip.
9. Short, smooth, pointed interambulacral abactinal spine, very slightly fluted at tip.
10. Short, stout, abactinal interambulacral spine, fluted its whole length.

Phyllacanthus baculosa, *f. 11 – 20^{a}.*

11, 12. Large abactinal interambulacral spines, irregularly serrated.
13. Long, pointed abactinal interambulacral spine, strongly serrated and fluted at tip.
13^{a}. Magnified base of Fig. 13.
14, 15. Magnified tip of Fig. 13, in profile, and end view.
16. Short abactinal interambulacral pointed serrated spine.
16^{a}. Magnified base of Fig. 16.
17. Short abactinal interambulacral smooth spine.
18. Shorter interambulacral flattened serrated spine, near ambitus.
19. Shorter, serrated at edges only, granular interambulacral actinal spine.
20. Short, sharp, pointed abactinal interambulacral thorny spine.
20^{a}. Magnified base of Fig. 20.

Phyllacanthus annulifera, *f. 21 – 26^{a}.*

21. Large abactinal interambulacral spine, spiny and serrated, banded.
22. Small, smooth abactinal interambulacral spine, banded.
23. Short, stout, cupped actinal interambulacral spine.
25. Short, slender, cupped actinal interambulacral spine.
26. Small, slender, serrated interambulacral abactinal spine.
26^{a}. Magnified base of Fig. 26.

Phyllacanthus gigantea, *f. 27 – 31.*

27. Long, spiny abactinal interambulacral spine.
28. Shorter abactinal interambulacral spine, with lamellar serration.
29. Short abactinal interambulacral spiny spine.
30, 31. Short actinal interambulacral spines.

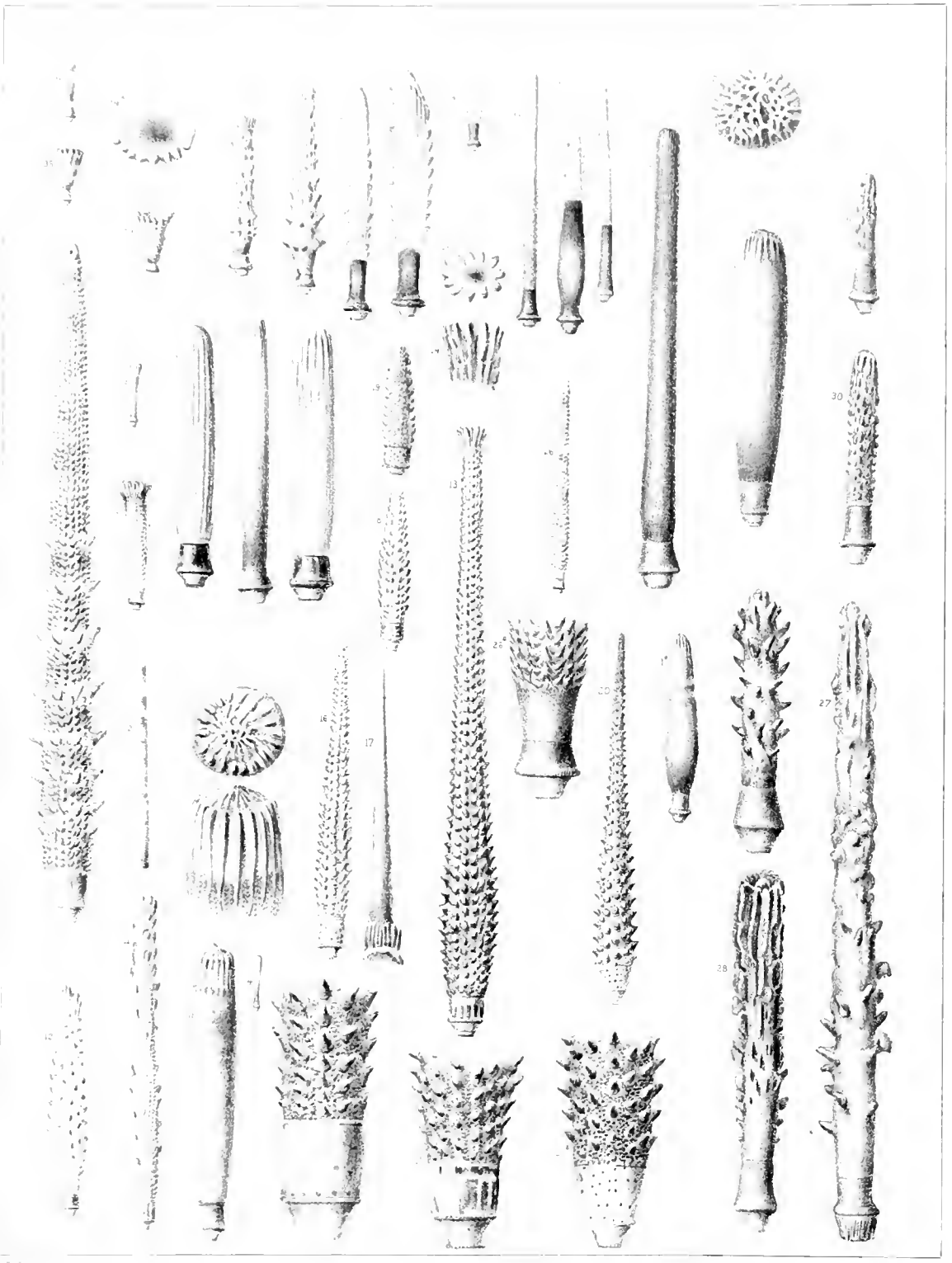


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PLATE IV.

Stephanocidaris bispinosa, *f. 1.*

1. Seen from abactinal pole.

Phyllacanthus imperialis, *f. 2.*

2. Seen in profile, nat. size.

Phyllacanthus verticillata, *f. 3.*

3. Seen from abactinal pole, two thirds nat. size.

Phyllacanthus baculosa, *f. 4, 5.*

4. Seen in profile, two thirds nat. size.
5. Seen from abactinal pole, two thirds nat. size.

Phyllacanthus dubia, *f. 6, 7.*

6. Seen from below, two thirds nat. size.
7. Seen in profile, two thirds nat. size.

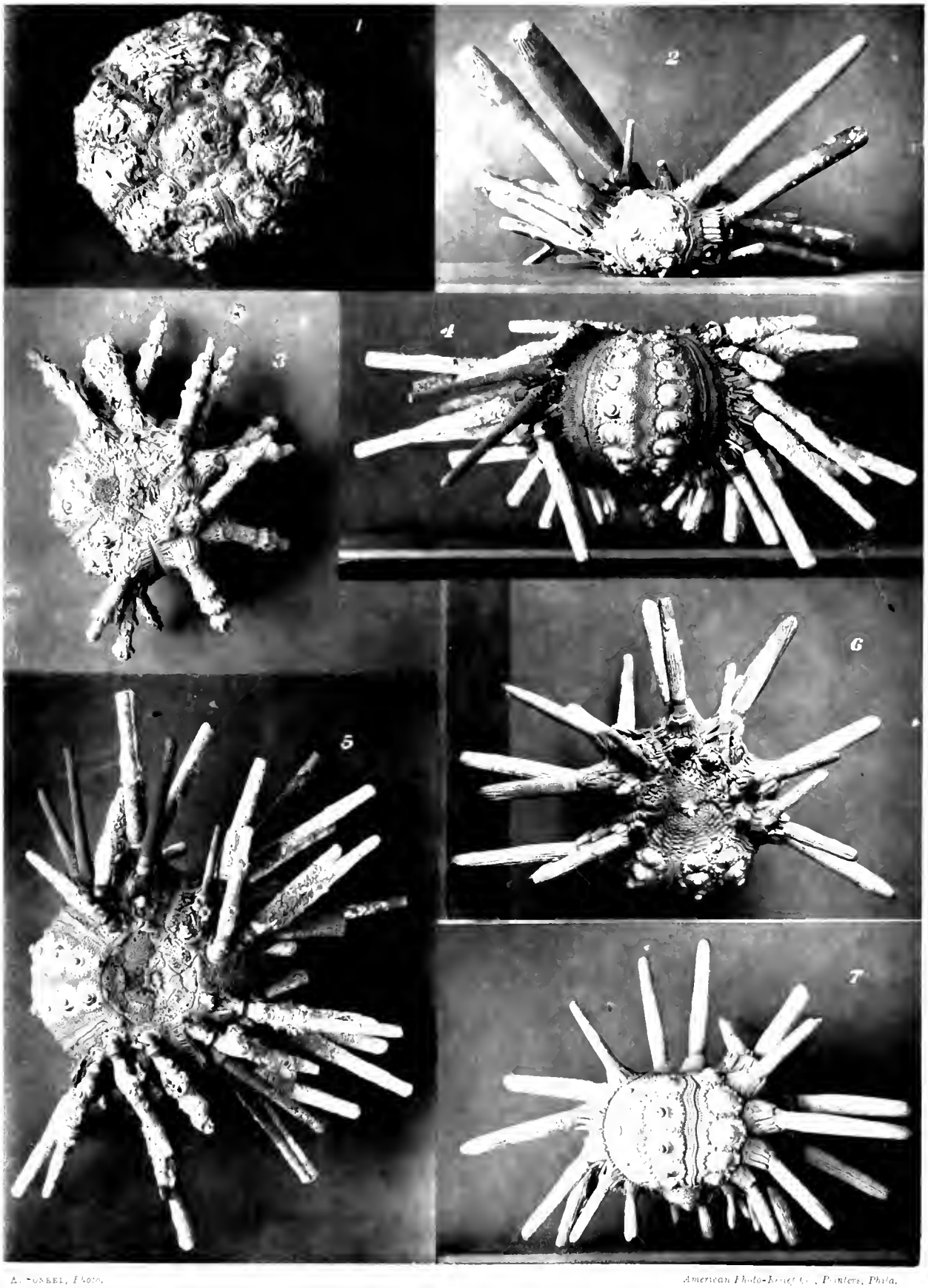
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PLATE Ig.

Cidaris metularia, *f. 1.*

1. Seen from the abactinal pole.

Goniocidaris canaliculata, *f. 2.*

2. Seen in profile.

Goniocidaris geranioides, *f. 3, 4.*

3. Seen from the abactinal pole.
4. Seen in profile.

Arbacia pustulosa, *f. 5.*

5. Seen from the above pole.

Arbacia nigra, *f. 6, 7.*

6. Seen from the actinal side.
7. Seen from the abactinal pole.

(*All Figs. natural size.*)

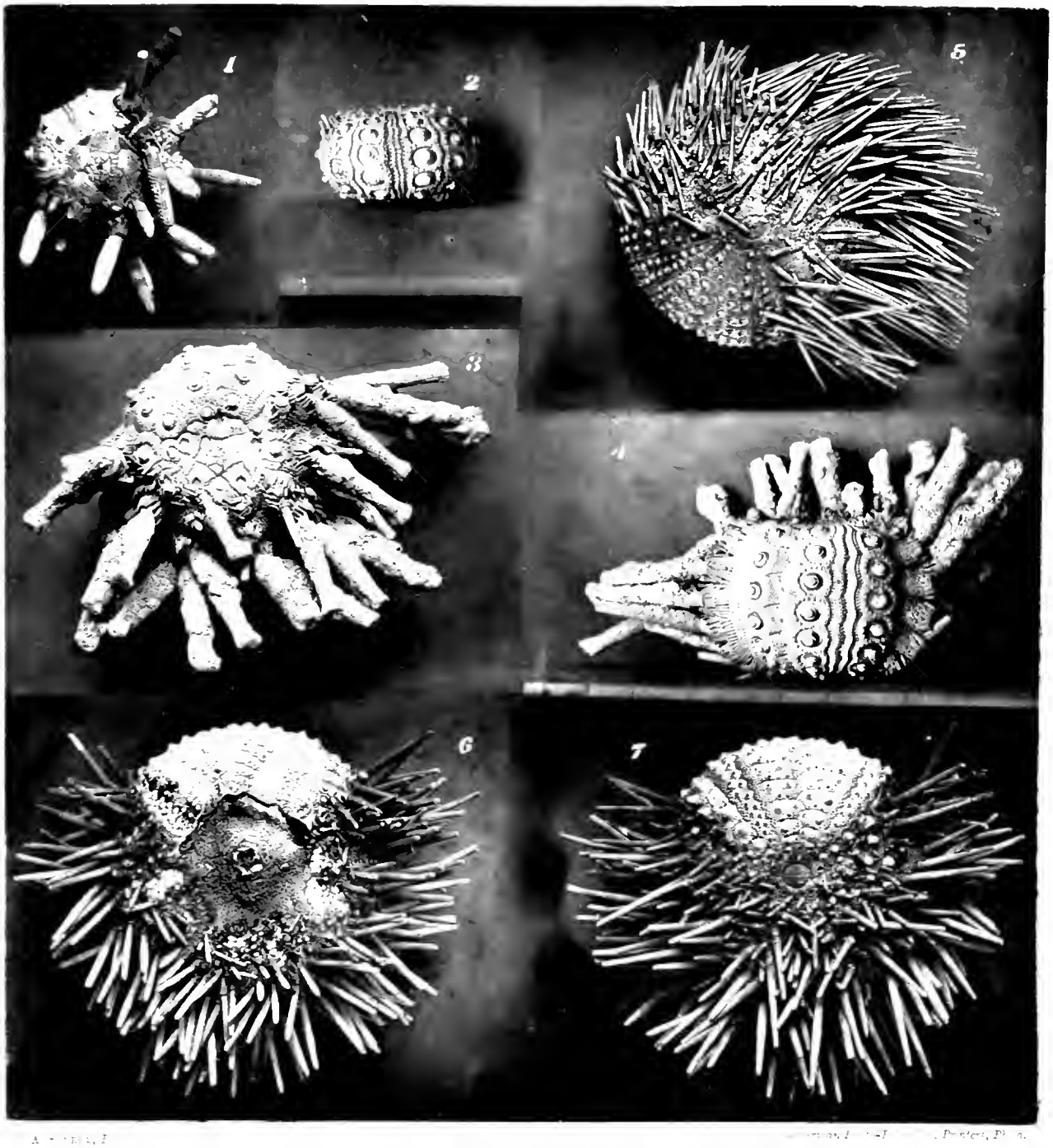
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PLATE II.

Cidaris tribuloides, *f. 1–3.*

1. Seen in profile.
2. Seen from the actinal side.
3. Seen from the abactinal pole.

Arbacia punctulata, *f. 4.*

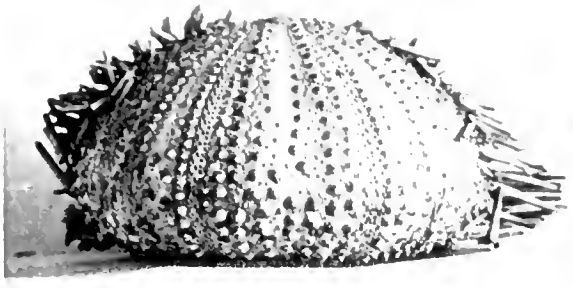
4. Seen from abactinal pole.

Toxopneustes variegatus, *f. 5, 6.*

5. Seen from above.
6. Seen in profile.

(*All figs. natural size.*)

6



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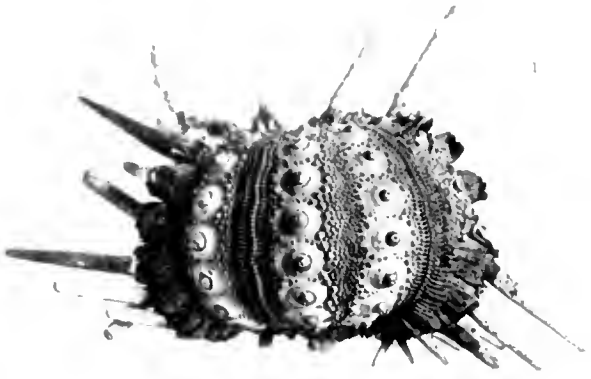

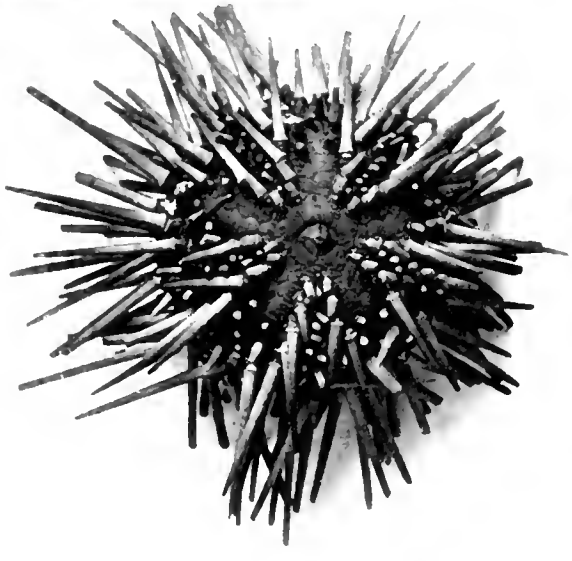

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3

A Sonrel Photo

Photo Plate Print.

PLATE II[a].

Dorocidaris papillata, *f. 1 – 13.*

1. Single jaw (pyramid) seen from outside of lantern.
2. Same in profile, showing striation of lateral face.
3. Base of pyramid (inside of lateral face) in profile.
4. " " " from interior of jaw.
5. Pyramid seen from above.
6. Part of upper end of pyramid side plate (exterior.)
7. " " " " " " " " " (interior.)
8. Upper part of pyramid in profile.
9. Brace from inside.
10. " " above.
9′. Compass.
11. Tooth seen from outside.
12. " " " within.
13. " " in profile.

Arbacia pustulosa, *f. 15 – 33.*

15. Single jaw (pyramid) seen from outside.
16. Same from within.
17. Same in profile.
18. " " " interior of lateral face.
19. Pyramid from above.
20. Upper part of pyramid in profile.
21. " " " " " " side plate (exterior.)
22. " " " " " " " " (interior.)
23. Portion of lateral face.
24. Part of tooth from without.
25. Tooth seen from without.
26. " " " within.
27. " " in profile.
28. Brace from above.
29. " " below.
30. " in profile.
31 – 33. Different views of compass.

Echinothrix turcarum, *f. 34 – 48.*

34. Pyramid, interior of lateral face, in profile.
35. " seen from outside.
36. " " in profile.
37. " " from above.
38. Upper part of pyramid.
39. Interior of upper part of pyramid.
40. Brace seen in profile.
41. Brace seen from below.
42. " " " above.
43 – 45. Compass.
46. Single tooth in profile.
47. " " from inside.
48. " " " outside.

Hipponoë variegata, *f. 49 – 61.*

49. Single pyramid from without.
50. " " in profile.
51. " " " " interior of lateral face.
52. Part of lateral face.
53. Upper part of pyramid (exterior.)
54. Pyramid from above.
55. Brace from below.
56. Brace in profile.
57. Compass.
58. Single tooth from outside.
59. " " " inside.
60. " " in profile.
61. Braee from above.

(*All figs. of jaws* (*pyramids*) *natural size, others slightly magnified.*)

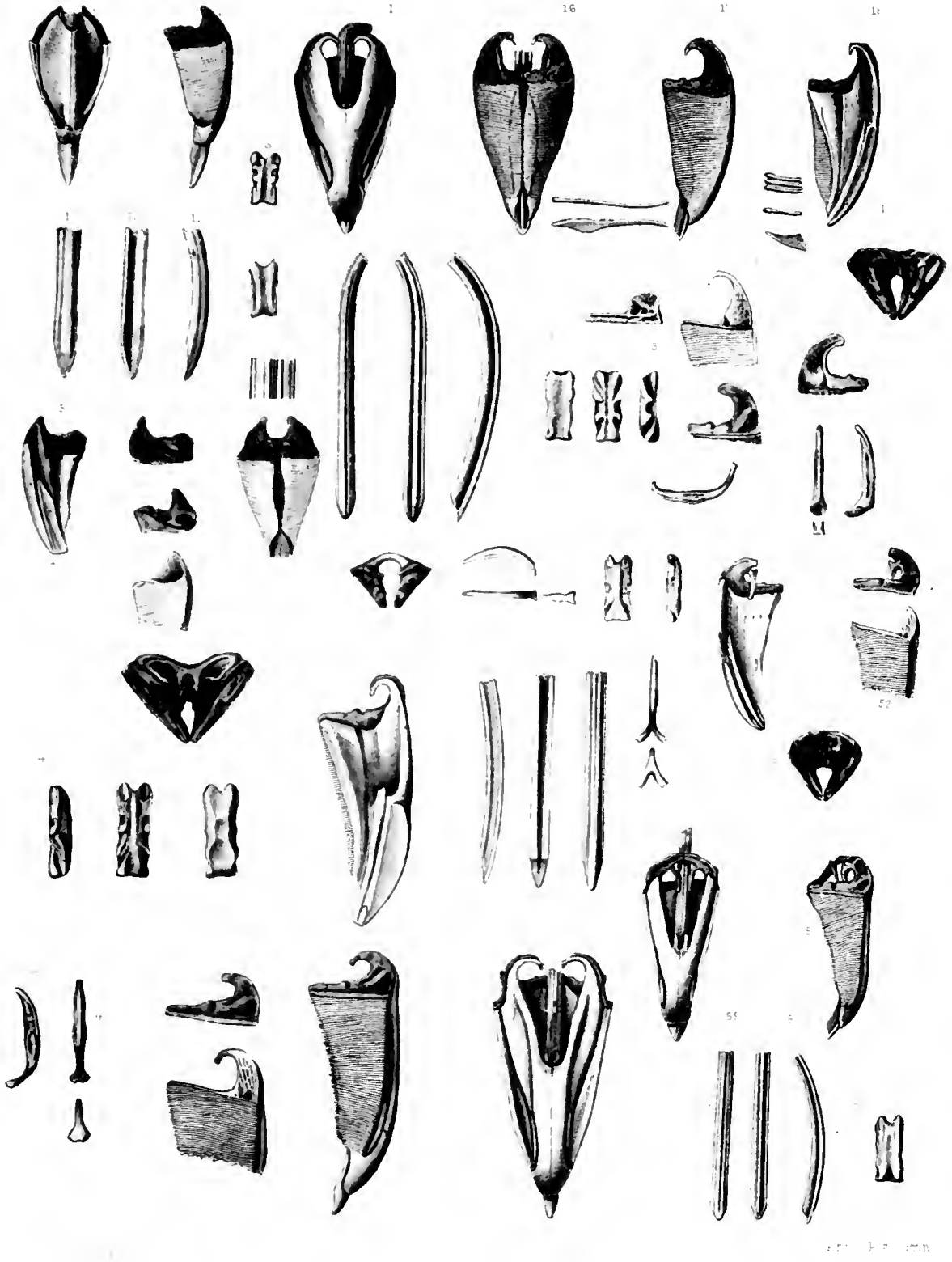


PLATE II^b.

Dorocidaris papillata, *f. 1–5.*

1. Abactinal system, magnified $1\frac{7}{1}5$.
2. Actinal membrane and part of adjoining test showing continuation of the ambulacral system along the imbricated membrane, magnified $1\frac{5}{1}$.
3. Same as fig. 2, seen from the interior of test.
4. Interior view of abactinal system of fig. 1.
5. Interior profile view of part of test, to show auricles, magnified $1\frac{5}{1}$.

Diadema setosum, *f. 6–10.*

6. Abactinal part of test, showing abactinal system, magnified $1\frac{5}{1}$.
7. Same seen from interior of test.
8. Actinal part of test adjoining the actinostome.
9. Same as fig. 8, seen from interior of test.
10. Same seen in profile, to show auricles.

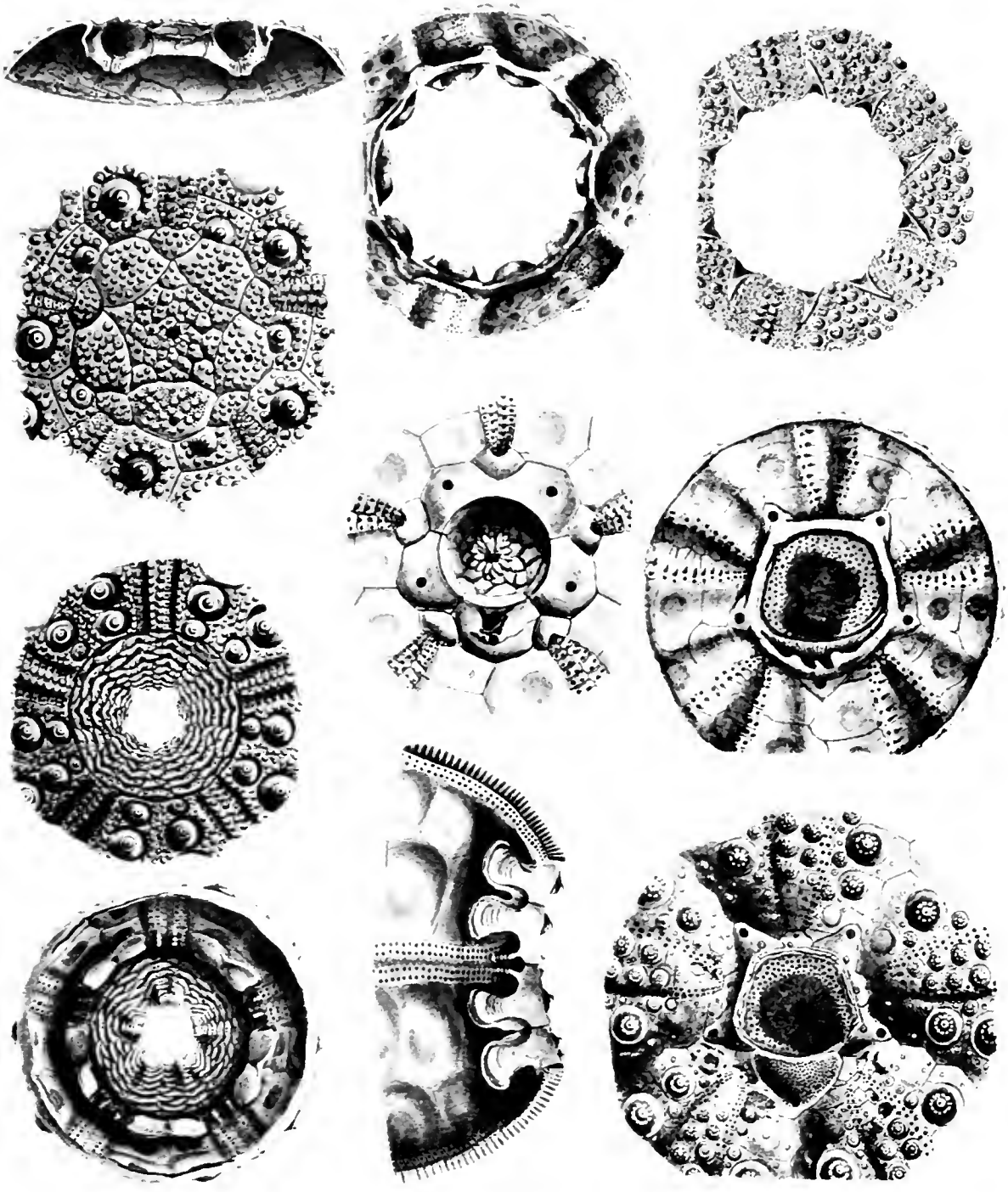


PLATE II^{c}.

Asthenosoma hystrix, *f. 1 – 5.*

1. Part of test of young, from actinal side, 3.1$^{mm.}$ in diam.
2. Same from abactinal side.
3. Spine of the same.
4. Spine of fragment of fig. 5^{a}.
5. Transverse section of same.

5^{a}. Fragment of test of Asthenosoma hystrix, magnified $\frac{1}{1}\frac{5}{1}$.

Diadema setosum, *f. 6 – 12.*

6. Young in profile, showing anal tube, 2.4$^{mm.}$ in diam.

6^{a}. Pointed tentacles of adult Diadema, in abactinal part of poriferous zone.

Dorocidaris papillata, *f. 7 – 12.*

7. Young, partly denuded, from abactinal side, 2.4$^{mm.}$ in diam.
8. Abactinal system of same, showing mode of growth of coronal plates.
9. Plates of buccal membrane, showing continuation of the poriferous zone, of same.
10. Magnified spine of buccal membrane of same, showing mode of articulation.
11. Buccal membrane, nat. size, of larger specimen.
12. Edge of two buccal plates of large specimen, with spines and pores magnified.

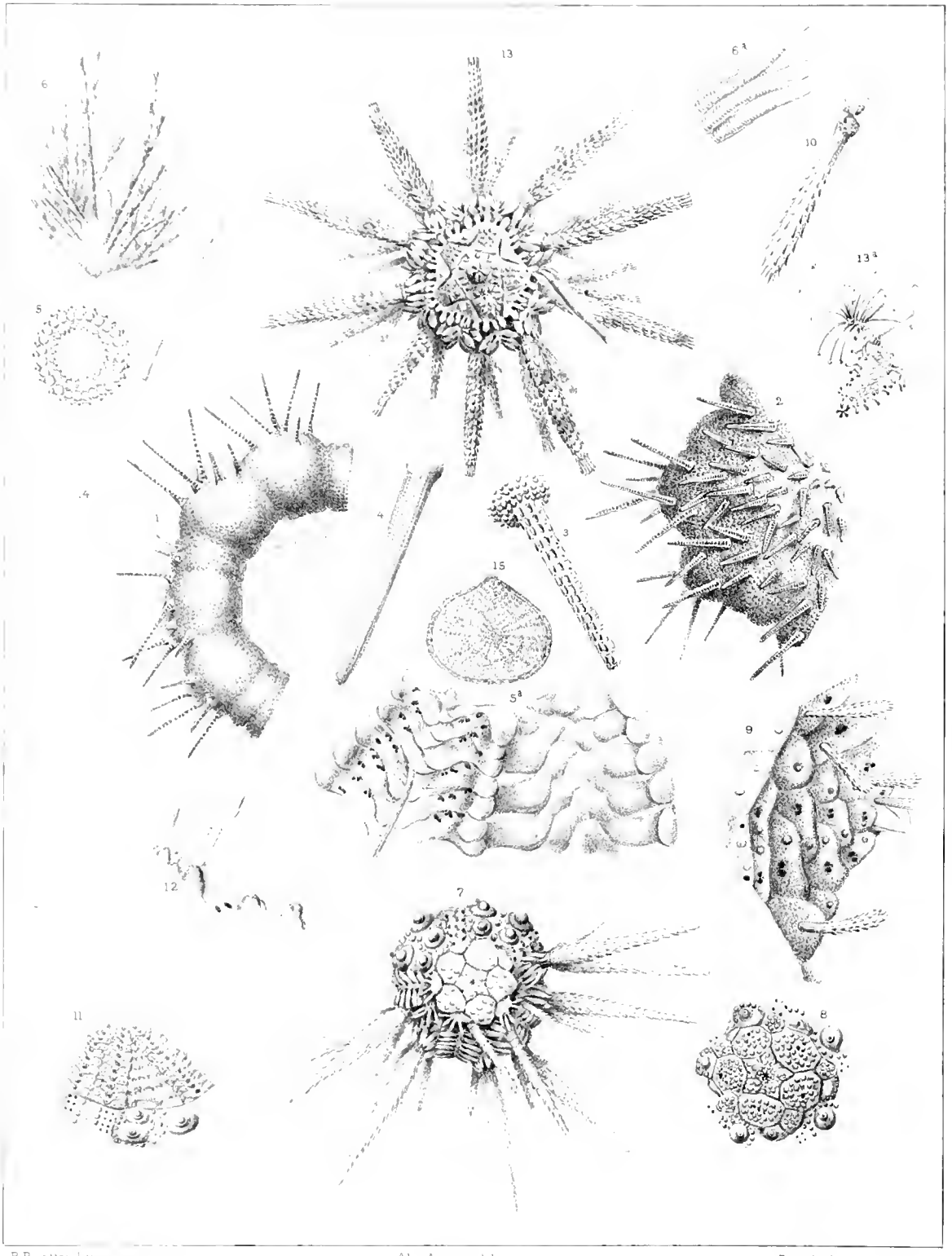
Cidaris tribuloides, *f. 13, 13^{a}.*

13. Young specimen, from abactinal side, 5.4$^{mm.}$ in diam.

13^{a}. Actinal membrane of adult, showing continuation of poriferous zone and tentacles from the edge of test to the teeth.

Coelopleurus floridanus, *f. 14, 15.*

14. Restored spine of Coelopleurus, nat. size.
15. Transverse section of same, magnified.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6a
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13a
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5a
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12
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11
8

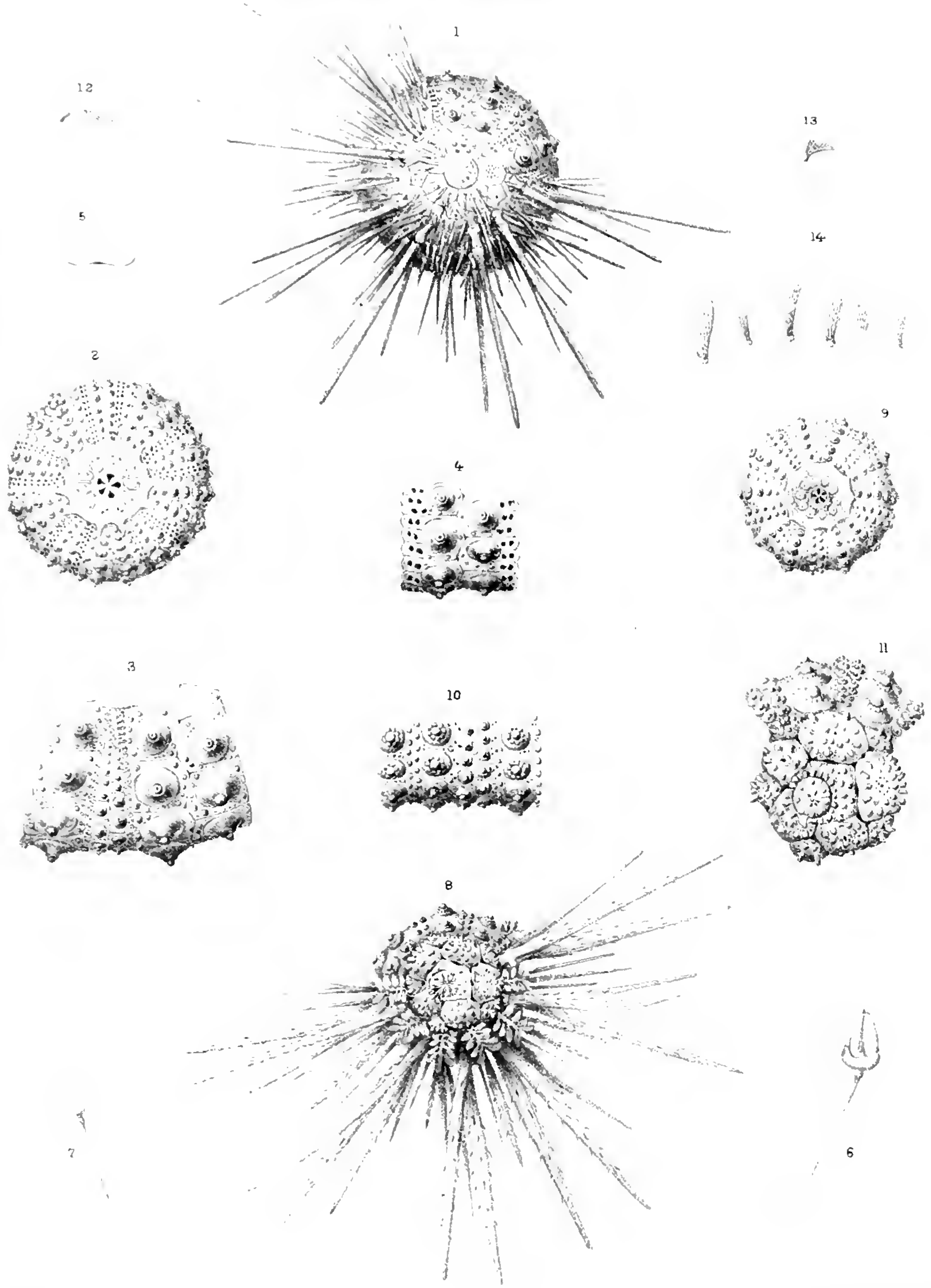
PLATE III.

Hemipedina cubensis, *f. 1 – 7.*

1. Specimen, measuring 12.7$^{mm.}$ in diameter from above.
2. Same from below, denuded.
3. Portion of test of same specimen.
4. Portion of ambulacral area, showing arrangement of pores.
5. Profile outline of test, nat. size.
6. Large pedicellaria, from test.
7. Young of same.

Salenia varispina, *f. 8 – 14.*

8. From above, $\frac{3}{2}$ nat. size.
9. From below, test denuded, same specimen.
10. Portion of ambulacral and interambulacral part of the test, magnified.
11. Abactinal system and part of test, magnified.
12. Flat spine of medium interambulacral area.
13. One of the spines of the abactinal system.
14. Different small flat spines occupying the median ambulacral areas.



R. Poetter lith. sg. Alex Agassiz del. Print by H. W. Longfellow

PLATE III[a].

Echinothrix calamaris, *f. 1, 2.*

1. Seen from the abactinal pole.
2. Seen in profile.

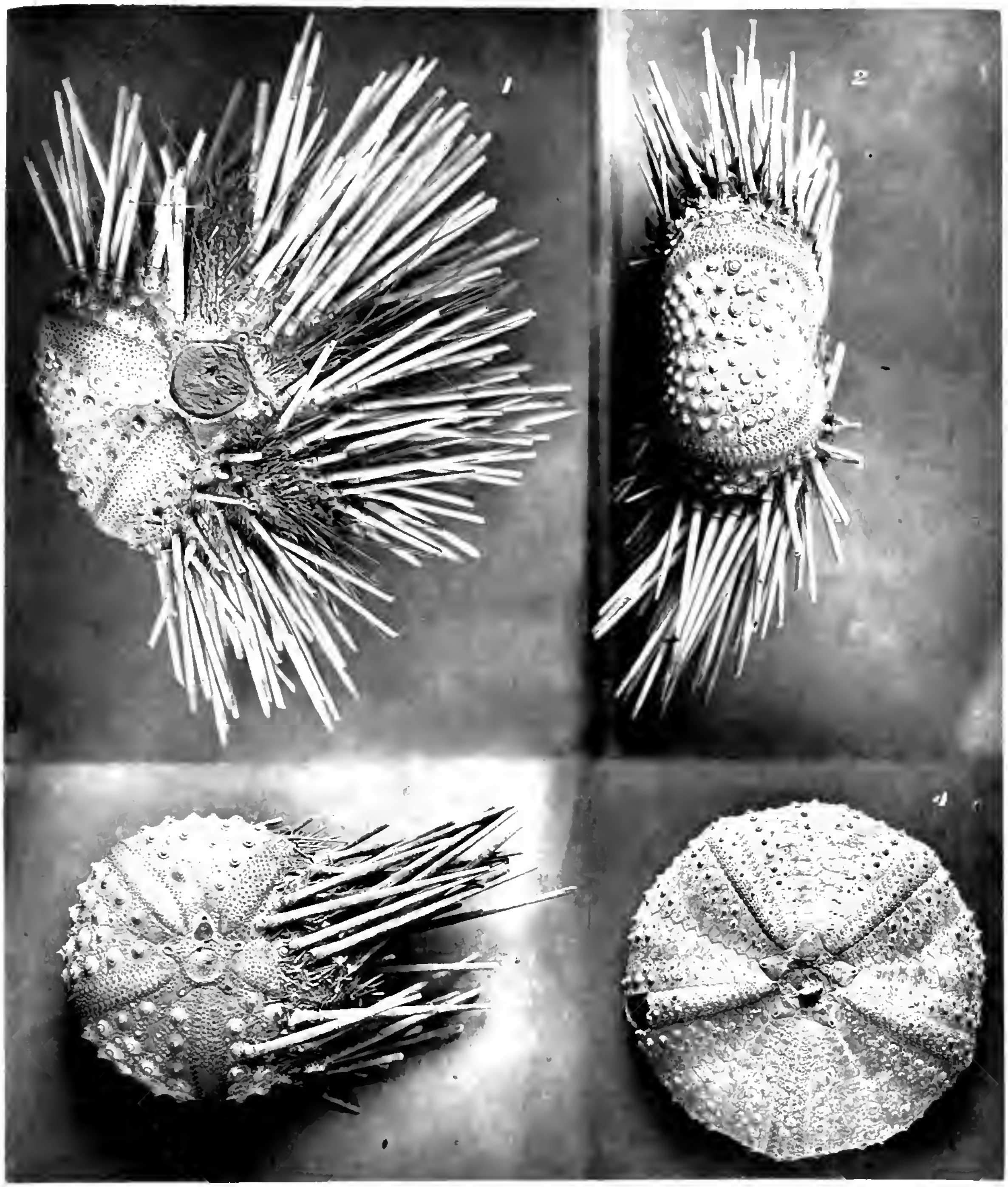
Echinothrix turcarum, *f. 3.*

3. Seen from the abactinal pole.

Astropyga pulvinata, *f. 4.*

4. Seen from the abactinal pole.

(*All Figs. two thirds natural size.*)



A. Sone Photo.

PLATE III^{b}.

Centrostephanus Rodgersii, *f. 1–3.*

1. Seen from the abactinal pole, $\frac{2}{3}$ nat. size.
2. Profile of same, $\frac{2}{3}$ nat. size.
3. Same from the actinal side, $\frac{2}{3}$ nat. size.

Astropyga pulvinata, *f. 4, 5.*

4. Young seen in profile, nat. size.
5. Same seen from the abactinal pole.

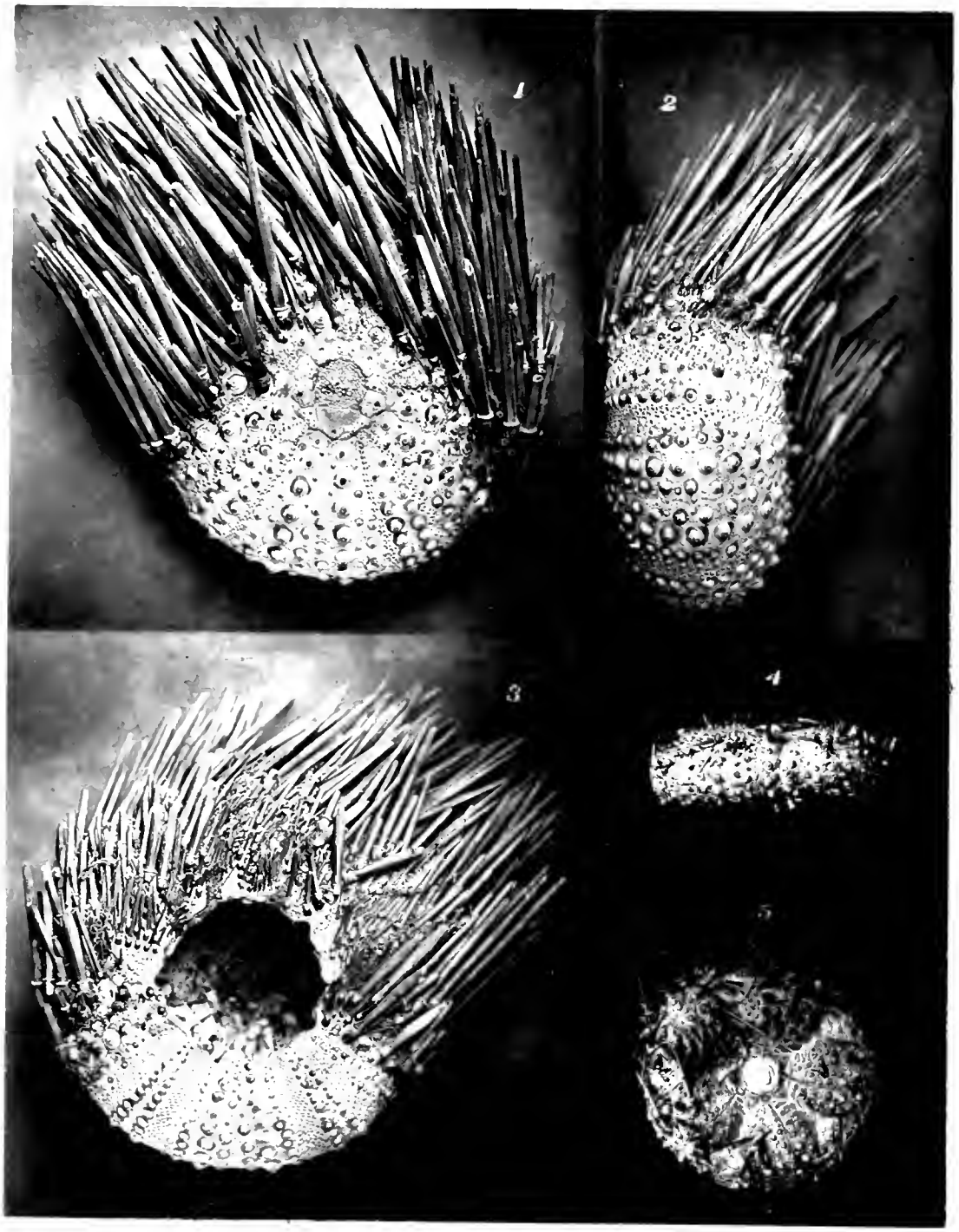

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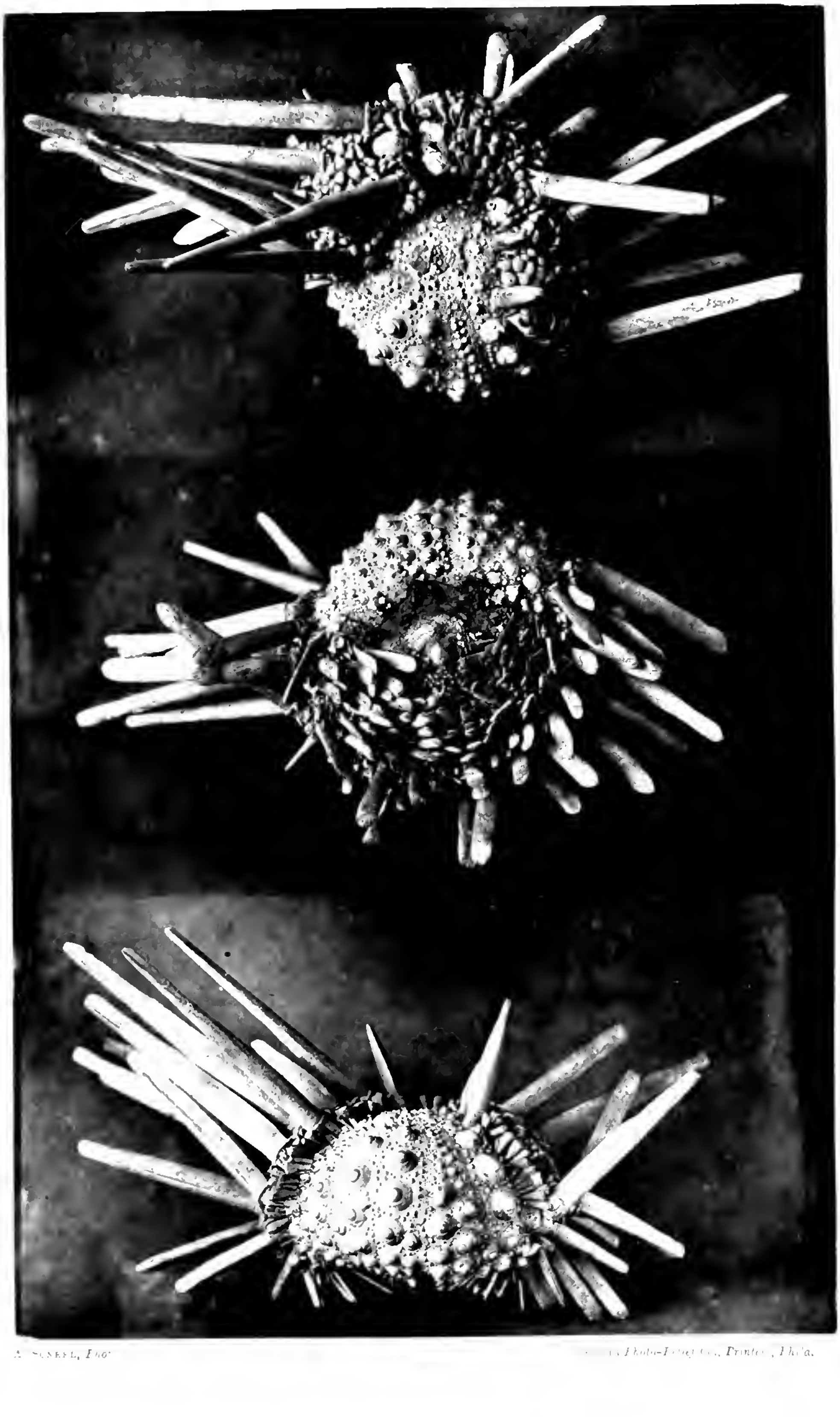
PLATE III[c].

Heterocentrotus mammillatus.

1.* (Upper Fig.) Seen from above.
2. (Middle Fig.) Seen from the actinal side.
3. (Lower Fig.) Seen in profile.

* The numbers have accidentally been omitted in this Plate ; the figures quoted in the text correspond to the figures in brackets.



A. Sonrel, Phot. … Photo-Engr. Co., Printer, Phila.

PLATE III[d].

Parasalenia gratiosa, *f. 1, 2.*

1. Seen in profile.
2. Seen from the abactinal pole.

Colobocentrotus atratus, *f. 3.*

3. Seen from the abactinal pole.

Colobocentrotus Mertensii, *f. 4, 5.*

4. Seen from the abactinal pole.
5. Seen from the actinal pole.

Heterocentrotus trigonarius, *f. 6.*

6. Seen from the abactinal pole, $\frac{2}{3}$ nat. size.

(*All Figs., except* 6, *natural size.*)

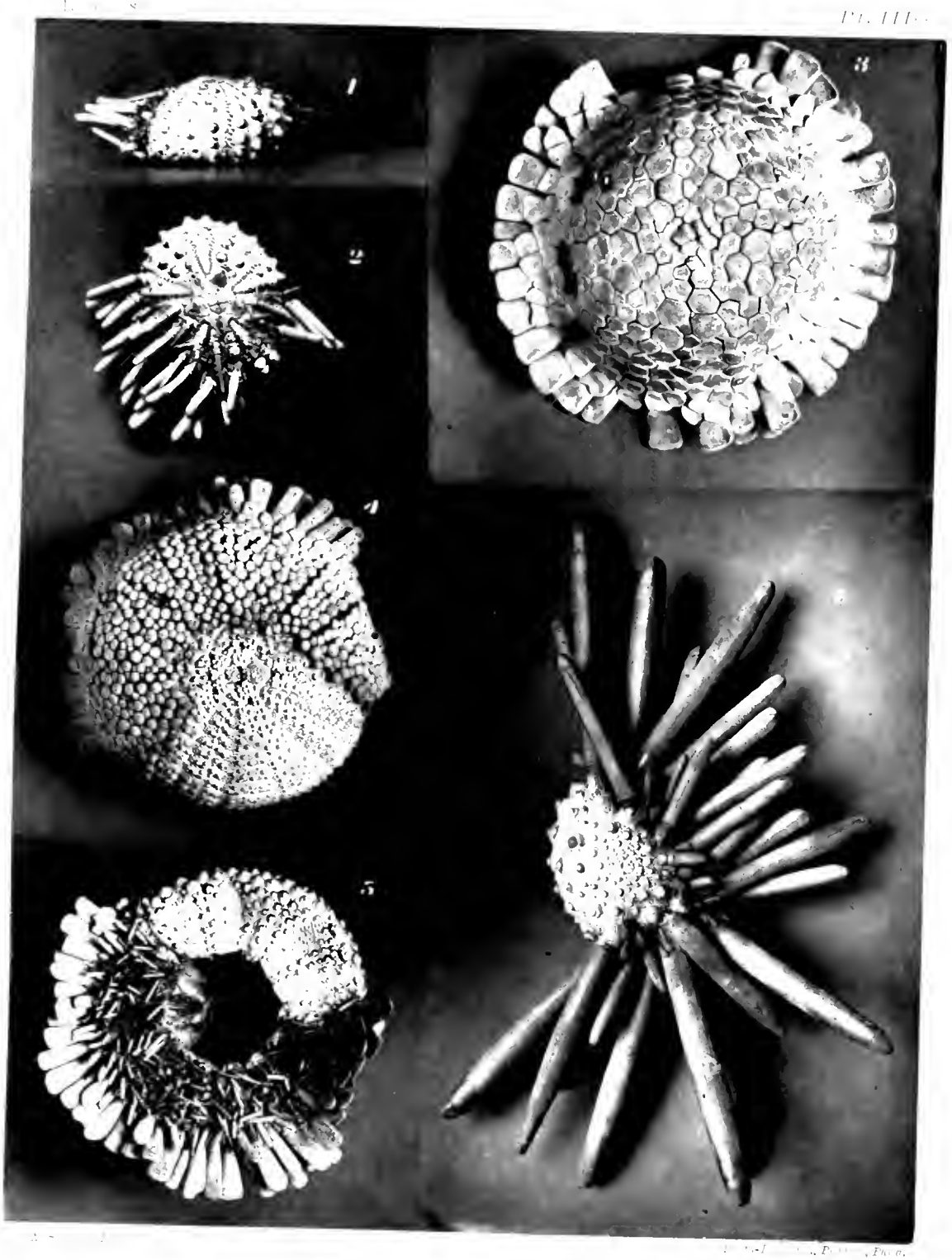

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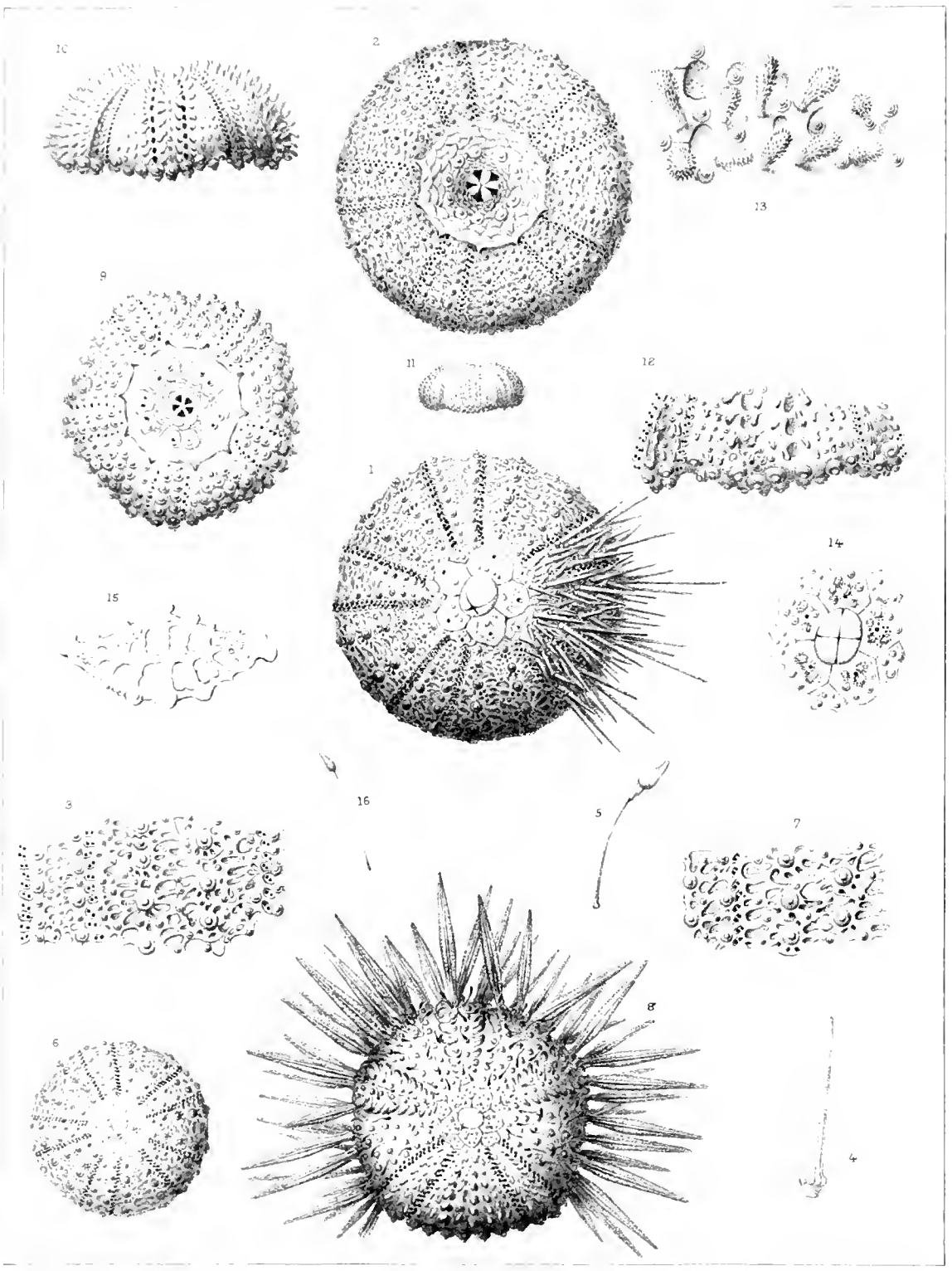
PLATE IV.

Trigonocidaris albida, *f. 1–7.*

1. Specimen measuring 12.7$^{mm.}$ in diam. from above.
2. Same measuring 12.7$^{mm.}$ in diam. from actinal side.
3. Part of test of same specimen, more highly magnified.
4. Spine of same specimen.
5. One of the pedicellariæ of test.
6. Younger specimen, measuring 4.75$^{mm.}$ in diam. from above.
7. Portion of test of same specimen.

Podocidaris sculpta, *f. 8–15.*

8. Specimen measuring 11$^{mm.}$ in diam. from above.
9. Another specimen of about same size from actinal side.
10. The same in profile.
11. Profile of a very large specimen, nat. size.
12. Portion of test of same magnified.
13. Portion of median interambulacral area of same, showing the tubercles, scrobicular circles of pedicellariæ.
14. Abactinal system of same.
15. Section of a principal spine near edge of test, greatly magnified.
16. One of the pedicellariæ.



Alex. Agassiz del.

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PLATE IV[a].

Diadema setosum, *f. 1.*

1. Seen in profile.

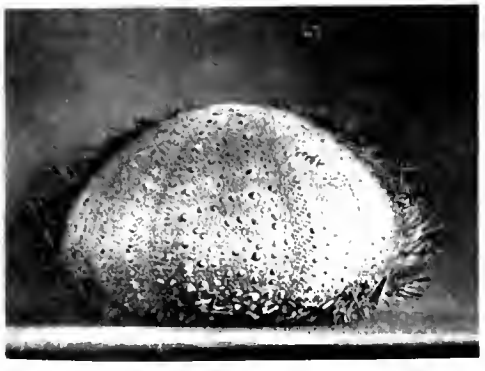
Strongylocentrotus Dröbachiensis, *f. 2, 3, 6.*

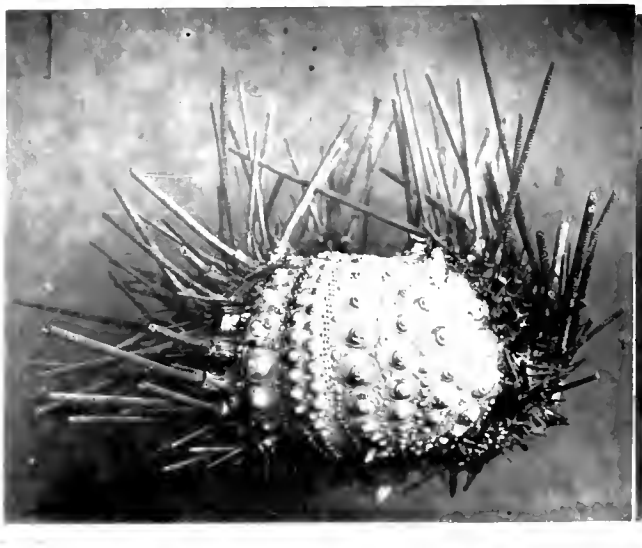
2. Seen from abactinal pole.
3. Same, seen in profile.
6. Seen from actinal side; nat. size.

Toxopneustes variegatus, *f. 4, 5.*

4. Seen from abactinal pole.
5. Seen from actinal side.

(*All figs.* $\frac{2}{3}$ *natural size, except fig.* 6.)





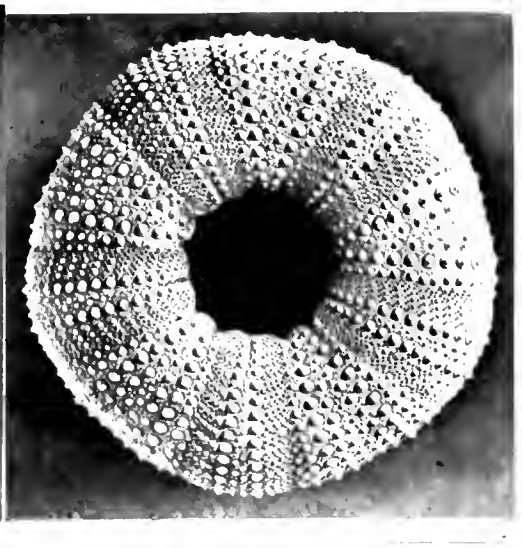


PLATE IV^b.

Stomopneustes variolaris, *f. 1–3.*

1. Seen from the actinal side.
2. Same seen in profile.
3. Seen from the abactinal pole.

Echinometra lucunter, *f. 4.*

4. Seen from the abactinal pole, nat. size.

Hipponoë variegata, *f. 5, 6.*

5. Seen in profile.
6. Same from the abactinal pole.

Evechinus chloroticus, *f. 7.*

7. Seen from the abactinal pole.

(*All Figs., except 4, two thirds natural size.*)

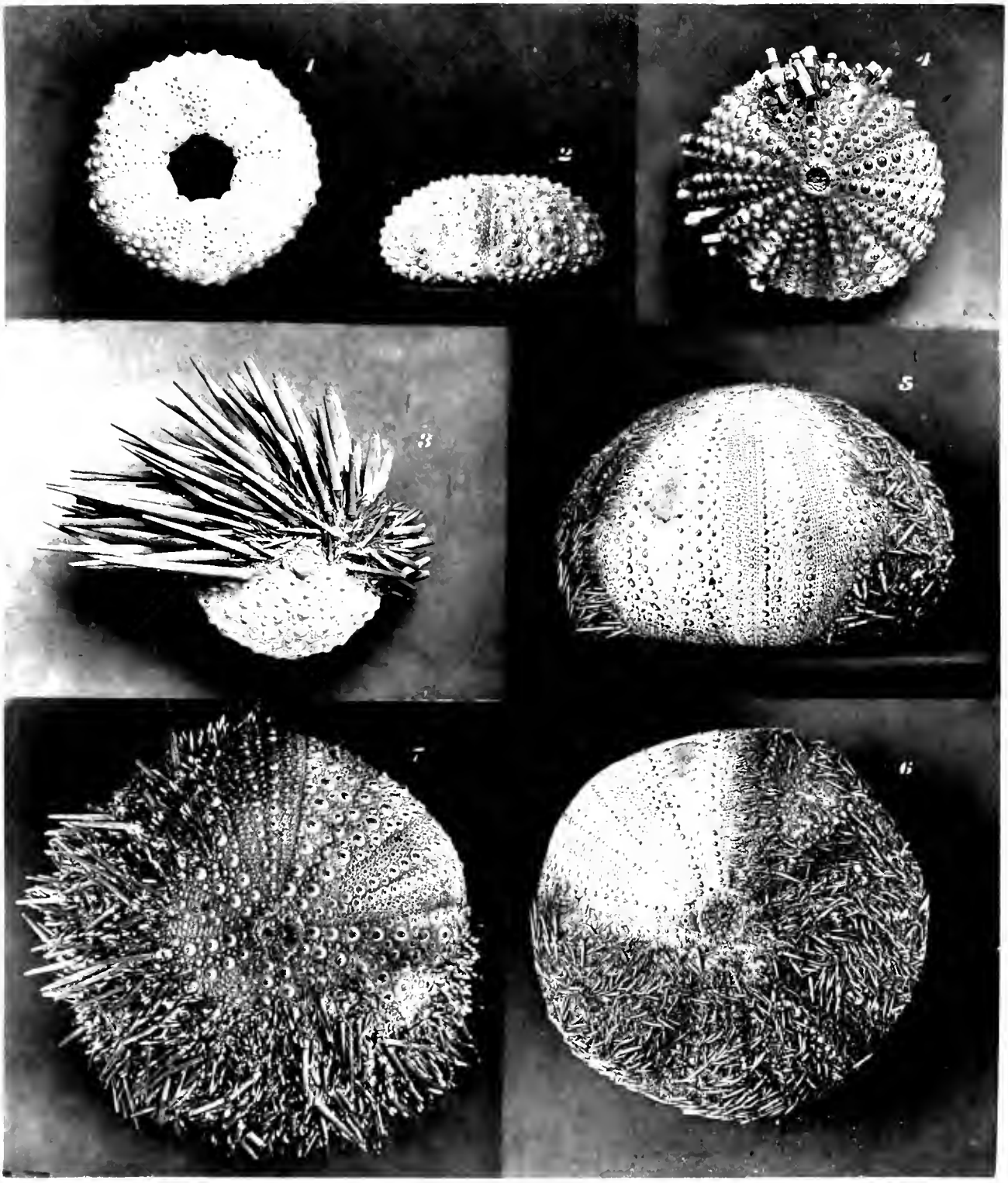


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PLATE V.

Arbacia punctulata, *f. 1–18.*

1. Seen in profile, somewhat reduced, with the tentacles fully expanded.
2. Same, seen from above (part of test).
3. (Somewhat magnified) profile view of the abactinal part of the test, showing the pointed tentacles.
4. A single disk bearing tentacle, one of the ten near the actinostome.
5. Cluster of gills.

6, 7. Pointed tentacles, from the flat side.

8. Pointed tentacle, from the narrow side.
9. Young, measuring 2.11$^{mm.}$ in diameter, from above.
10. Abactinal system and part of test of specimen of nearly the same size as in fig. 9.
11. The same portion of test of a specimen very slightly older.
12. Spine of fig. 9, magnified.
13. Spine of specimen of the size of fig. 14.
14. Young specimen, measuring 4.2$^{mm.}$ in diam. from above.
15. Actinal view of same.
16. Young, measuring 7.5$^{mm.}$ in diam., first appearance of pedicellariæ.
17. Spine of specimen of size of fig. 16.
18. Young, measuring 10.5$^{mm.}$ in diam., having all features of adult.

Arbacia pustulosa, *f. 19–21.*

19. Young, measuring 4.0$^{mm.}$ in diam. from above.
20. Young, measuring 3.1$^{mm.}$ in diam. from above.
21. Young, measuring 7.2$^{mm.}$ in diam. from above.

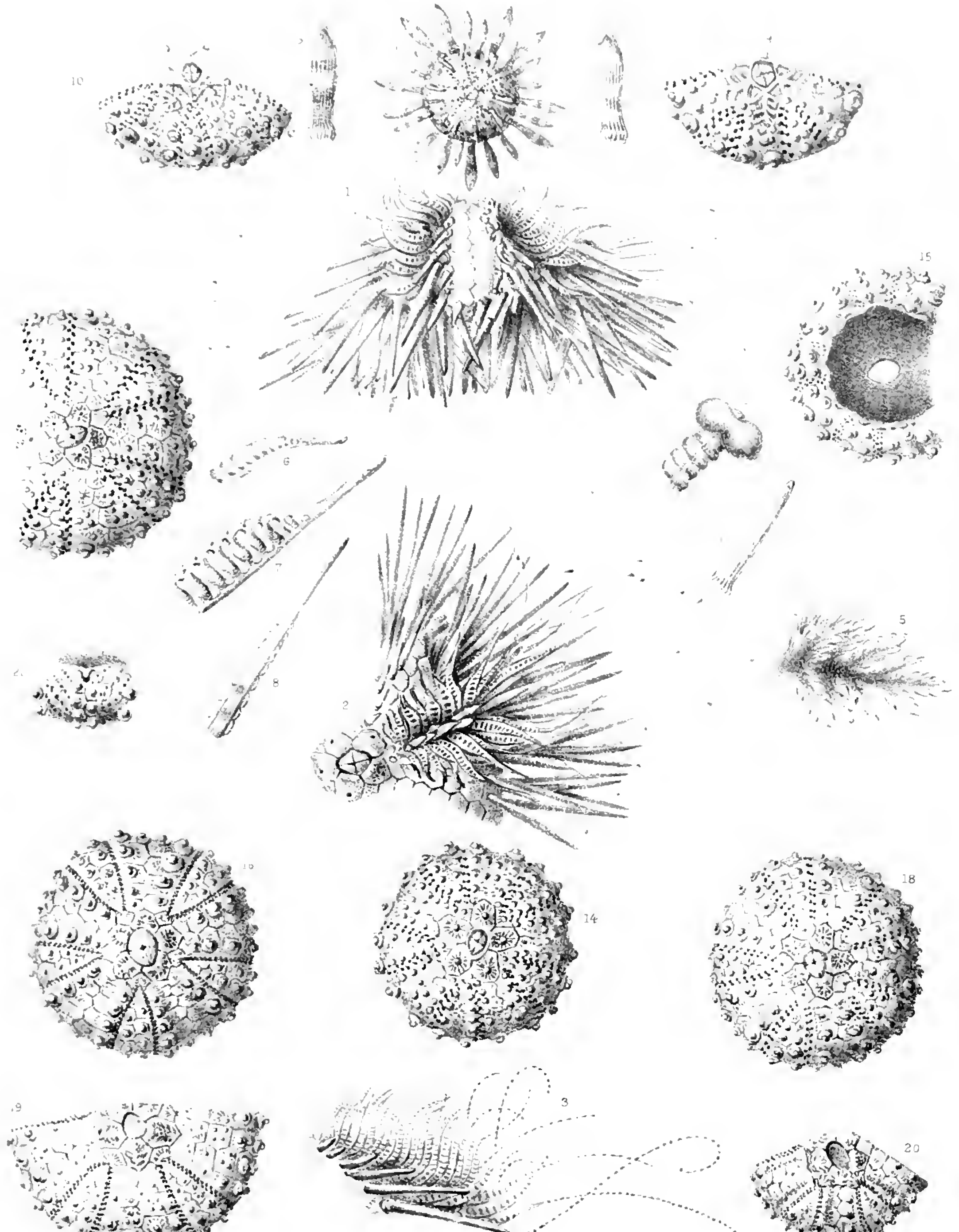
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PLATE V[a].

Strongylocentrotus armiger, *f. 1.*

1. Seen in profile.

Strongylocentrotus eurythrogrammus, *f. 2–4.*

2. Seen in profile.
3. Seen from actinal side.
4. Seen from the abactinal pole.

Strongylocentrotus purpuratus, *f. 5, 6.*

5. Seen from abactinal side.
6. Seen from the actinal side.

Sphaerechinus granularis, *f. 7.*

7. Seen from the abactinal pole, $\frac{2}{3}$ nat. size.

Pseudoboletia indiana, *f. 8, 9.*

8. Seen from the actinal side.
9. Seen from the abactinal pole.

Echinostrephus molare, *f. 10–12.*

10. Seen from the actinal side.
11. Same in profile.
12. Seen from the abactinal side.

(*All Figs., except* 7, *natural size.*)

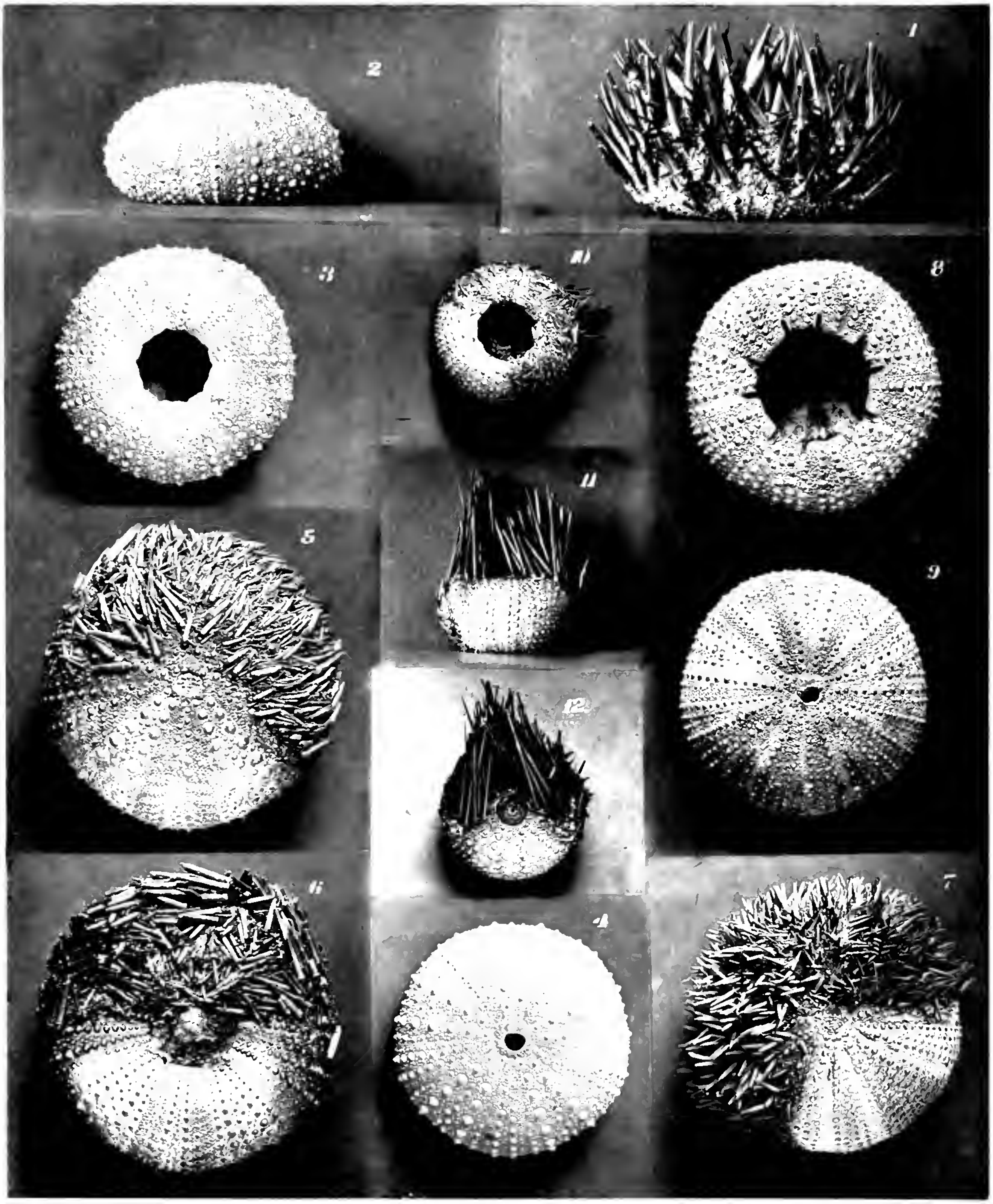

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PLATE V^{b}.

Strongylocentrotus franciscanus, *f. 1, 2.*

1. Seen from the abactinal side, $\frac{2}{3}$ nat. size.
2. Same from the actinostome, $\frac{2}{3}$ nat. size.

Strongylocentrotus lividus, *f. 3.*

3. Seen from the abactinal side.

Strongylocentrotus tuberculatus, *f. 4, 5.*

4. Seen from the actinal side.
5. Seen from the abactinal side.

(*Figs.* 3–5 *natural size.*)

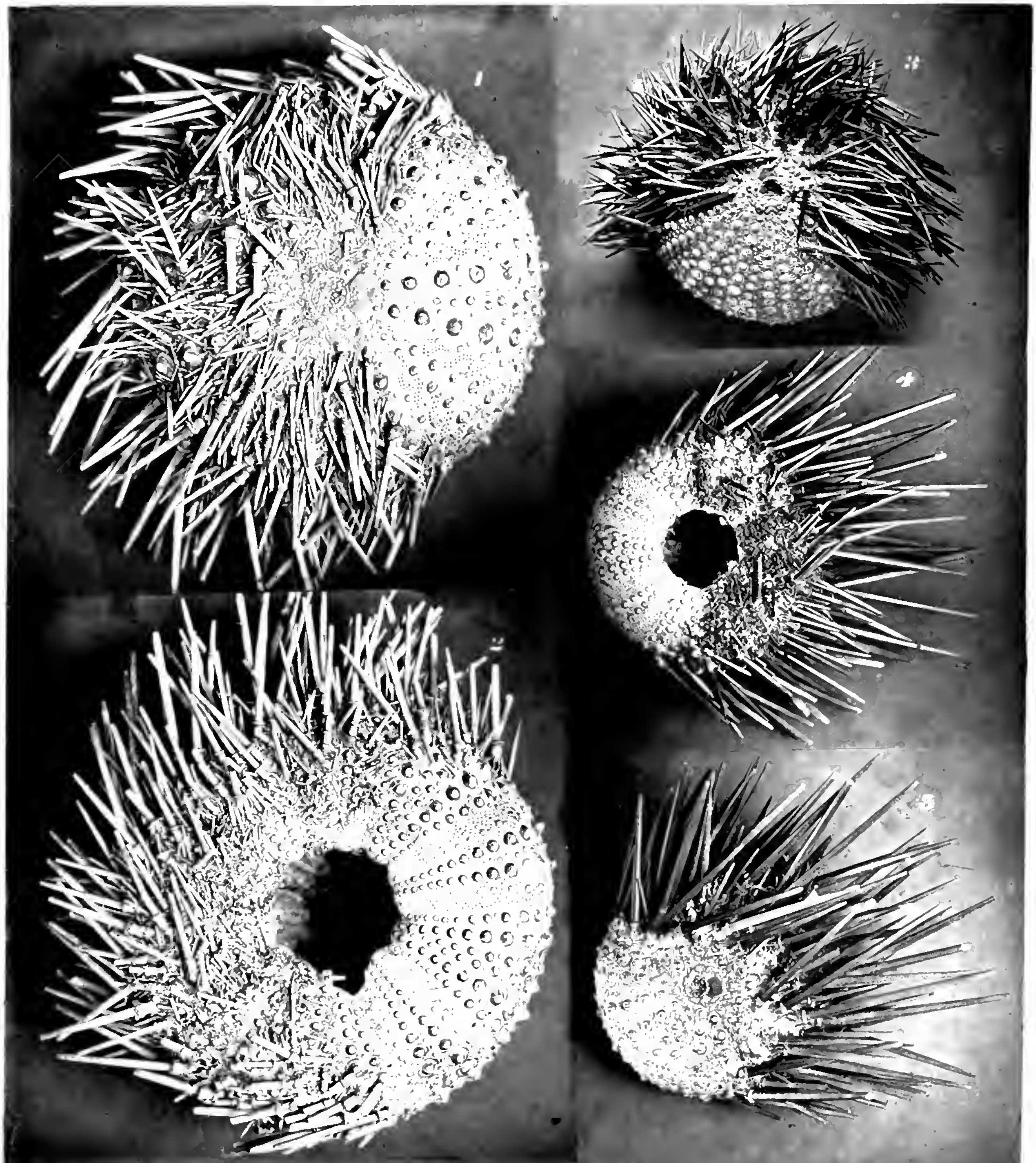

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PLATE VI.

DIAGRAM OF THE PORIFEROUS ZONE OF THE PRINCIPAL GENERA OF DESMOSTICHA.

1. **Mespilia globulus.**
2. **Phymosoma crenulare.**
3. **Phymosoma crenulare** (abactinal extremity).
4. **Echinus microtuberculatus.**
5. **Temnopleurus toreumaticus.**
6. **Salmacis sulcata.**
7. **Strongylocentrotus purpuratus.**
8. **Strongylocentrotus depressus.**
9. **Strongylocentrotus Dröbachiensis.**
10. **Strongylocentrotus franciscanus.**

10a. **Strongylocentrotus franciscanus** (juv.).

11. **Stomopneustes variolaris.**

11a. **Stomopneustes variolaris** (juv.).

12. **Echinometra lucunter.**
13. **Heterocentrotus trigonarius.**
14. **Parasalenia gratiosa.**
15. **Diadema setosum.**

16, 17. **Sphaerechinus granularis.**

18. **Sphaerechinus Australiae.**
19. **Sphaerechinus pulcherrimus.**
20. **Echinostrephus molare.**
21. **Cidaris tribuloides.**
22. **Arbacia punctulata.**
23. **Toxopneustes variegatus.**

25a. **Holopneustes purpurascens** (juv.).

25. **Holopneustes purpurascens.**
26. **Amblypneustes.**
27. **Amblypneustes.**
28. **Hipponoë esculenta** (juv.).
29. **Hipponoë esculenta.**
30. **Evechinus chloroticus.**

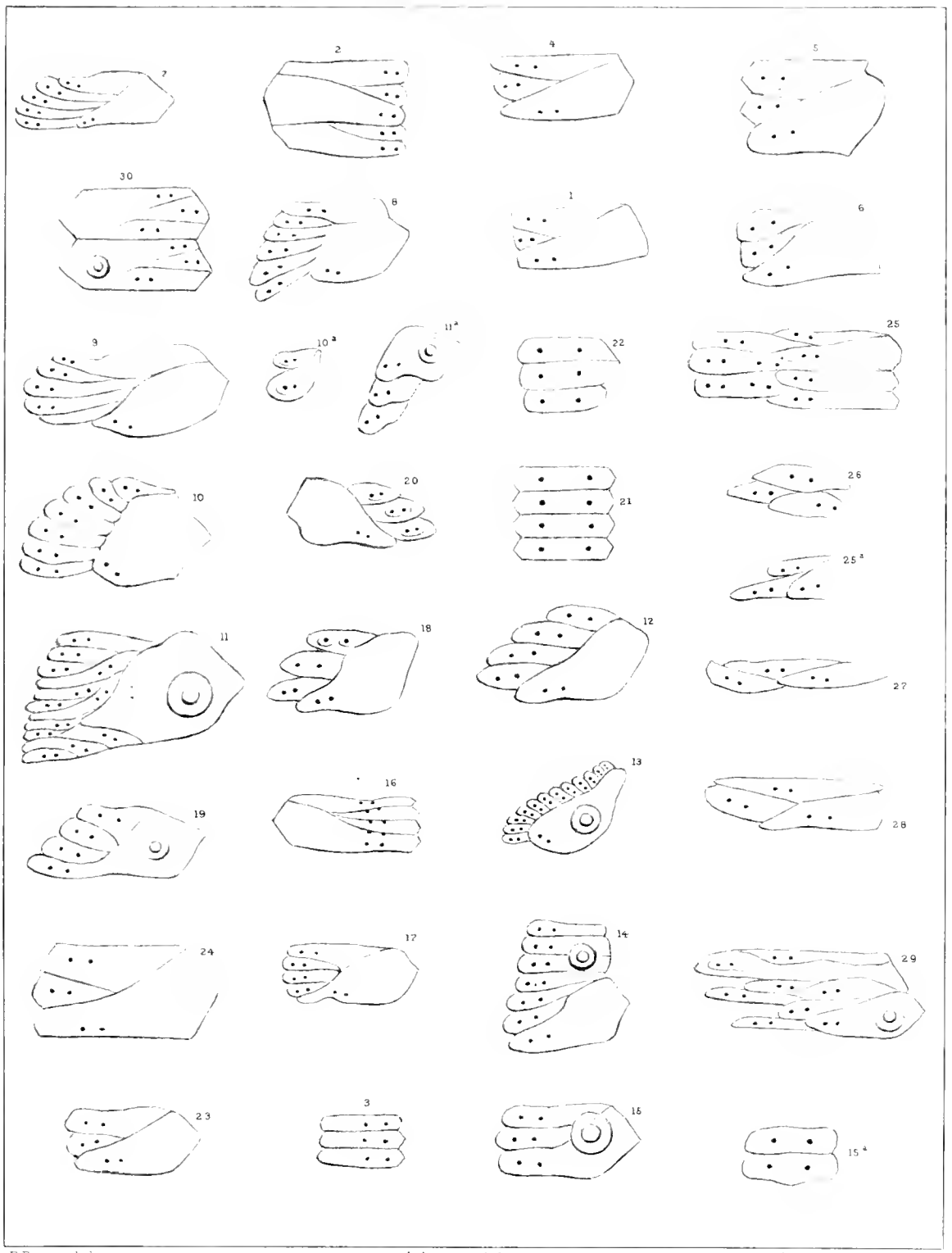
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PLATE VI[a].

Hipponoë esculenta, *f. 1–3.*

1. Seen from actinal side, $\frac{2}{3}$ nat. size.
2. Same seen from abactinal pole.
3. Young, from abactinal pole, nat. size.

Echinus norvegicus, *f. 4.*

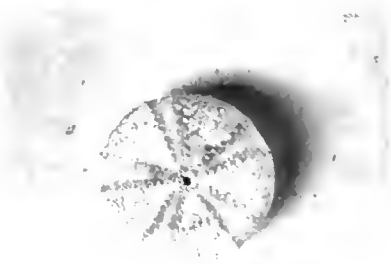
4. Seen from abactinal pole, nat. size (from Cape Wrath).

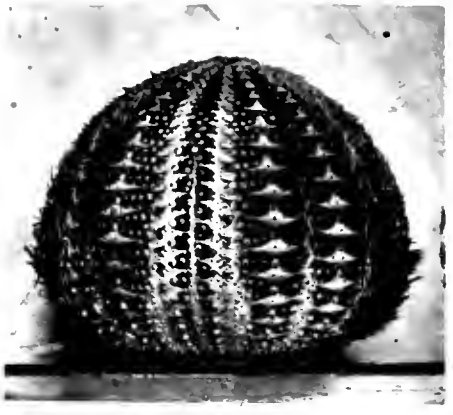
Diadema setosum, *f. 5.*

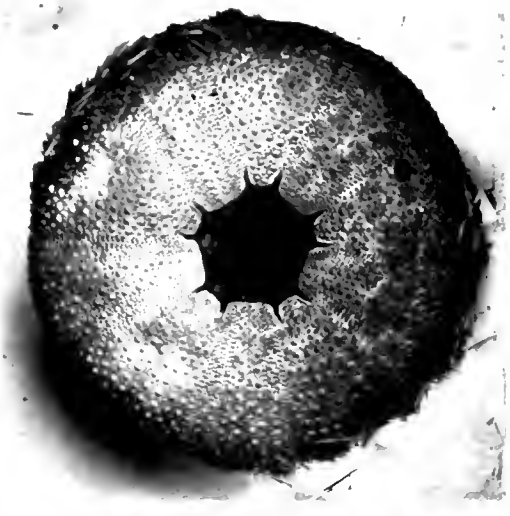
5. Seen from abactinal pole, $\frac{2}{3}$ nat. size.

Echinus gracilis, *f. 6.*

6. Seen in profile, $\frac{2}{3}$ nat. size.







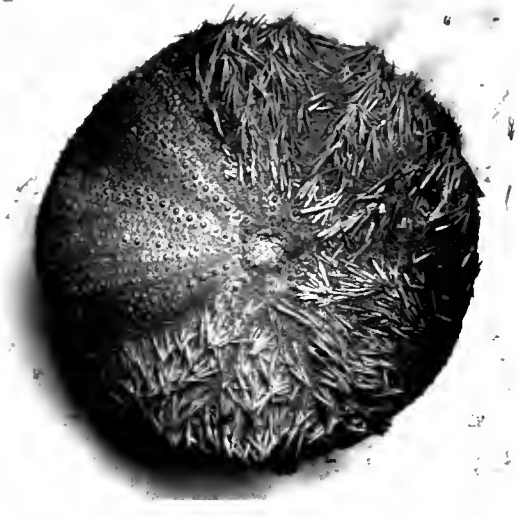


PLATE VII.

Echinus gracilis, *f. 1–6ª.*

1. Abactinal system of specimen, measuring 10.5$^{mm.}$ in diam., magnified.
2. Part of test of same specimen magnified, showing arrangement of pores, and formation of secondary and miliary tubercles.
3. Abactinal system of specimen, measuring 43$^{mm.}$ in diam., magnified.
4. Part of test of same, magnified.
5. Abactinal system of specimen measuring 12.7$^{mm.}$ in diam., magnified.
6. Abactinal system of specimen somewhat larger ($\frac{2}{1}$).

6ª. Abactinal system of large specimen $\frac{2}{1}$.

Toxopneustes variegatus, *f. 7–22.*

7. Specimen measuring 4.74$^{mm.}$ in diam. from actinal pole, magnified.
8. Magnified part of test of same specimen as fig. 7.
9. Same (fig. 7) seen from abactinal side.
10. Specimen measuring 6.2$^{mm.}$ in diam. from abactinal pole, magnified.
11. Magnified part of test of same (fig. 10).
12. Spine of same, magnified.
13. Actinal side of same, magnified.
14. Specimen measuring 10.9$^{mm.}$ from actinal pole, magnified.
15. Magnified part of test of same (fig. 14).
16. Same specimen (fig. 14) from abactinal side.
17. Abactinal system of specimen, from Florida ($\frac{3}{1}$).
18. Abactinal system of specimen somewhat older ($\frac{5}{1}$).
19. Abactinal system of larger specimen ($\frac{2}{1}$).
20. Buccal membrane of same ($\frac{2}{1}$).
21. Portion of test of specimen, measuring 38$^{mm.}$ in diam.
22. Portion of test of specimen, measuring 57$^{mm.}$ in diam.

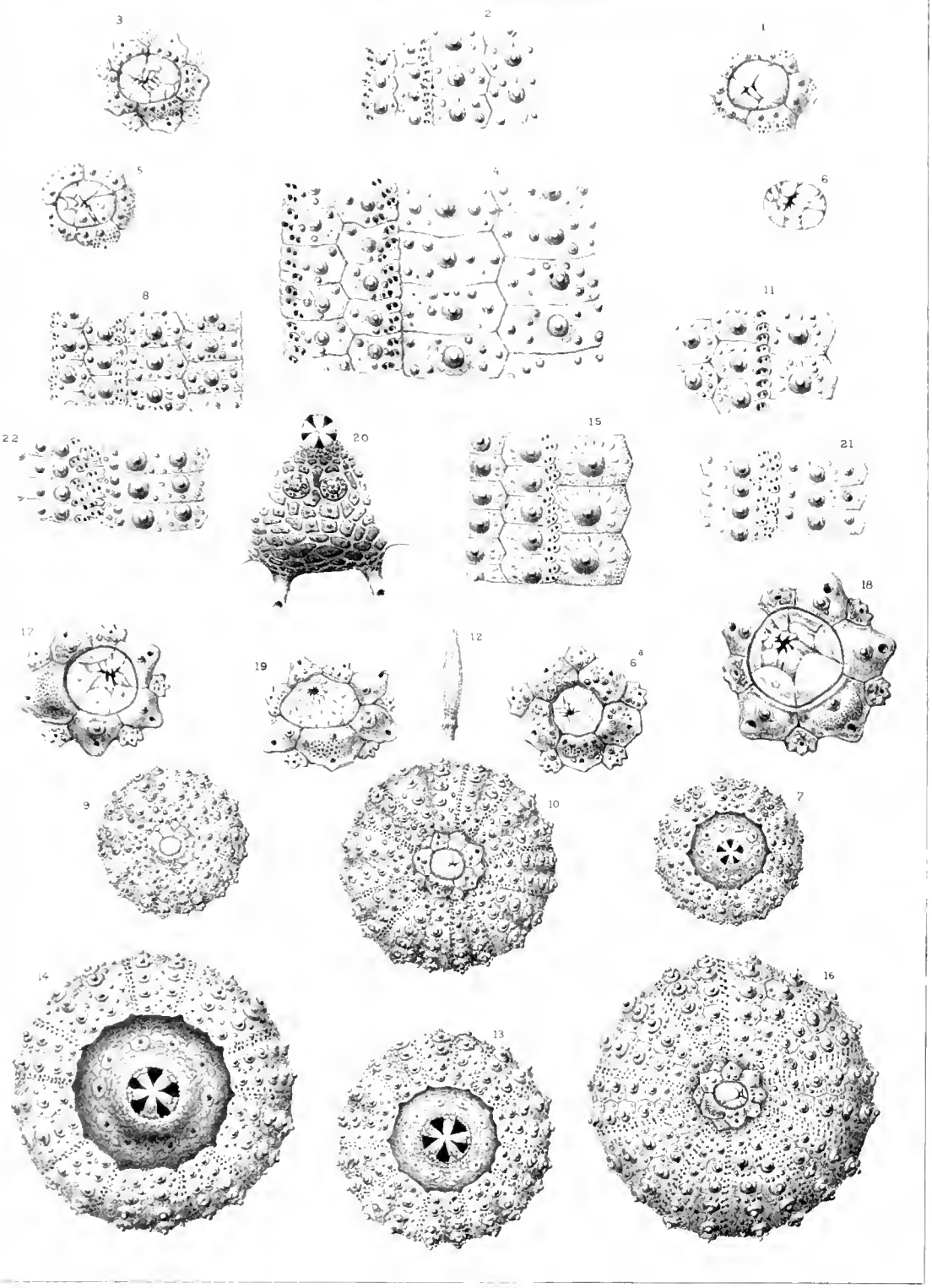


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PLATE VII[a].

Echinus microtuberculatus, *f. 1, 2.*

1. Seen in profile.
2. Seen from the abactinal pole.

Echinus angulosus, *f. 3.*

3. Seen from above.

Echinus elegans, *f. 4.*

4. Seen from above.

Echinus acutus, *f. 5.*

5. Seen in profile.

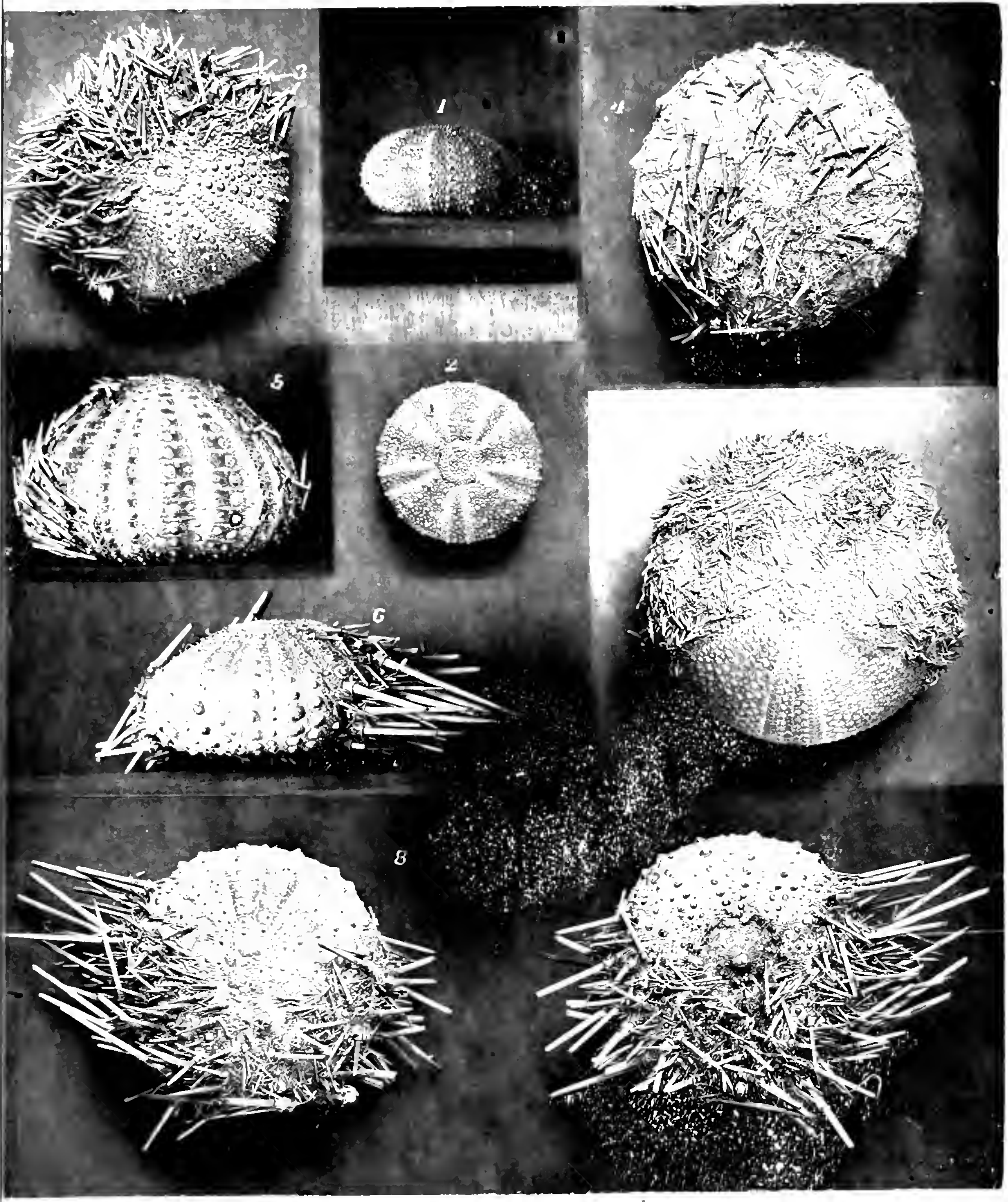
Echinus esculentus, *f. 7.*

7. Seen from above, $\frac{2}{3}$ nat. size.

Phymosoma crenulare, *f. 6, 8, 9.*

6. Seen in profile.
8. Seen from above.
9. Seen from the actinal side.

(*All Figs., except* 7, *natural size.*)



A. Sonrel, Ph.

Photo-Relief Co., Printers, Phila.

PLATE VIII.

Temnechinus maculatus, *f. 1 - 18.*

1. Specimen from abactinal pole, one half denuded, 12.7$^{mm.}$ in diam.
2. Same, without spines, showing actinal cuts.
3. Abactinal system of same specimen, showing the large anal plate.
4. Magnified portion of test of same specimen.
5. Spine of same, magnified.
6. Pedicellaria of same, magnified.
7. Outline of specimen in profile.
8. Specimen somewhat younger, from above, measuring 7.2$^{mm.}$
9. Same from actinal side.
10. Abactinal system of same specimen, magnified.
11. Magnified portion of test of same.
12. Magnified spine of same.
13. Auricle of same specimen.
14. Magnified portion of test of fig. 15.
15. Young specimen from actinal side, measuring 2.5$^{mm.}$ in diam.
16. Young specimen, pentagonal, flat, with Cidaris-like spines, seen from abactinal side, measuring 0.8$^{mm.}$ in diam.
17. Test of same denuded from actinal side.
18. Spine of specimen somewhat older.

Echinus microtuberculatus, *f. 19 - 21.*

19. Young specimen, measuring 5.1$^{mm.}$ in diam., showing size of actinostome.
20. Magnified part of test of same.
21. Magnified part of test of younger specimen (2.1$^{mm.}$ in diam.).

Temnopleurus Reynaudi, *f. 22 - 25.*

22. Part of test of specimen measuring 18.6$^{mm.}$ in diam.
23. Anal system of specimen measuring 7.9$^{mm.}$ in diam.
24. Part of test of specimen of fig. 23.
24'. Abactinal system of specimen of fig. 22.

Temnopleurus Hardwickii, *f. 26.*

25. Part of test of specimen measuring 7.9$^{mm.}$ in diam.
26. Part of test of specimen measuring 11$^{mm.}$ in diam.
27. Abactinal system of same (11$^{mm.}$ in diam.).
28. Abactinal system of specimen measuring 7.9$^{mm.}$ in diam.

Hipponoë esculenta, *f. 29.*

29. Arrangement of part of poriferous zone of young specimen.

Temnechinus globosus, *f. 30.*

30. Part of test of specimen measuring 18$^{mm.}$ in diam. from the Crag.

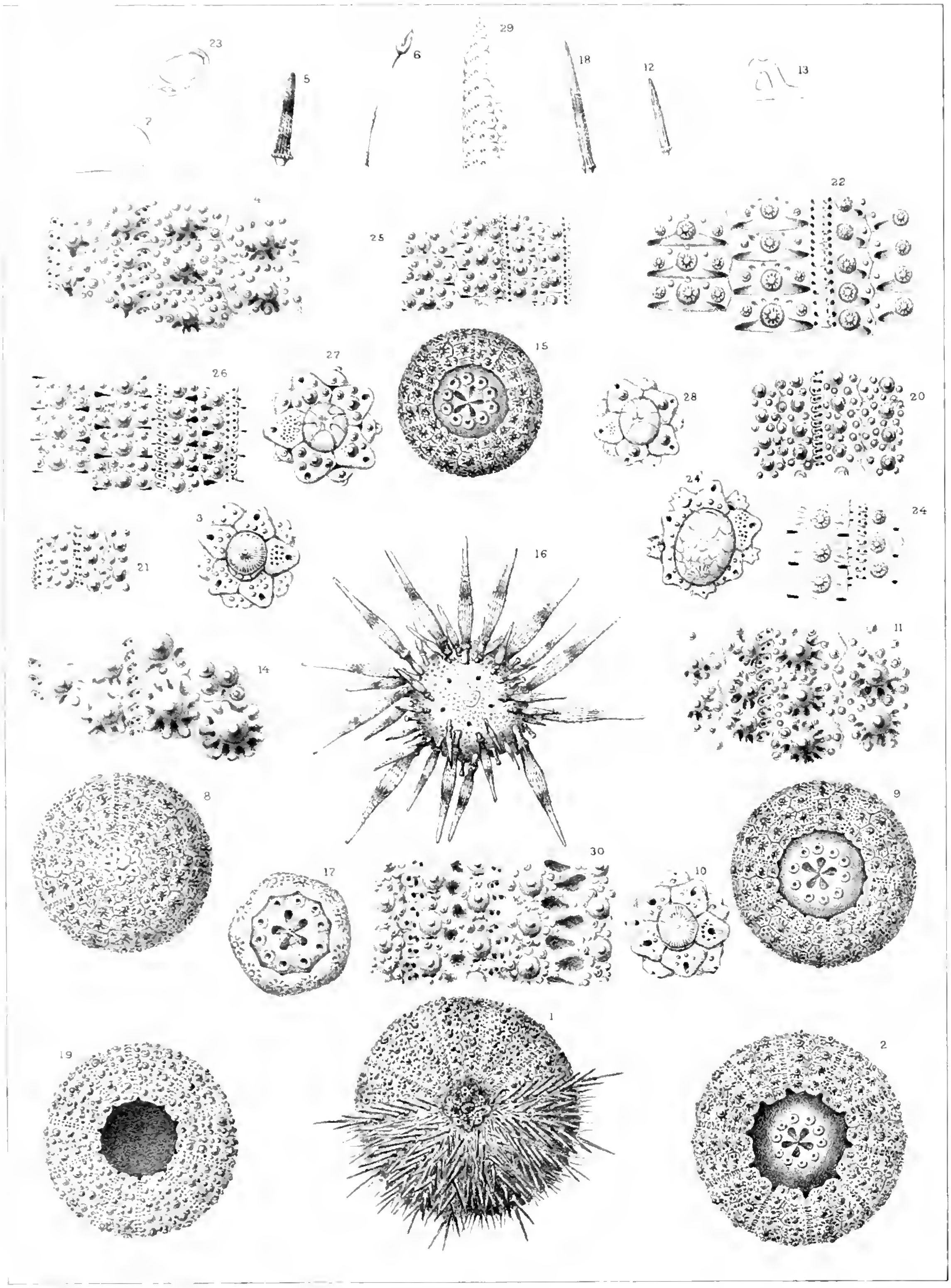


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PLATE VIII[a].

Temnopleurus Hardwickii, *f. 1–3.*

1. Seen in profile.
2. Seen from above.
3. Seen from the actinal side.

Temnopleurus toreumaticus, *f. 4, 5.*

4. Denuded, seen from above.
5. Young specimen from above.

Temnopleurus Reynaudi, *f. 6, 7.*

6. Seen from the abactinal side.
7. In profile.

Microcyphus maculatus, *f. 8–10.*

8. Large specimen in profile.
9. Somewhat younger, in profile.
10. Still younger, in profile.

Salmacis bicolor, *f. 11, 12.*

11. Seen from the actinal side.
12. From the abactinal pole.

Mespilia globulus, *f. 13, 14.*

13. Seen from the abactinal pole.
14. Seen in profile.

(*All Figs. natural size.*)

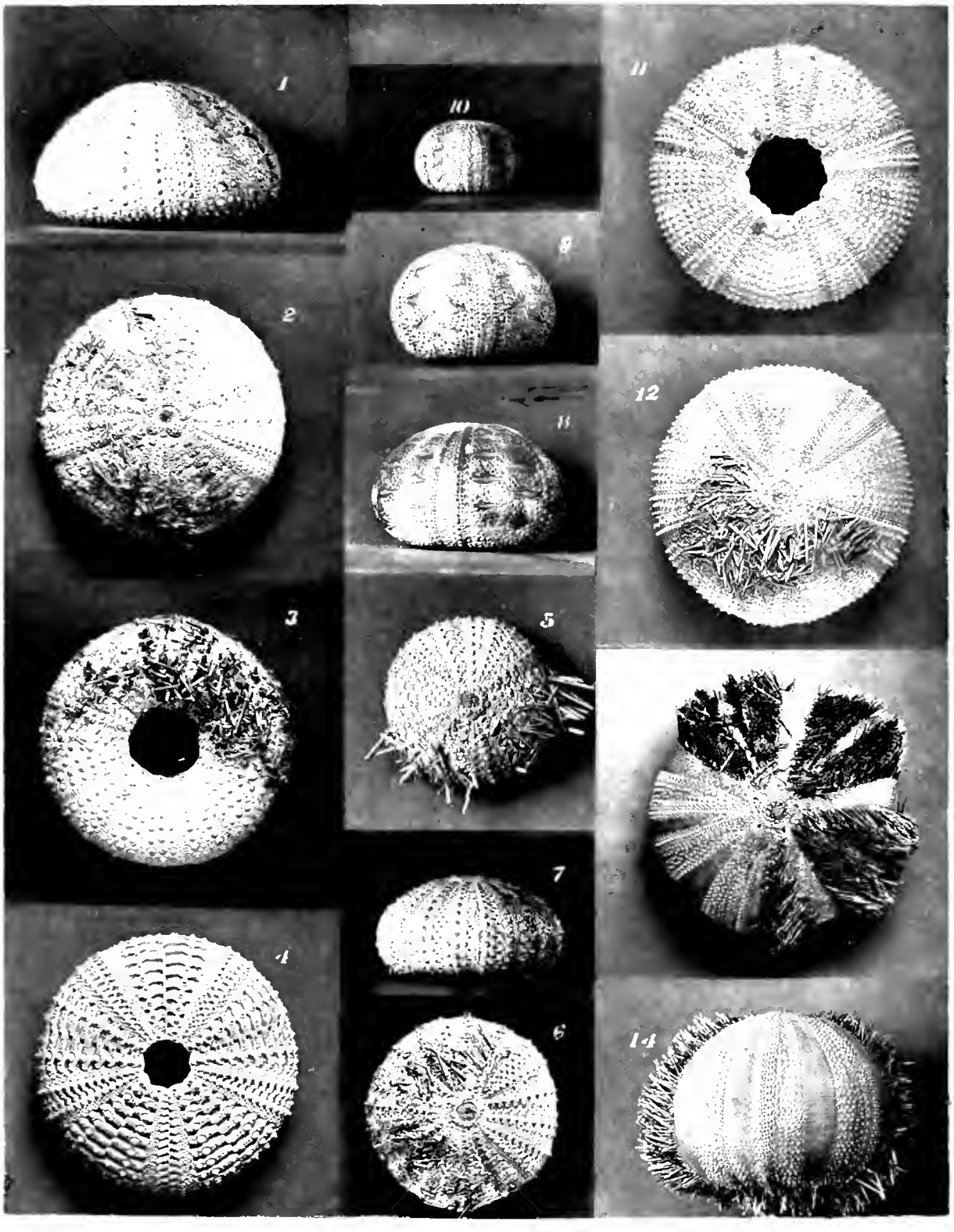
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PLATE VIII^{b}.

Toxopneustes pileolus, *f. 1, 2.*

1. Seen from above. (Acapulco.)
2. Seen from the actinal side. (Acapulco.)

Salmacis sulcata, *f. 3.*

3. Seen from above, nat. size.

Salmacis rarispina, *f. 4 – 6.*

4. Seen from above.
5. Seen in profile.
6. From the actinal side.

Salmacis Dussumieri, *f. 7, 8.*

7. Seen from above, nat. size.
8. From the actinal side, nat. size.

(*All Figs. not marked* $\frac{3}{4}$ *natural size.*)

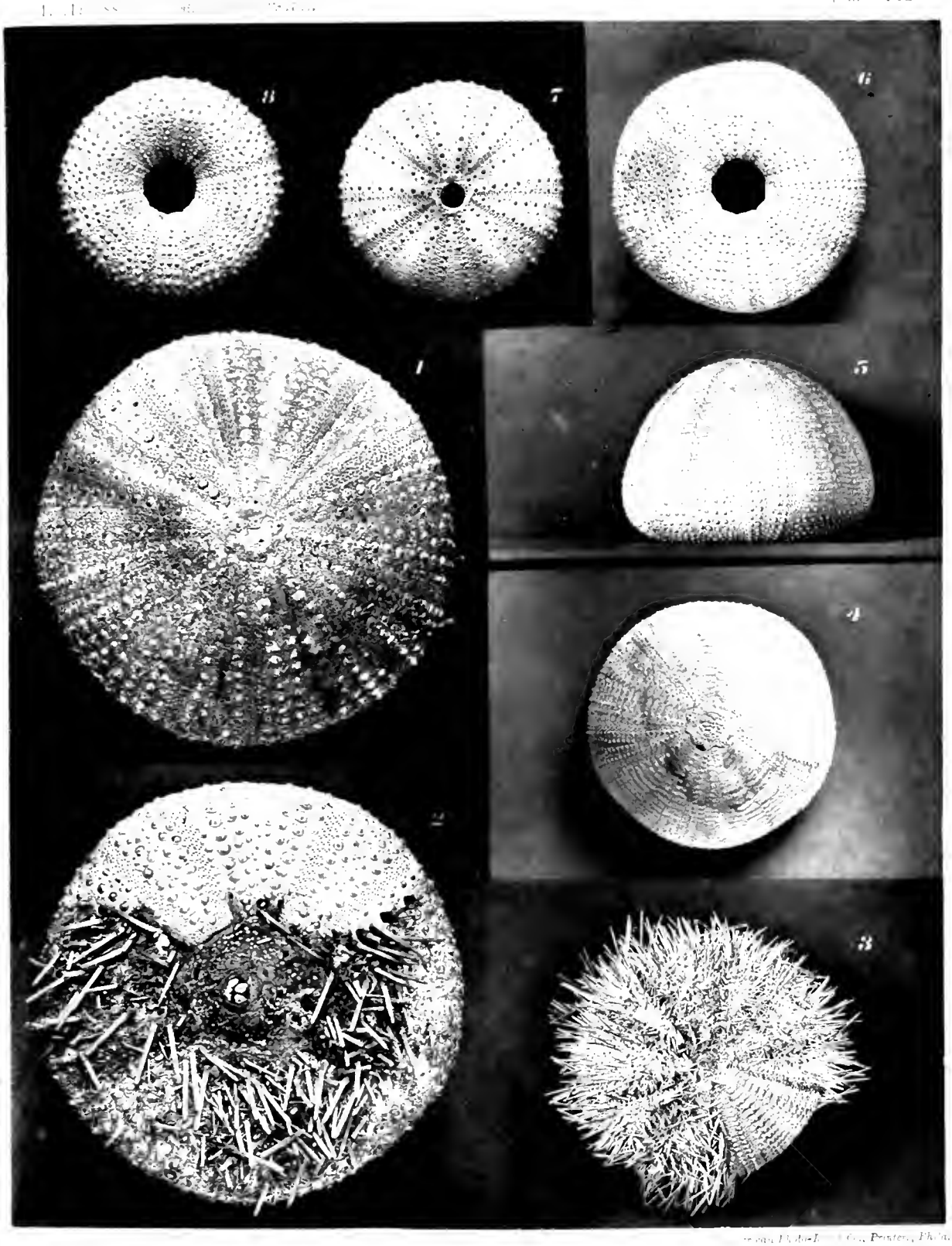
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PLATE VIII.

Amblypneustes formosus, *f. 1, 2.*

1. Ovoid specimen in profile.
2. Spherical specimen in profile.

Amblypneustes ovum, *f. 3, 4.*

3. Seen in profile.
4. Seen from the abactinal pole.

Holopneustes purpurescens, *f. 5, 6.*

5. Seen in profile.
6. Seen from the abactinal pole.

Amblypneustes pentagonus, *f. 7, 8.*

7. From above.
8. In profile.

Holopneustes porosissimus, *f. 9, 10.*

9. Seen in profile.
10. Seen from the abactinal pole.

Microcyphus zigzag, *f. 11 – 13.*

11. Seen in profile.
12. Seen from the abactinal pole.
13. Young specimen seen in profile.

Mespilia globulus, *f. 14.*

14. Seen from the actinal side.

(*All Figs. natural size.*)

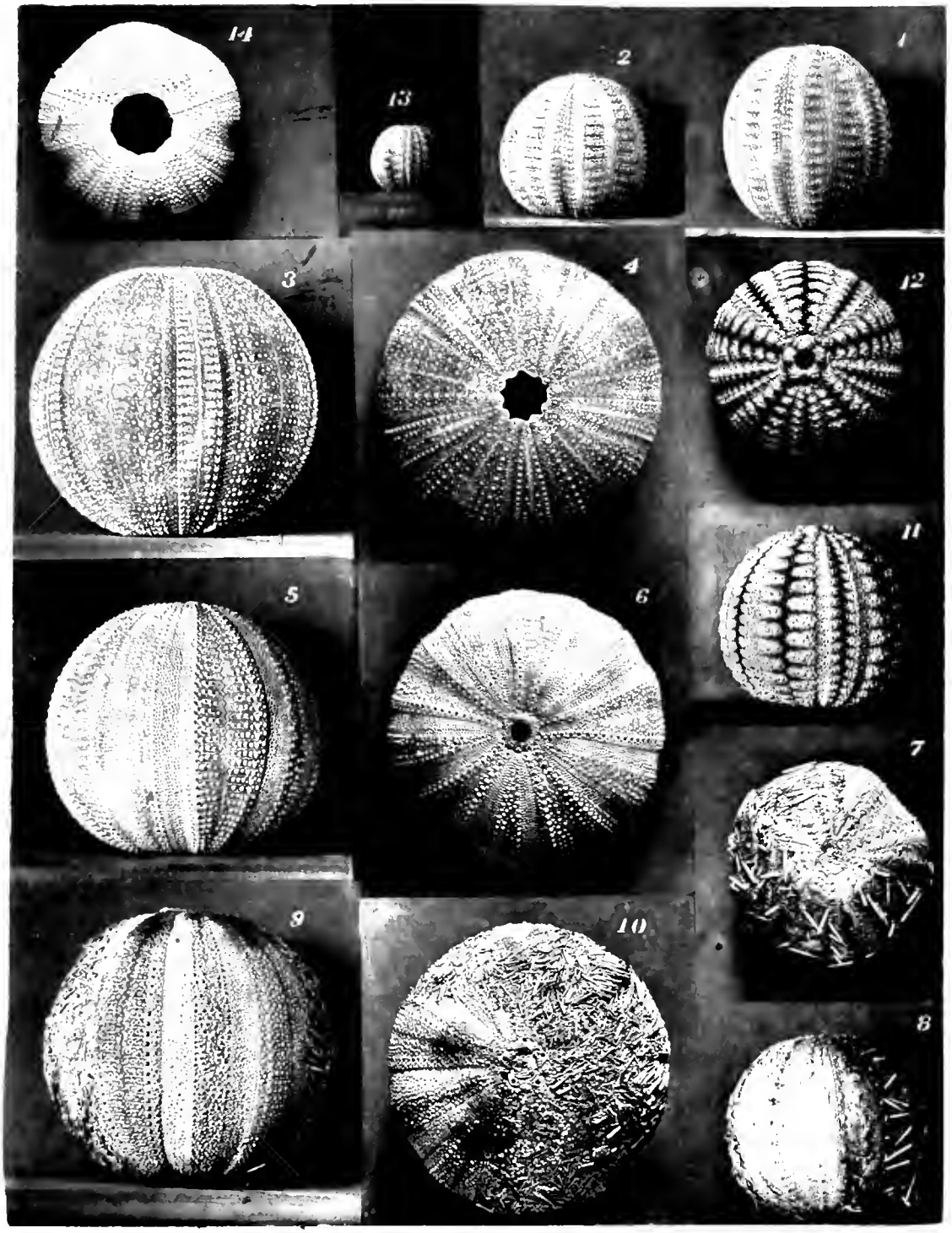
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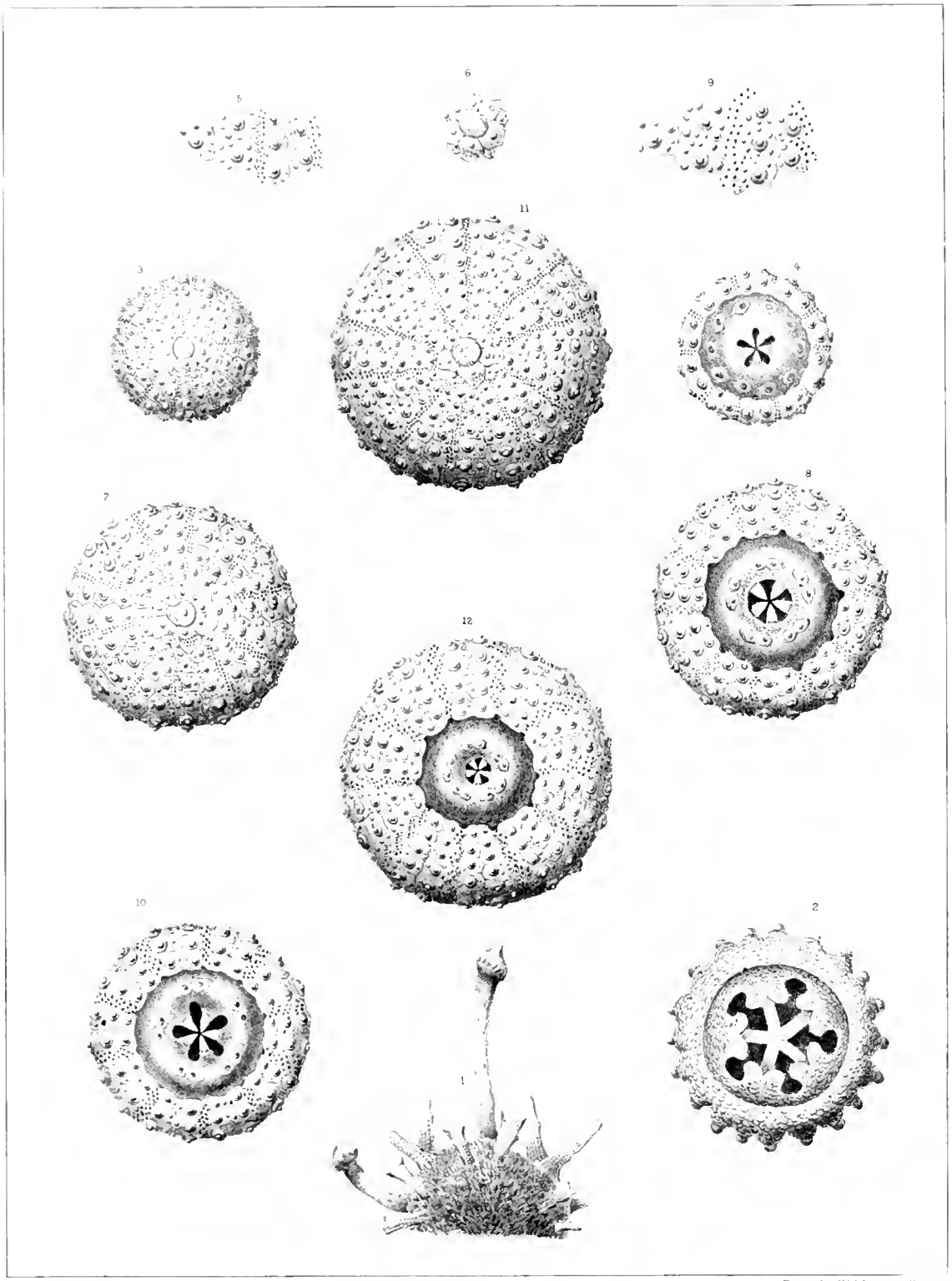
PLATE IX.

Strongylocentrotus Dröbachiensis.

1. Young specimen immediately after resorption of Pluteus, greatly magnified, abactinal side.
2. Specimen somewhat older, denuded (actinal side).
3. Abactinal view of young, having from 5 to 6 plates, magnified $\frac{8}{1}$.
4. Same from actinal side.
5. Same, magnified portion of ambulacral and interambulacral space.
6. Abactinal system of young, measuring $3.6^{mm.}$ in diam.
7. Same specimen from the actinal side.
8. Abactinal view of specimen measuring $5.4^{mm.}$ in diam.
9. Magnified portion of test of same specimen.
10. Actinal view of same.
11. Abactinal view of specimen measuring $8.2^{mm.}$ in diam.
12. The same seen from actinal side.



P. Roetter lithog. Alex. Agassiz, del. Print. by H.W. Longfellow

PLATE X.

Strongylocentrotus Dröbachiensis.

1. Specimen, nat. size, with tentacles fully expanded from abactinal side.
2. 1.6$^{mm.}$ in diam. including spines, where spines have assumed the shape of adult, with pedicellaria and anal plate.
3. Specimen somewhat younger, having only five tentacles, from actinal side.
4. The same seen from abactinal side.

5, 6. Expanded tentacles of adult, magnified.

7, 8. Pedicellariæ of the abactinal part of test.

9, 10. Pedicellariæ round the actinostome

11 – 13. Pedicellariæ of abactinal part of test in different stages of growth.

14, 15. Pedicellariæ of abactinal part of test, seen from above.

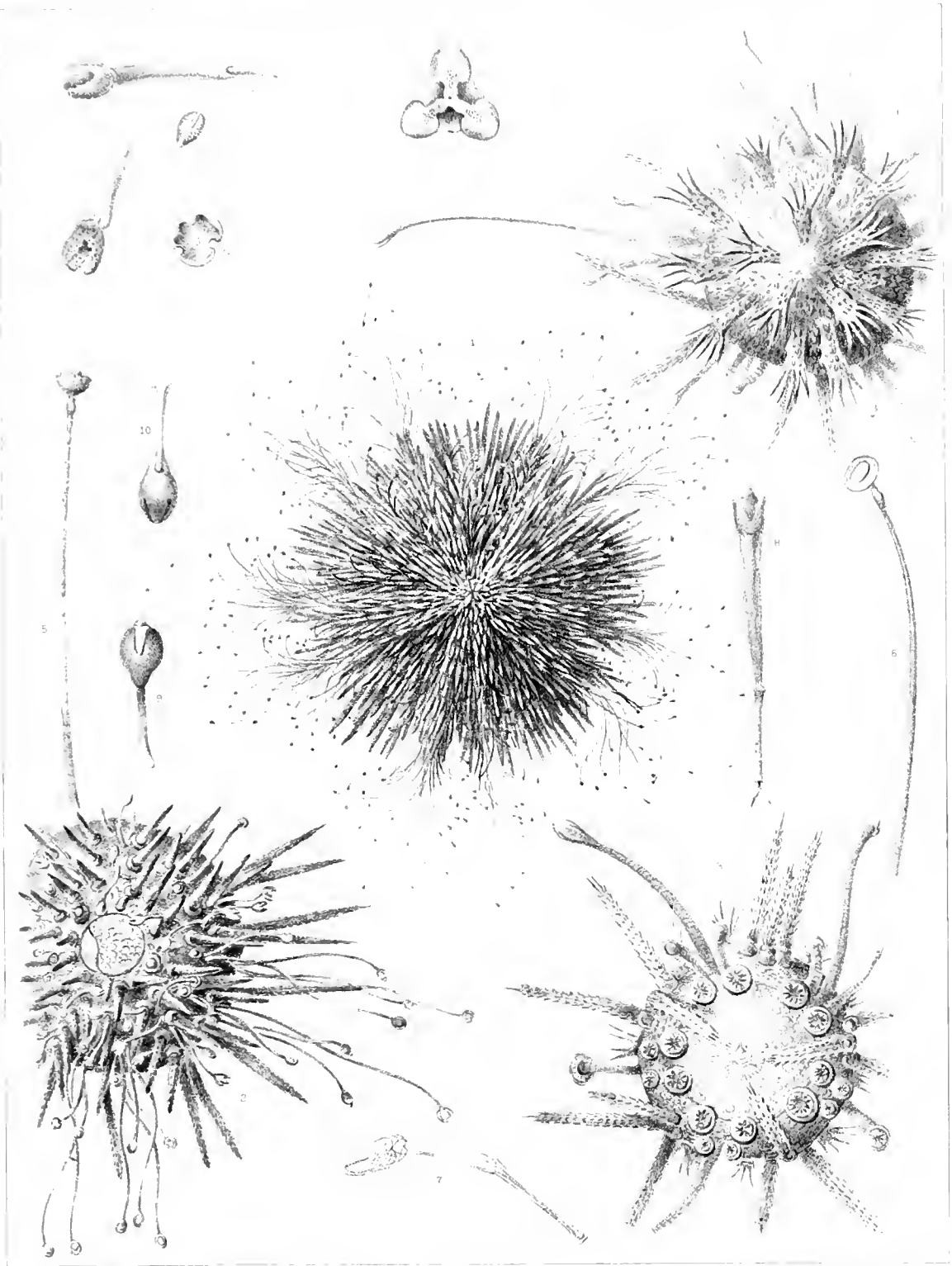

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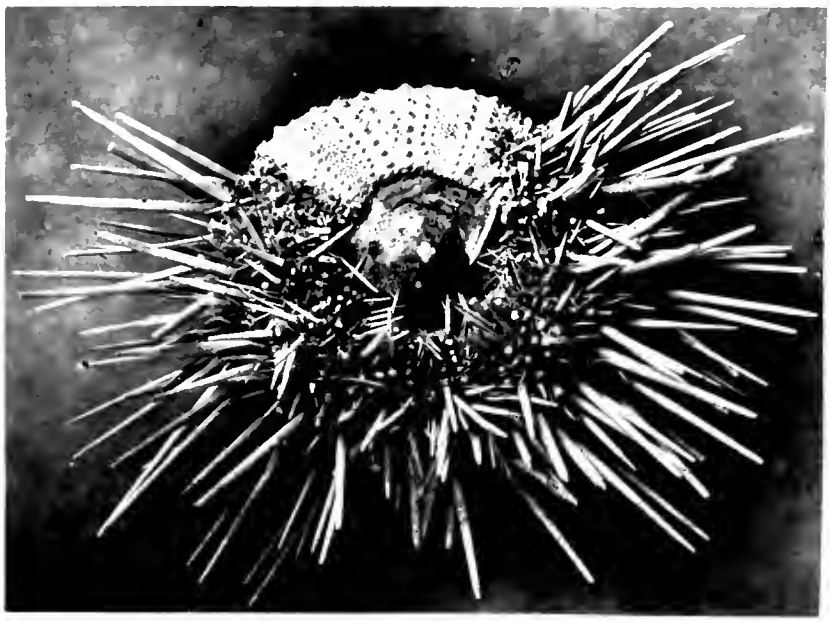
PLATE X[a].

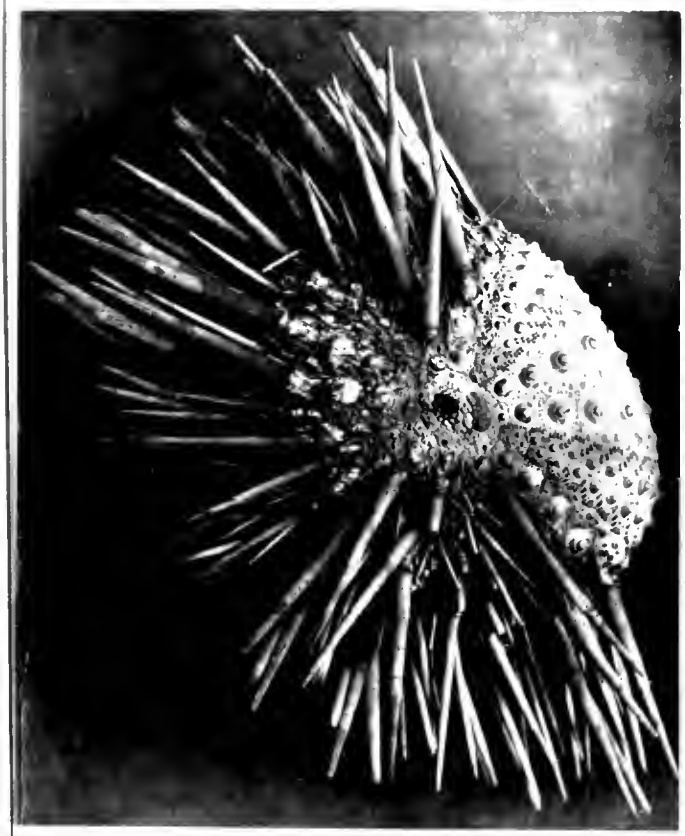
Echinometra viridis, *f. 1.*

1. Seen from abactinal pole, nat. size.

Echinometra subangularis, *f. 2–4.*

2. Seen from abactinal pole, nat. size.
3. Other specimen, nat. size, with more slender spines.
4. Same from actinal side.





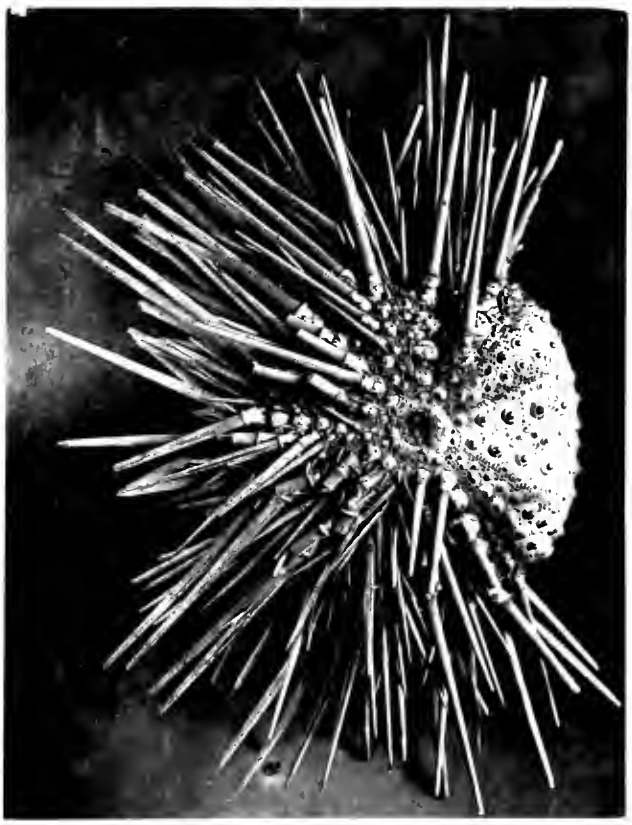


PLATE XI.

Mellita sexforis, *f. 1–12.*

1. Young M. sexforis of a Laganum shape, no posterior interambulacral lunule seen from above, 2.4$^{mm.}$ in diam.
2. Same from actinal side, deeply concave, showing commencement of lunule.
3. Young, showing first trace of posterior interambulacral lunule, from above, 4.0$^{mm.}$ in diam.
4. Same from actinal side.
5. Rotulæ of same magnified.
6. Posterior interambulacral lunule of specimen measuring 5.3$^{mm.}$ in diam., magnified.
7. Young specimen, measuring 7 5$^{mm.}$ in diam., from above.
8. Same from actinal side, no trace as yet of pits forming ambulacral lunules.
9. Young specimen, measuring 10.1$^{mm.}$ in diam., from above, showing trace of the ambulacral lunules all unequally developed.
10. The same from below, showing the deep pits, unequal in size, forming the rudimentary lunules.
11. Young specimen, measuring 12.7$^{mm.}$ in diam., with all the ambulacral lunules completely pierced through and well formed.
12. Young specimen, measuring 38$^{mm.}$ in diam., having all the the principal features of the adult.

Mellita testudinata, *f. 13–23.*

13. Young, with scarcely a trace of notches and a well-formed posterior lunule; from above, nat. size.
14. Posterior part of test of same from above, magnified.
15. Somewhat older specimen than fig. 13.
16. Magnified portion of test of same from above.
17. Magnified portion of test of same from below.
18. Young specimen, older than fig. 15, with a trace of notches, commencement of ambulacral lunules.
19. Young specimen, considerably older, with deep notches, nat size.
20. Rotulæ, with part of poriferous zone, of fig. 18, magnified.
21. Part of ambulacral rosette of specimen measuring 60$^{mm.}$ in diam.
22. Diagram of arrangement of pores of Mellita testudinata.
23. Diagram of arrangement of pores of Echinanthus rosaceus.

Mellita longifissa, *f. 24–27.*

24. Young, nat. size, from above; ambulacral notches commencing to close.
25. Part of test of same, magnified.
26. Young, nat. size, with ambulacral notches changed to lunules.
27. Part of test of same, magnified.

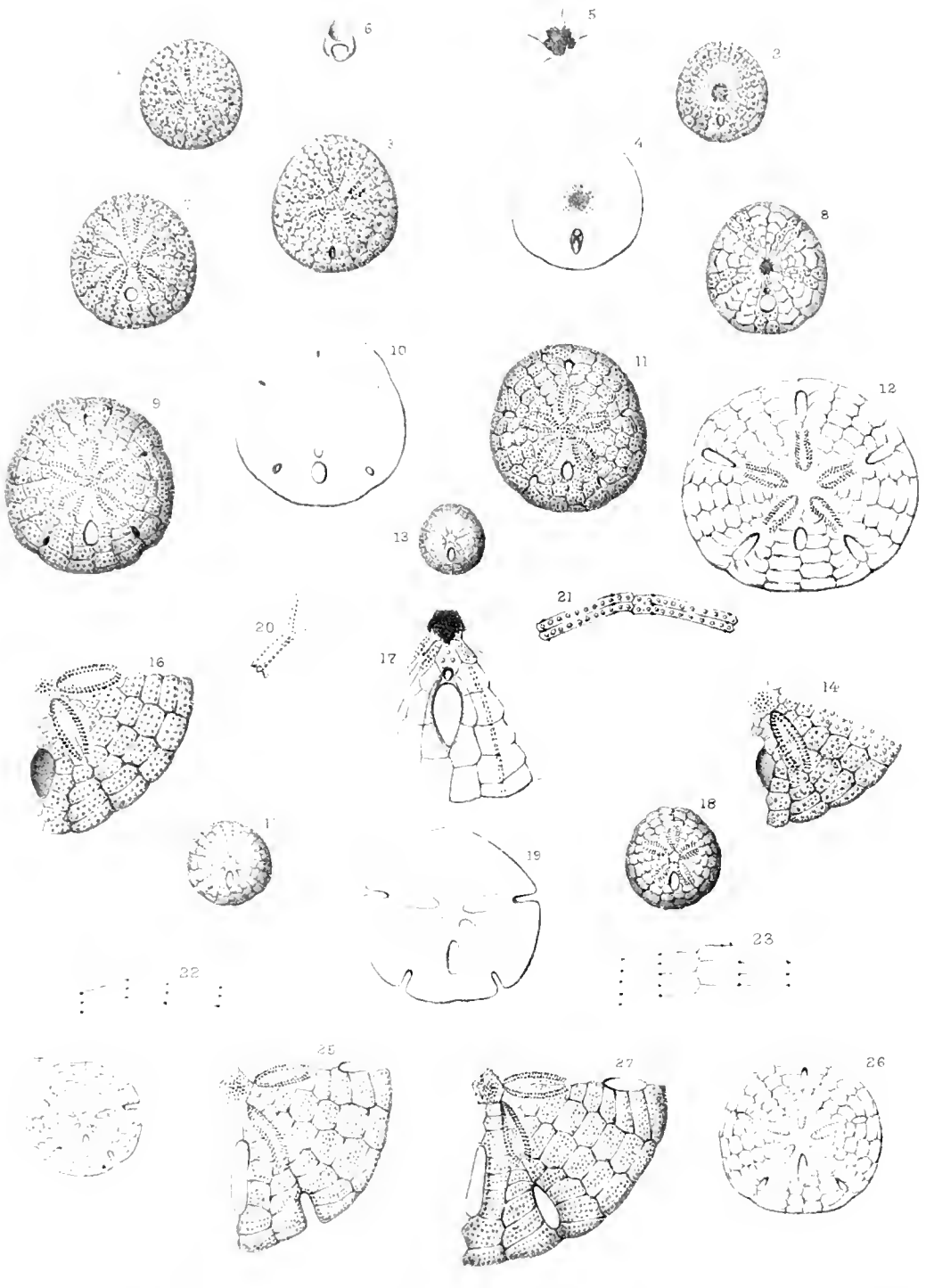

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PLATE XI[a].

Clypeaster humilis, *f. 1 – 8.*

1. The five jaws seen from abactinal side.
2. Same seen in profile.
3. Same seen from the actinal side.
4. One of the jaws in profile.
5. One of the jaws seen from the centre of mouth.
6. One of the jaws seen endwise.
7. Single lateral jaw seen from the actinal side.
8. The odd jaw seen from the actinal side.

Echinodiscus auritus, *f. 9 – 13.*

9. The five jaws seen from the abactinal side.
10. Same seen from the actinal side.
11. Single jaw seen from the actinal side.
12. Single jaw seen in profile.
13. Single jaw seen from the abactinal side.

(*All figs. natural size.*)

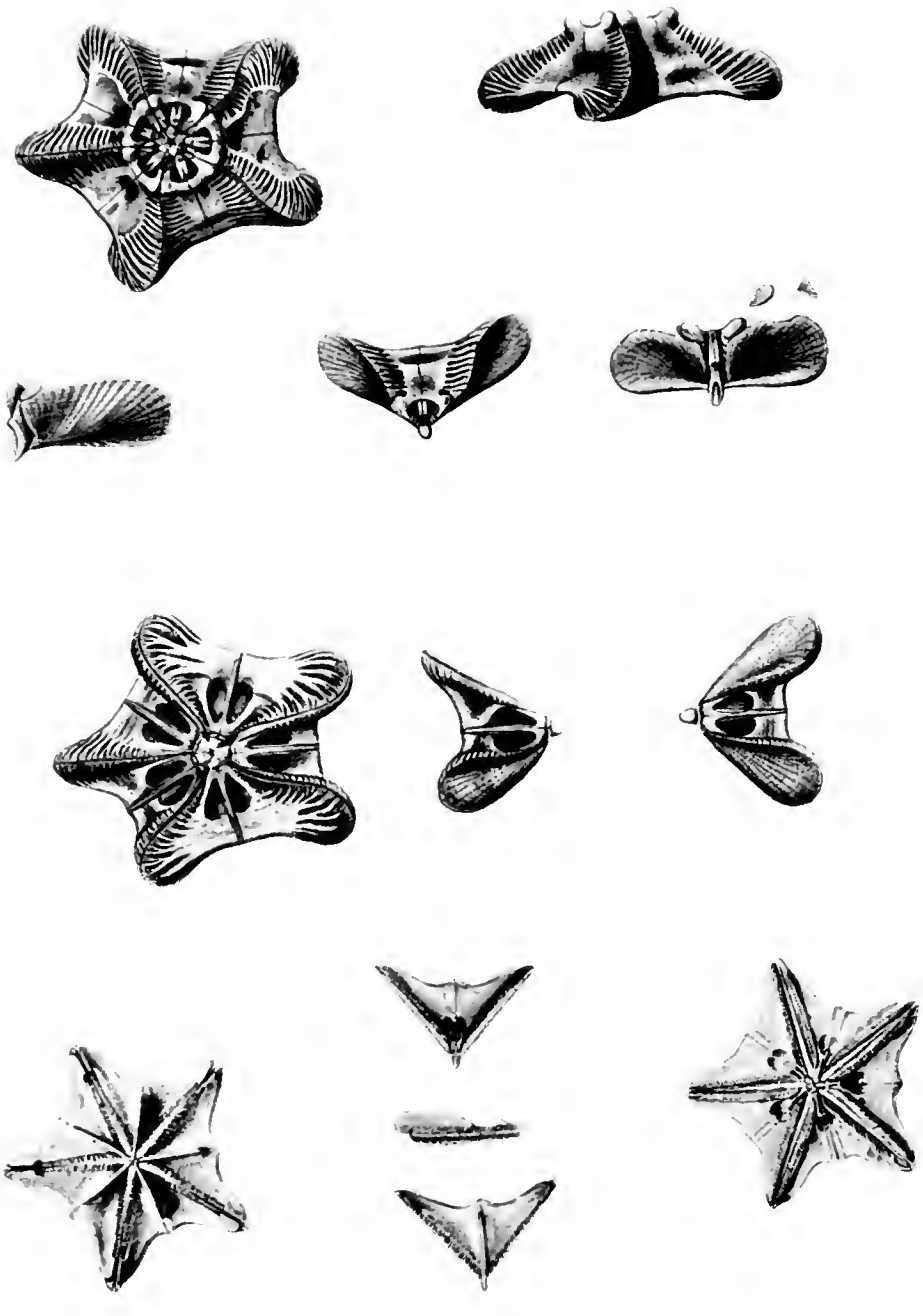

PLATE XI[b].

Clypeaster subdepressus.

1. Seen from above.
2. Seen from actinal side.
3. Actinal floor removed, showing petaloid ambulacra connecting with the main cavity.
4. Abactinal part of test removed to show needle-like pillars of the actinal floor.

(*All figs.* $\frac{3}{4}$ *natural size.*)

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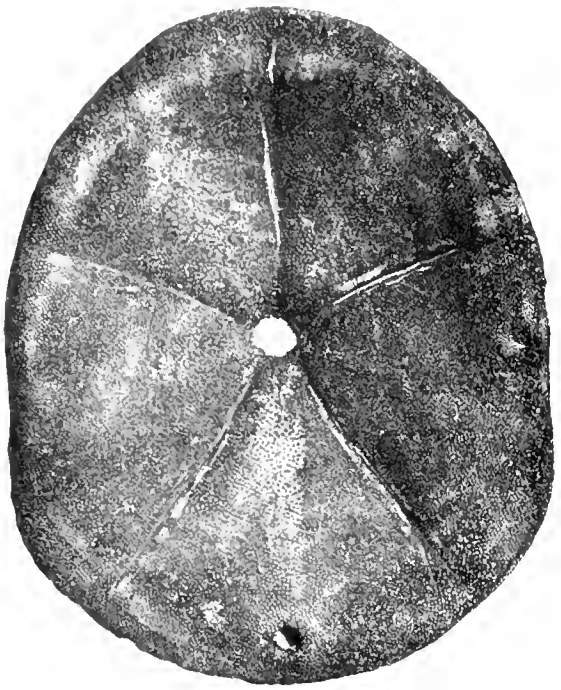

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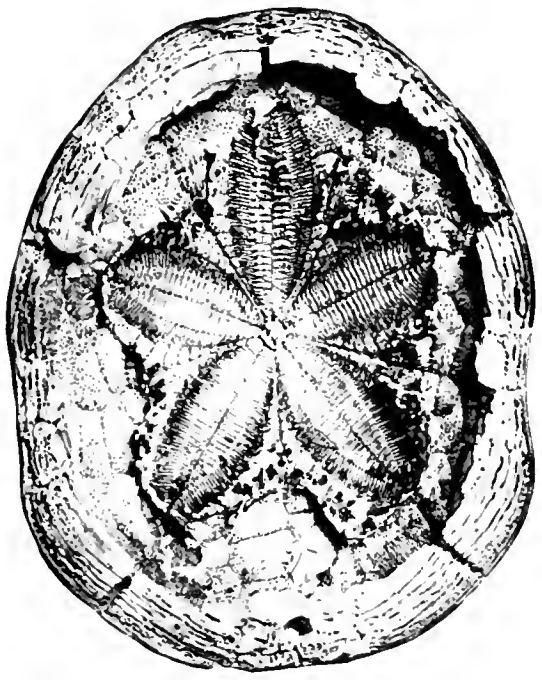

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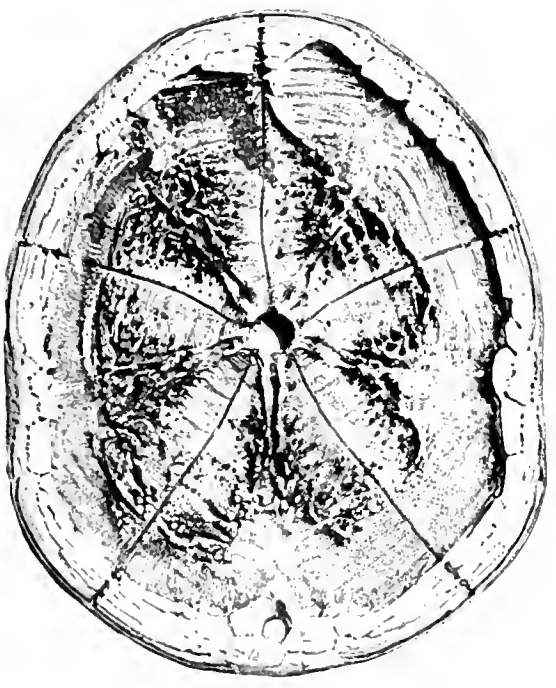


A. Sonrel Photo

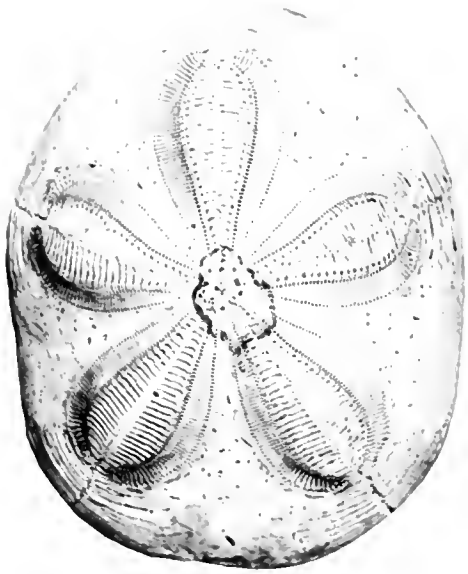
Photo. Plate Print

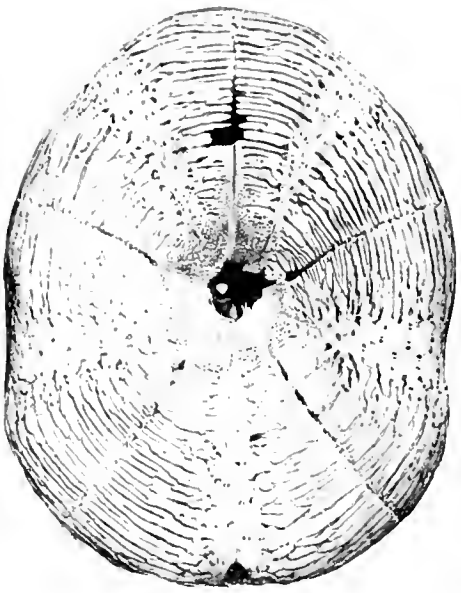
PLATE XI^c.

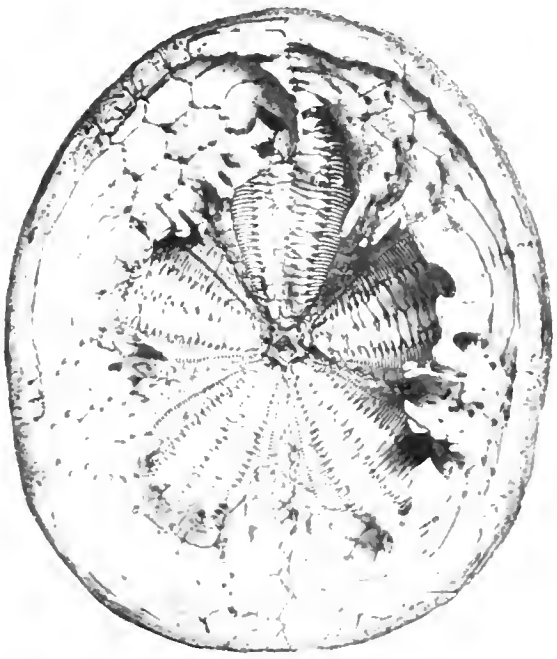
Echinanthus rosaceus.

1. Seen from above, showing ramifications of water system.
2. Same from actinal side.
3. Another specimen, in which the actinal floor has been removed to show pillars and isolation of ambulacra from the main cavity.
4. Another specimen, showing teeth in situ, and the pores forming communication between the double floor and the main cavity.

(*All figs.* $\frac{3}{4}$ *natural size.*)







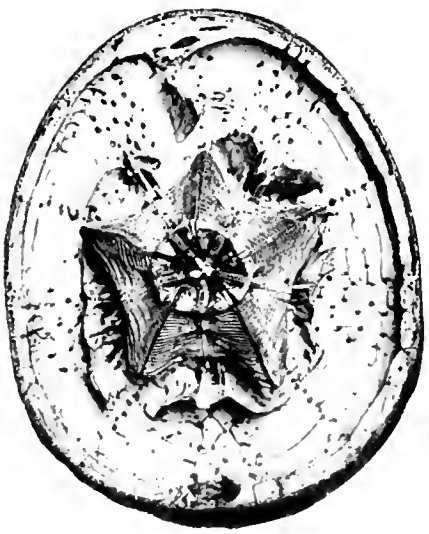


PLATE XI[d].

Echinanthus rosaceus, *f. 1, 2.*

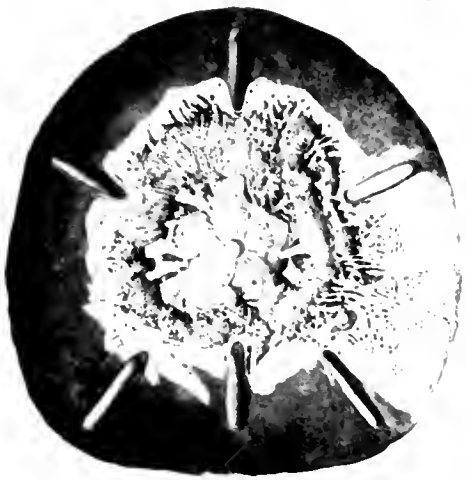
1. Seen from abactinal pole, denuded, $\frac{3}{4}$ nat. size.
2. Longitudinal section, showing pillars connecting the two floors, nat. size.

Mellita sexforis, *f. 3.*

3. Section, showing the course of the alimentary canal, nat. size.

Echinarachnius, parma, *f. 4, 5.*

4. Actinal floor removed, nat. size.
5. Another specimen, with the abactinal part of test removed, nat. size.



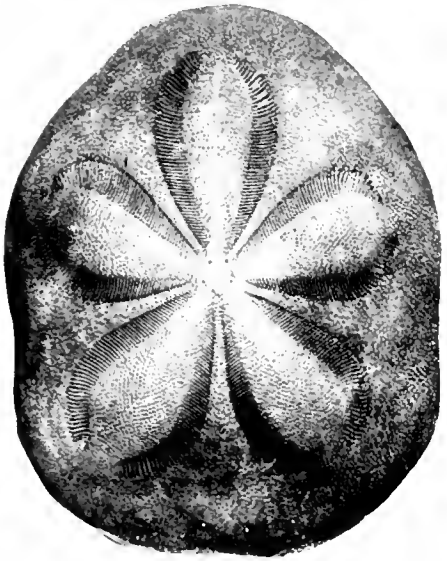


PLATE XI^{c}.

Clypeaster subdepressus, *f. 1, 2.*

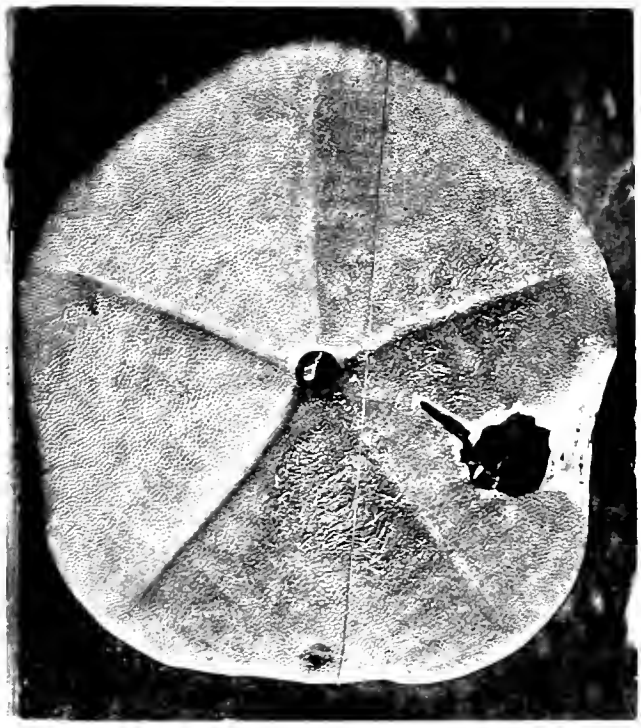
1. Seen from abactinal side, specimen with thick edge, $\frac{3}{4}$ nat. size.
2. Seen from actinal side, specimen with thick edge, $\frac{3}{4}$ nat. size.

Echinocyamus pusillus, *f. 3.*

3. Seen from above, magnified three diam.

Echinarachnius parma, *f. 4, 5.*

4. From actinal side, denuded, nat. size.
5. Same from abactinal side, nat. size.



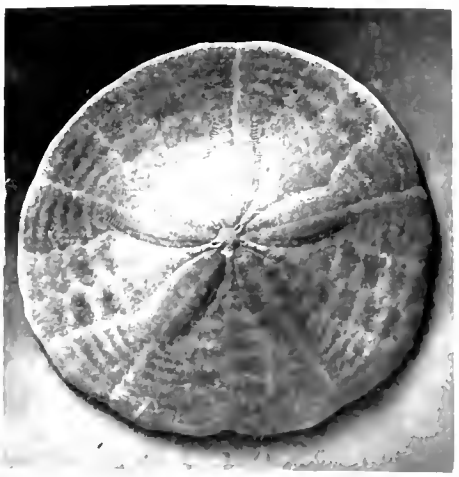


PLATE XIV.

Echinanthus rosaceus, *f. 1–18.*

1. Young specimen, from abactinal side, with spines, nat. size.
2. Part of petaloid ambulacrum of same magnified, showing the tentacles provided with suckers.
3. Portion of edge of test of same, showing the tentacles passing through the test outside of the regular poriferous zone.
4. Part of test of same, denuded, magnified.
5. Magnified portion of petaloid ambulacrum, pores connected by furrows.
6. First kind of tridactyle pedicellaria, with shaft, magnified.
7. Same closely contracted.
8. Terminal part of jaw of pedicellaria.
9. Pedicellaria closed, seen from above, magnified.
10. Second kind of globular pedicellaria carried upon a slender shaft and long contractile stem, magnified.
11. Younger stage of same.
12. Young fan-shaped articulated spine, magnified greatly.
13. Somewhat younger spine.
14. Spine having all features of the spines of large, full-grown specimens, magnified.
15. Section of edge of a specimen, somewhat older, showing commencement of the double-chambered walls, $\frac{3}{2}$ nat. size.
16. Magnified part of interambulacral part of test of same, showing the ambulacral pores discovered by Müller.
17. Portion of petaloid ambulacrum of adult specimen, nat. size.
18. Magnified portion of same, to show the lobed tentacles of the petaloid ambulacra.

Spatangus purpureus, *f. 19–22.*

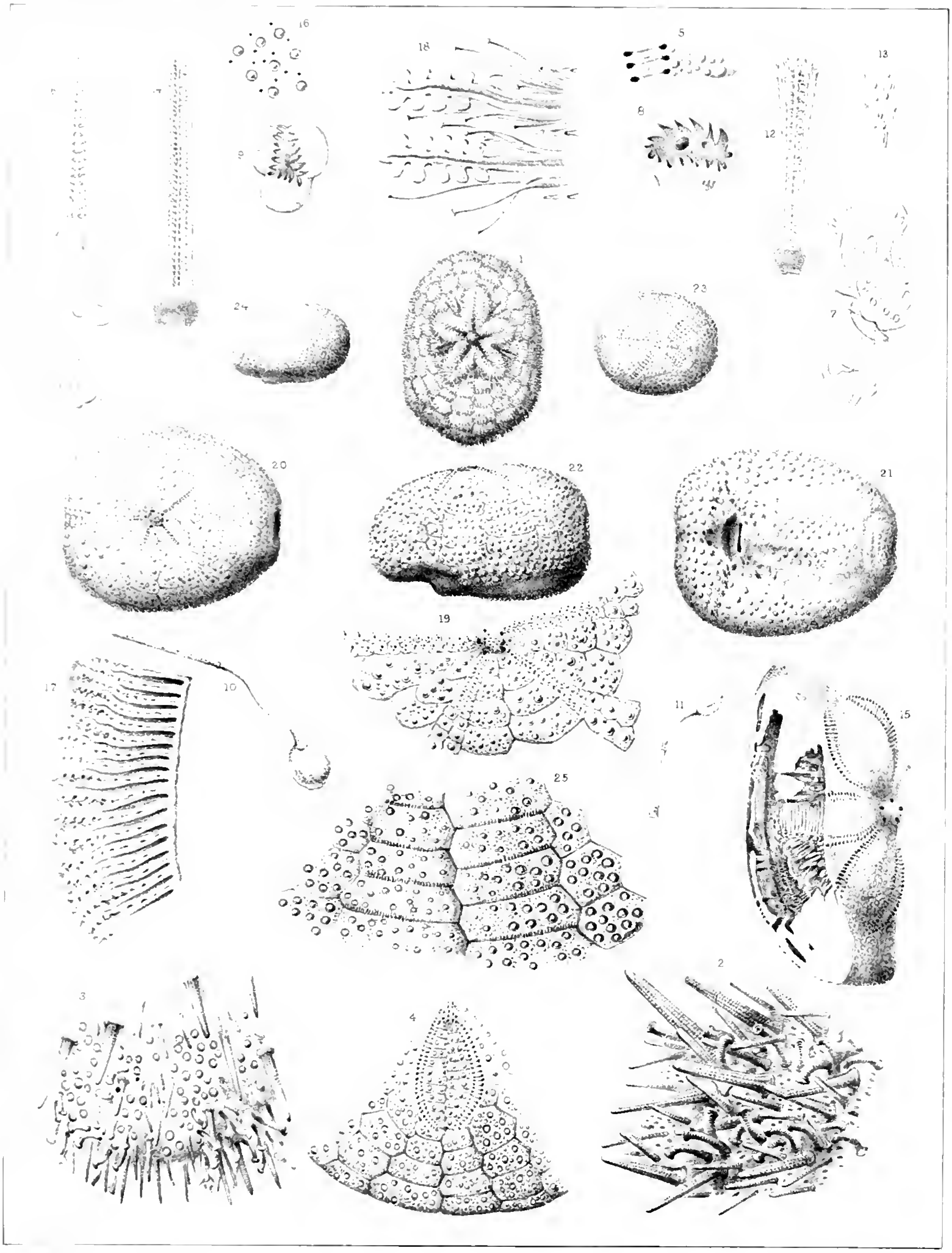
19. Magnified abactinal part of test of fig. 20.
20. Young specimen, from abactinal pole, $\frac{3}{1}$ nat. size.
21. Same from actinal side.
22. Same seen in profile.

Agassizia excentrica, *f. 23, 24.*

23. Same from abactinal pole, nat. size.
24. Seen in profile, nat. size.

Clypeaster subdepressus, *f. 25.*

25. Part of the poriferous zone of the actinal side of specimen measuring $25.4^{\text{mm.}}$ in diam., magnified.



F. Buetter lithog.   Alex Agassiz del.   Print by H W Longfellow

PLATE XII.

Echinarachnius parma, *f. 1 - 13.*

1. Young, from above, magnified $\frac{1}{1}^{0}$, elongated Echinometra-like.
2. The same from actinal side.
3. The same in profile.
4. Somewhat older than preceding, from above, $\frac{5}{1}$.
5. Older than fig. 4, from above, $\frac{7}{1}$.
6. The same as fig. 5, from below, $\frac{7}{1}$.
7. Rotula of specimen of fig. 4, magnified.
8. Rotula of specimen of fig. 6, magnified.
9. Older specimen, first trace of conjugation of pores, from above, $\frac{5}{1}$.
10. Still older than preceding, ambulacra petaloid, from above, $\frac{3}{1}^{3}$.
11. Anal plate of anal system, fig. 9.
12. Anal plates covering anal system, fig. 10.
13. Anal plates of specimen measuring 11.5$^{mm.}$ in diam.
14. Young Echinarachnius 15.1$^{mm.}$ in diam., having all main features of adult.

Encope emarginata, *f. 14 - 25.*

14. Young from above, in Moulinsia stage, $\frac{1}{1}^{3}$.
15. Young from below, in Moulinsia stage, $\frac{1}{1}^{3}$, showing first trace of posterior lunule.
16. Abactinal part of ambulacrum of fig. 14, somewhat more magnified.
17. Young, posterior lunule seen from above, nat. size.
18. Part of fig. 17, from actinal side, somewhat magnified.
19. Part of test of same, from above, still more magnified.
20. Young Encope, from above, slight indentations, nat. size.
21. Part of test of same, from actinal side, magnified.
22. Older than fig. 20, deeper indentations and larger lunule, nat. size.
23. Posterior lunule and anus of fig. 22.
24. Encope older than fig. 22, with deeper indentations.
25. Anus and posterior lunule of fig. 24.

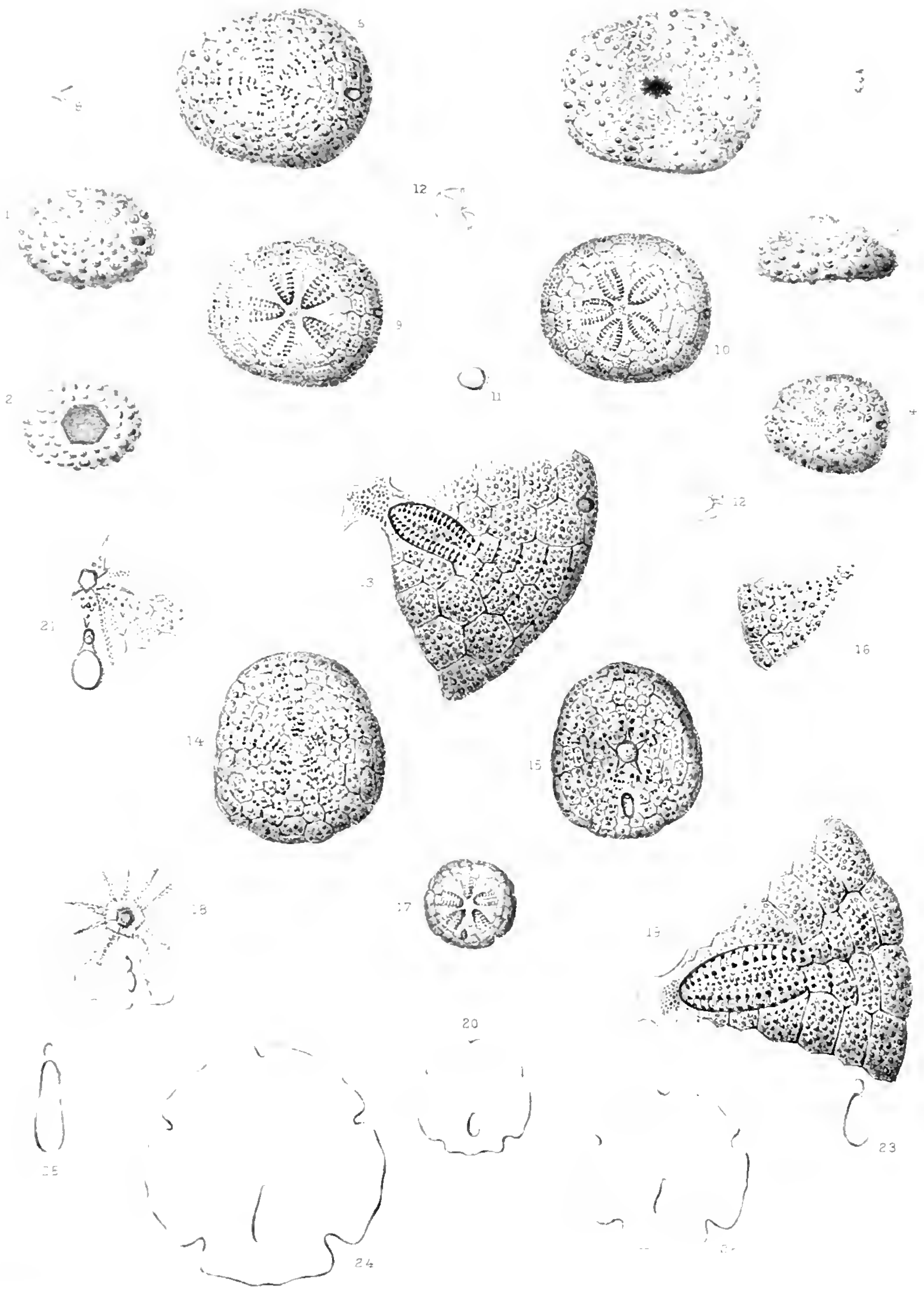


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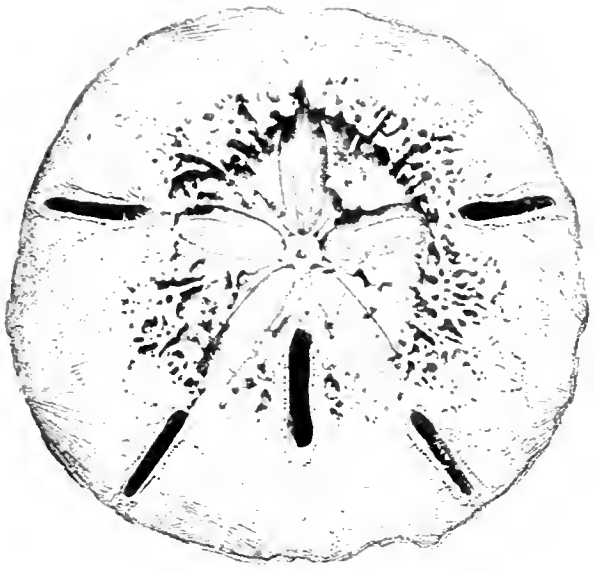
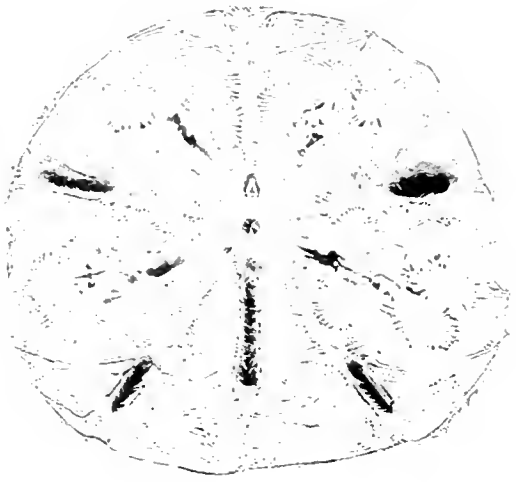
PLATE XII[a].

Mellita testudinata.

1. Actinal floor removed, showing interior cavity.
2. Actinal ramifications of limestone floor.
3. Abactinal ramifications of limestone floor.
4. Abactinal system removed, showing actinal interior cavity.

(*All figs. nat. size.*)





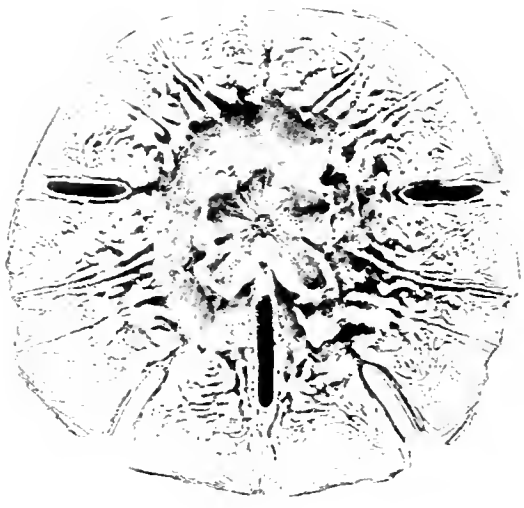


PLATE XII^{b}.

Encope emarginata, *f. 1–3.*

1. Ramifications of interambulacral part of abactinal limestone floor.
2. Part of test covering ambulacra removed, showing isolation of ambulacra from rest of the main cavity.
3. Abactinal part of test removed, showing teeth in situ and course of the alimentary canal.

Encope Michelini, *f. 4.*

4. Section similar to fig. 3, to show differences of the interior cavity between the two species.

(*All figs.* $\frac{3}{4}$ *nat. size*).

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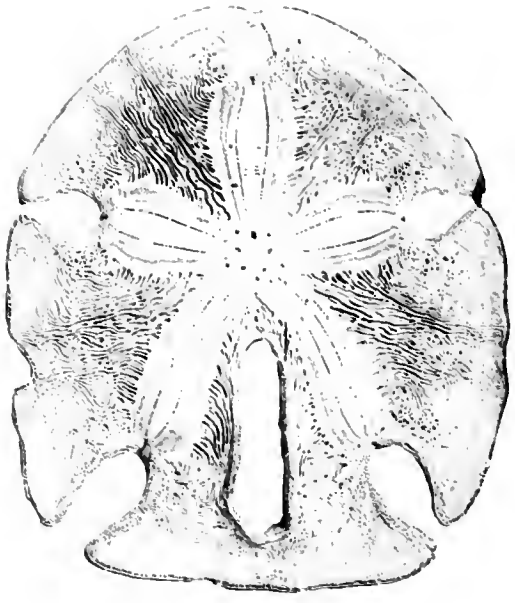

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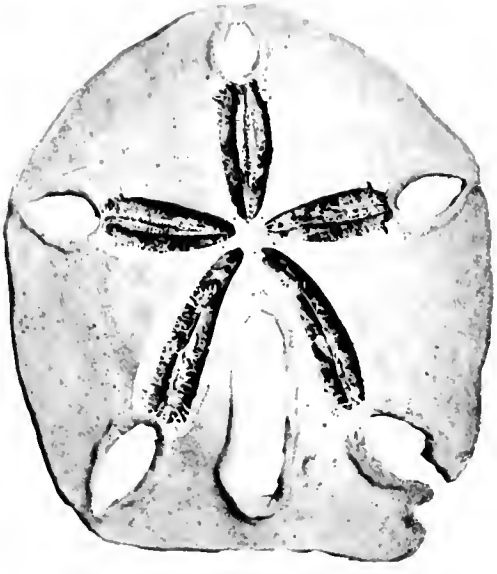

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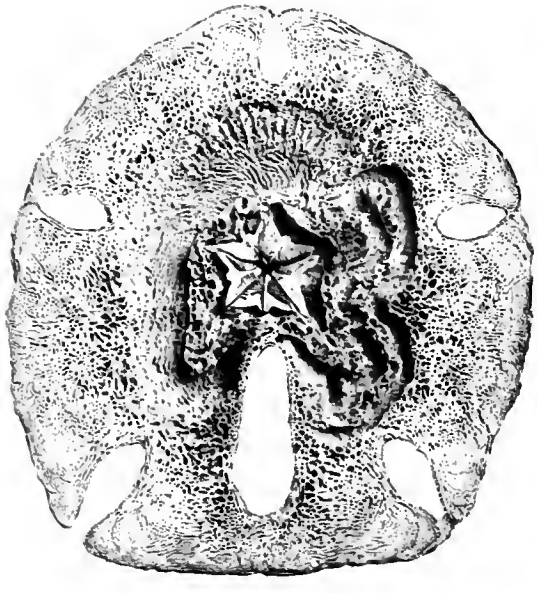

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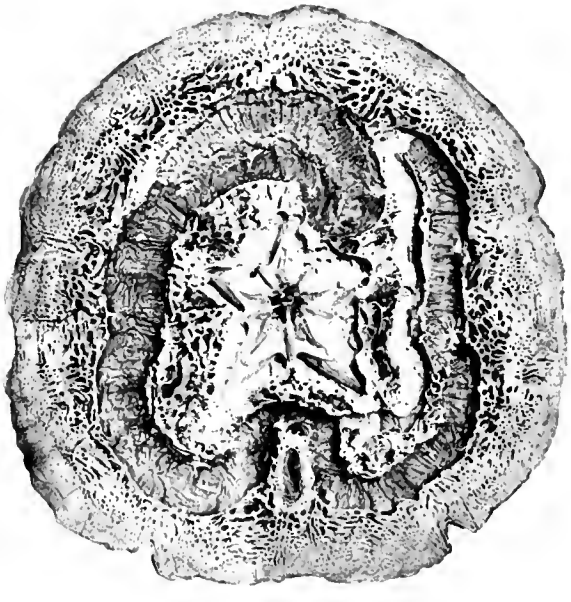


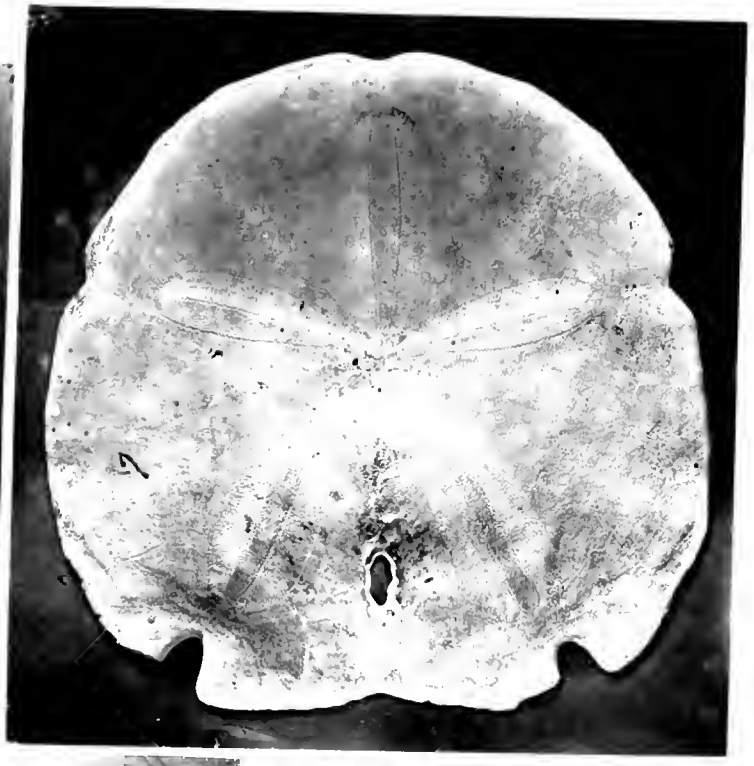
PLATE XII^{c}.

Mellita testudinata, *f. 1, 2.*

1. Seen from abactinal side, nat. size.
2. Seen from actinal side, nat. size.

Encope Michelini, *f. 3, 4.*

3. Seen from above, $\frac{2}{3}$ nat. size.
4. Seen from actinal side, to show the ramifications of the water system, $\frac{2}{3}$ nat. size.



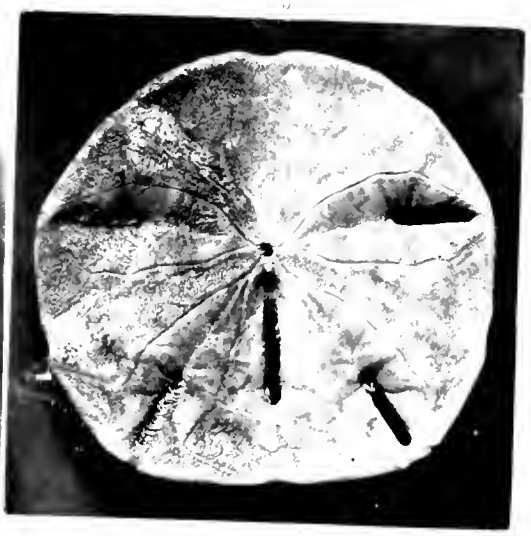


PLATE XII[d].

Encope emarginata, *f. 1–3.*

1. Seen from above, covered with spines, $\frac{2}{3}$ nat. size.
2. Seen from actinal side, denuded, $\frac{2}{3}$ nat. size.
3. Same as fig. 2, from abactinal side, $\frac{2}{3}$ nat. size.

Clypeaster subdepressus, *f. 4.*

4. Young specimen, nat. size, seen from above.

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PLATE XIII.

Echinocyamus pusillus, *f. 1–8.*

1. Specimen seen from above, 4.74$^{mm.}$ in diam.
2. Magnified portion of test showing pores along sutures, same specimen as fig. 1.
3. Magnified portion of test, showing rosette and connection with sutural pores of same.
4. Same specimen from actinal side.
5. Anal plates of same.
6. Older specimen, measuring 7.5$^{mm.}$ in diam., showing greater development of rosette.
7. Section of specimen measuring 6.3$^{mm.}$ in diam.
8. Anal plates of fig. 6.

Echinanthus rosaceus, *f. 9.*

9. Young Echinanthus rosaceus, from above, nat. size.

Clypeaster subdepressus, *f. 10–18.*

10. Young Clyp. prostratus, 15.4$^{mm.}$ in diam. from above.
11. Section showing interior edge of specimen.
12. Magnified portion of test of fig. 10.
13. Ambulacral petal and part of test of same.
14. Median interambulacral edge of test of specimen measuring 21.7$^{mm.}$ in diam.
15. Section of edge of same, showing trace of needle-like pillars.
16. Specimen, seen from abactinal side, nat. size.
17. Different specimen, showing structure of edge of test, nat. size.
18. Same from actinal side, nat. size. The bare part of test, near the ambulacral furrows, is not quite distinctly enough marked in the figure.

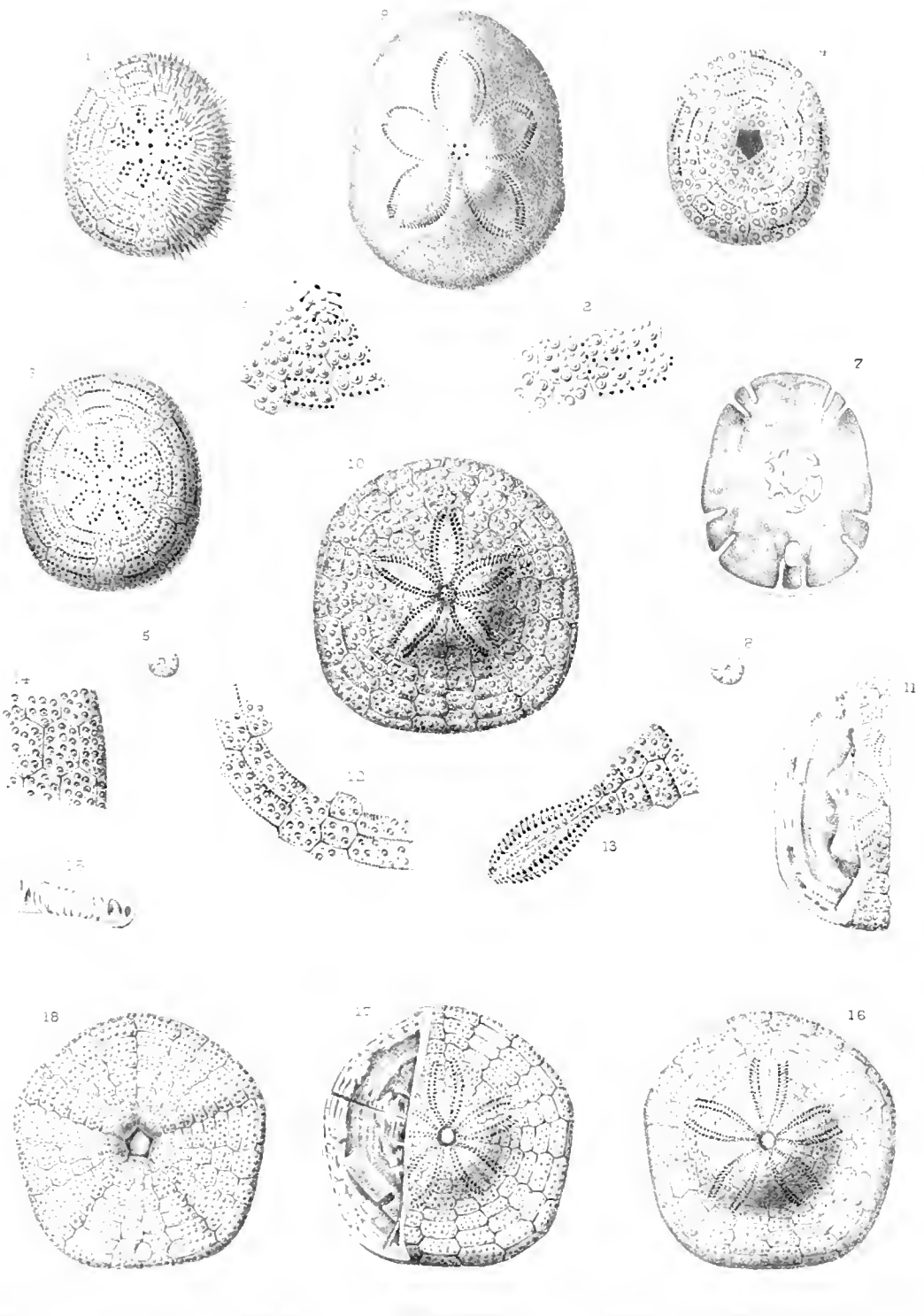
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PLATE XIII[a].

Echinarachnius excentricus, *f. 1 – 4.*

1. Interior view, the abactinal floor removed, $\frac{3}{4}$ nat. size.
2. Interior view, the actinal floor removed, $\frac{3}{4}$ nat. size.
3. Seen from the abactinal pole, $\frac{3}{4}$ nat. size.
4. Seen from the actinal side, $\frac{3}{4}$ nat. size.

Echinarachnius mirabilis, *f. 5, 6.*

5. Part of the abactinal floor removed to show the structure of the lower floor, nat. size.
6. Seen from the actinal side, nat. size.

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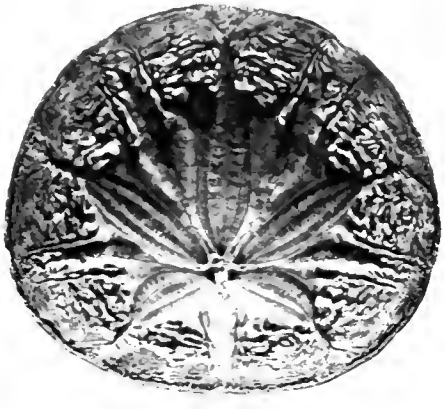

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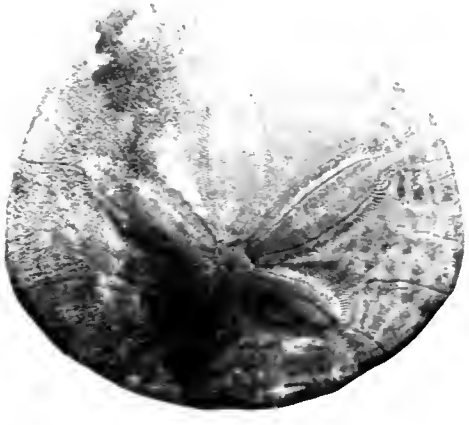

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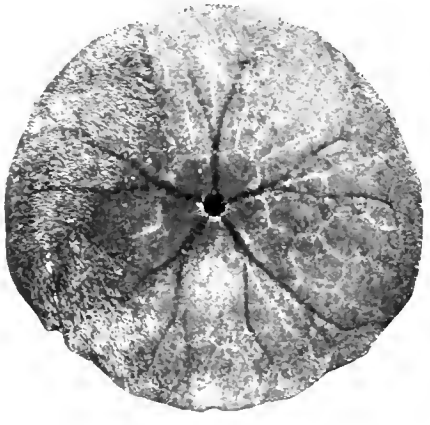

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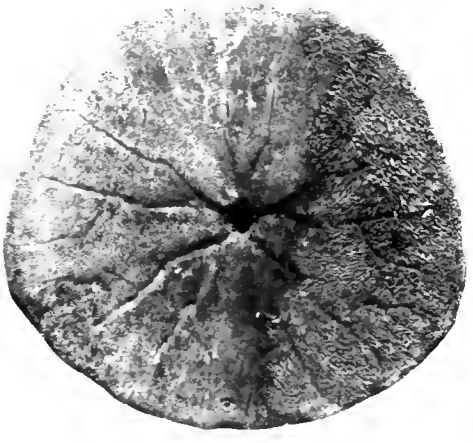

A. Sonrel, *Photog.* Bierstadt, *Albertype.*

PLATE XIII[b].

Arachnoides placenta, *f. 1 – 4.*

1. Young specimen, from the actinal side, nat. size.
2. Same from above, nat. size.
3. Older specimen from the actinal side, $\frac{3}{4}$ nat. size.
4. Same, with part of the abactinal floor removed, $\frac{3}{4}$ nat. size.

Echinodiscus biforis, *f. 5, 6.*

5. Seen from the actinal side, nat. size.
6. Part of abactinal floor removed to show the internal structure, nat. size.

1

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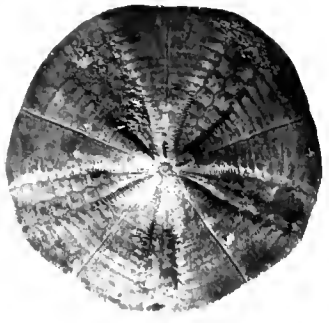

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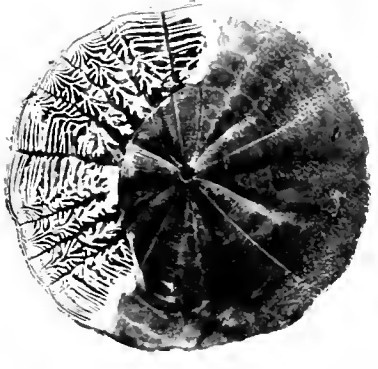

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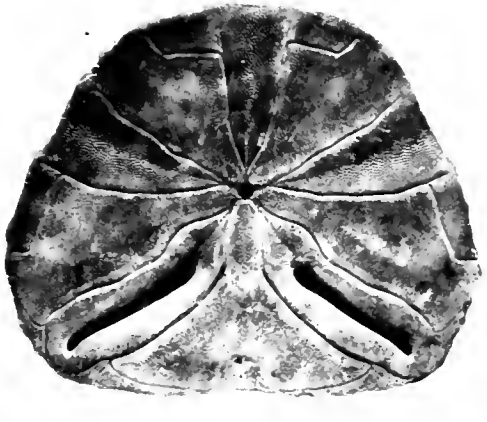

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PLATE XIII^{c}.

Echinodiscus auritus, *f. 1 – 3.*

1. Seen from above, $\frac{3}{4}$ nat. size.
2. Seen from below, $\frac{3}{4}$ nat. size.
3. Part of abactinal floor removed to show the internal structure, $\frac{3}{4}$ nat. size.

Rotula Augusti, *f. 4, 5.*

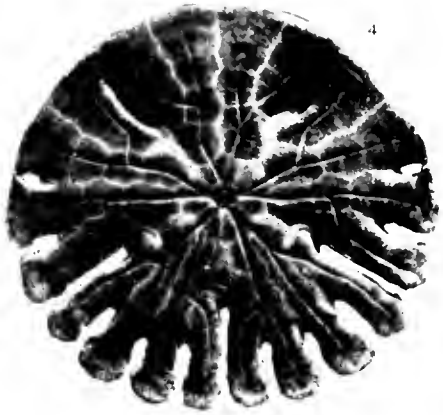
4. Seen from the actinal side.
5. Same seen from the abactinal side.

Rotula Rumphii, *f. 6, 7.*

6. Seen from the abactinal side.
7. Seen from the actinal side.

(*Figs.* 4 – 7 *natural size.*)

3



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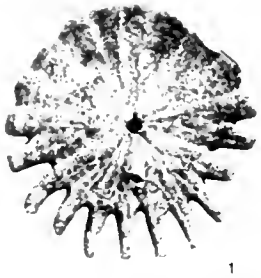

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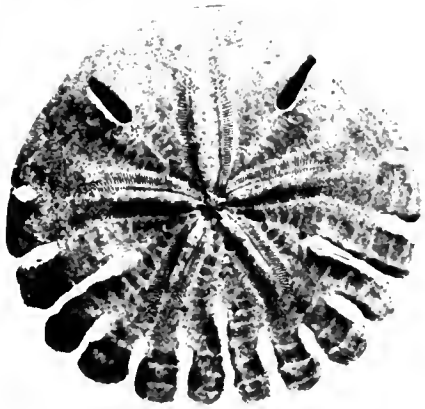

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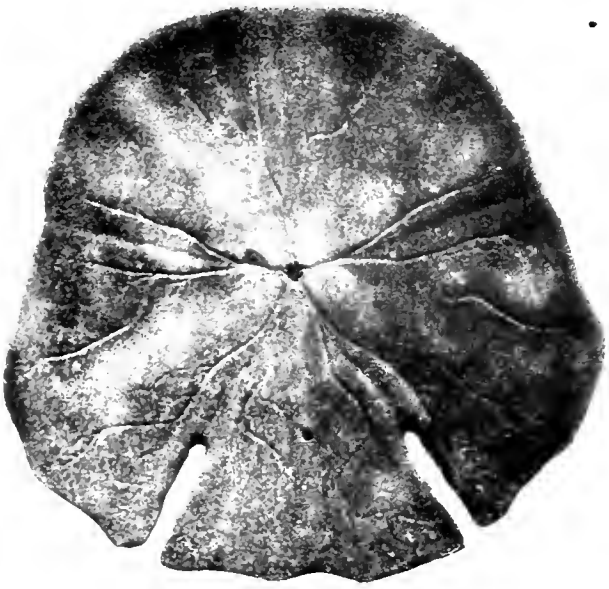


PLATE XIII[d].

Mellita Stokesii, *f. 1.*

1. Part of abactinal floor removed to show the internal structure, nat. size.

Astriclypeus Manni, *f. 2–4.*

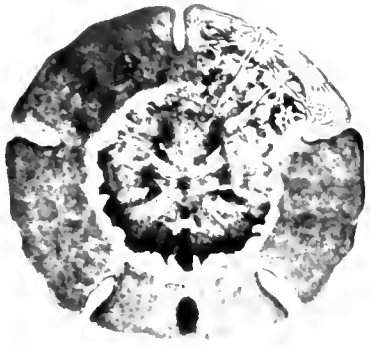
3. Part of abactinal floor removed to show the structure of edge of test.
2. Seen from the actinal side.
4. The same, seen from the opposite side.

Encope grandis, *f. 5, 6.*

5. Seen from the abactinal pole.
6. Seen from the actinal side.

(*Figs.* 2–6 *two thirds natural size.*)

1



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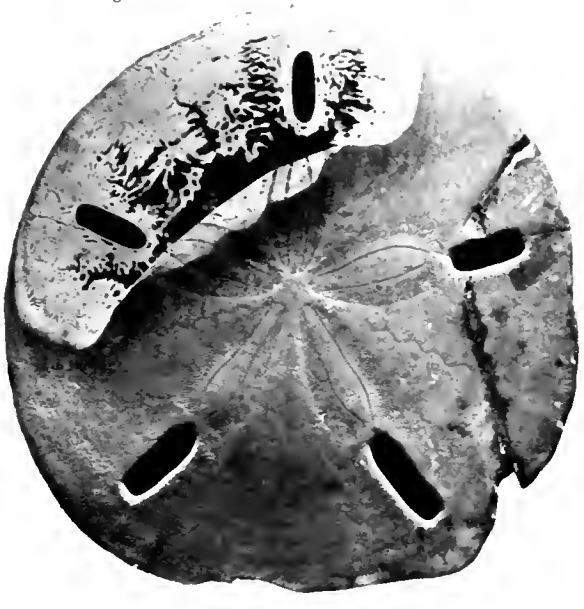

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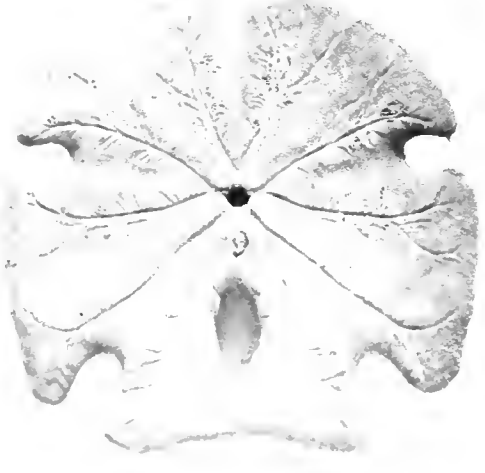

PLATE XIII[c].

Fibularia ovulum, *f. 1 – 3.*

1. Seen from the abactinal pole, $\frac{3}{1}$.
2. Same, from the actinal side.
3. Same, seen in profile.

Peronella Peronii, *f. 4, 5.*

4. Seen from the abactinal side, nat. size.
5. Seen from the actinal side, nat. size.

Laganum Bonani, *f. 6, 7.*

6. Seen from the abactinal pole, nat. size.
7. From the actinal side, nat. size.

Peronella decagonalis, *f. 8 – 11.*

8. Seen from the abactinal side, $\frac{3}{4}$ nat. size.
9. Seen from the actinal side, $\frac{3}{4}$ nat. size.
10. Abactinal floor removed to show the structure of the interior, $\frac{3}{4}$ nat. size.
11. Young specimen, nat. size, showing interior not materially different from larger specimens.


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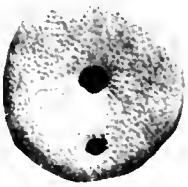

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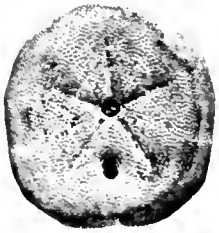

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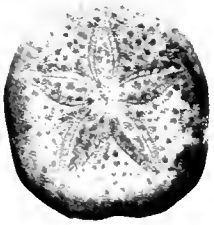

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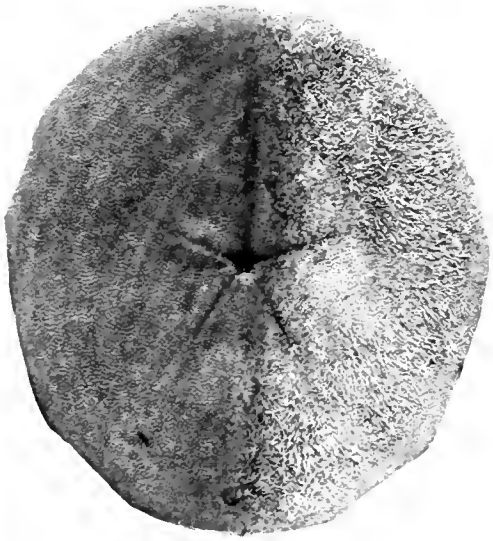

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PLATE XIII.

Clypeaster scutiformis, *f. 1 – 4.*

1. Seen from above, denuded.
2. Same seen from the actinal side.
3. Section showing internal structure of the abactinal side.
4. Section showing internal structure of the actinal side.

Laganum depressum, *f. 5 – 8.*

5. Seen from the abactinal side, denuded.
6. Same from the actinal side, denuded.
7. Seen from the abactinal side, covered with spines.
8. Section to show internal structure, actinal floor removed.

Fibularia australis, *f. 9, 10.*

9. Seen from the abactinal side, $\frac{1}{1}$.
10. Seen from the actinal side, $\frac{1}{1}$.

(*All Figs. not marked natural size.*)

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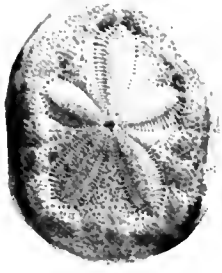

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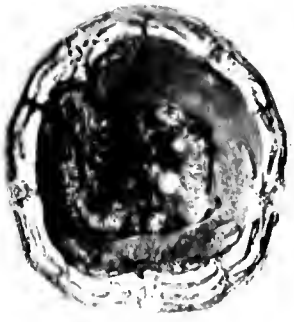

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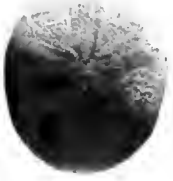

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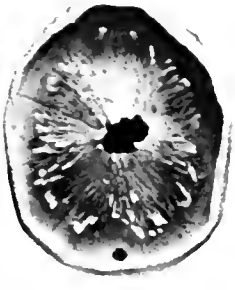

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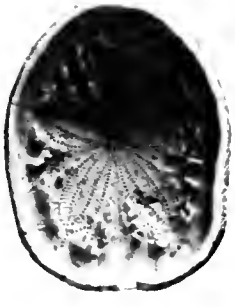

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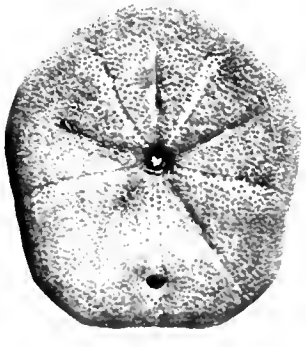

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PLATE XIV.

Echinonéus semilunaris, *f. 1–5.*

1. Seen from above, partly with spines and tentacles.
2. Part of test, with spines, tentacles, and pedicellariæ, magnified.
3. Part of test without spines.
4. Actinostome and anal system.
5. Anal system, showing arrangement of plates when spines are removed.

Echinonëus cyclostomus, *f. 6–8.*

6. Anal and actinal systems, showing plates, in specimen 31.7^{mm}. in longitud. diam.
7. Part of test magnified.
8. Young tubercles in specimen, 12.7^{mm}. in longitud. diam.

Agassizia excentrica, *f. 9–12.*

9. Very young, measuring 6.2^{mm}. in diam., seen from above.
10. Same, seen from actinal side.
11. Ambulaeral rosette of same specimen, more magnified.
12. Same in profile, to show fascioles.

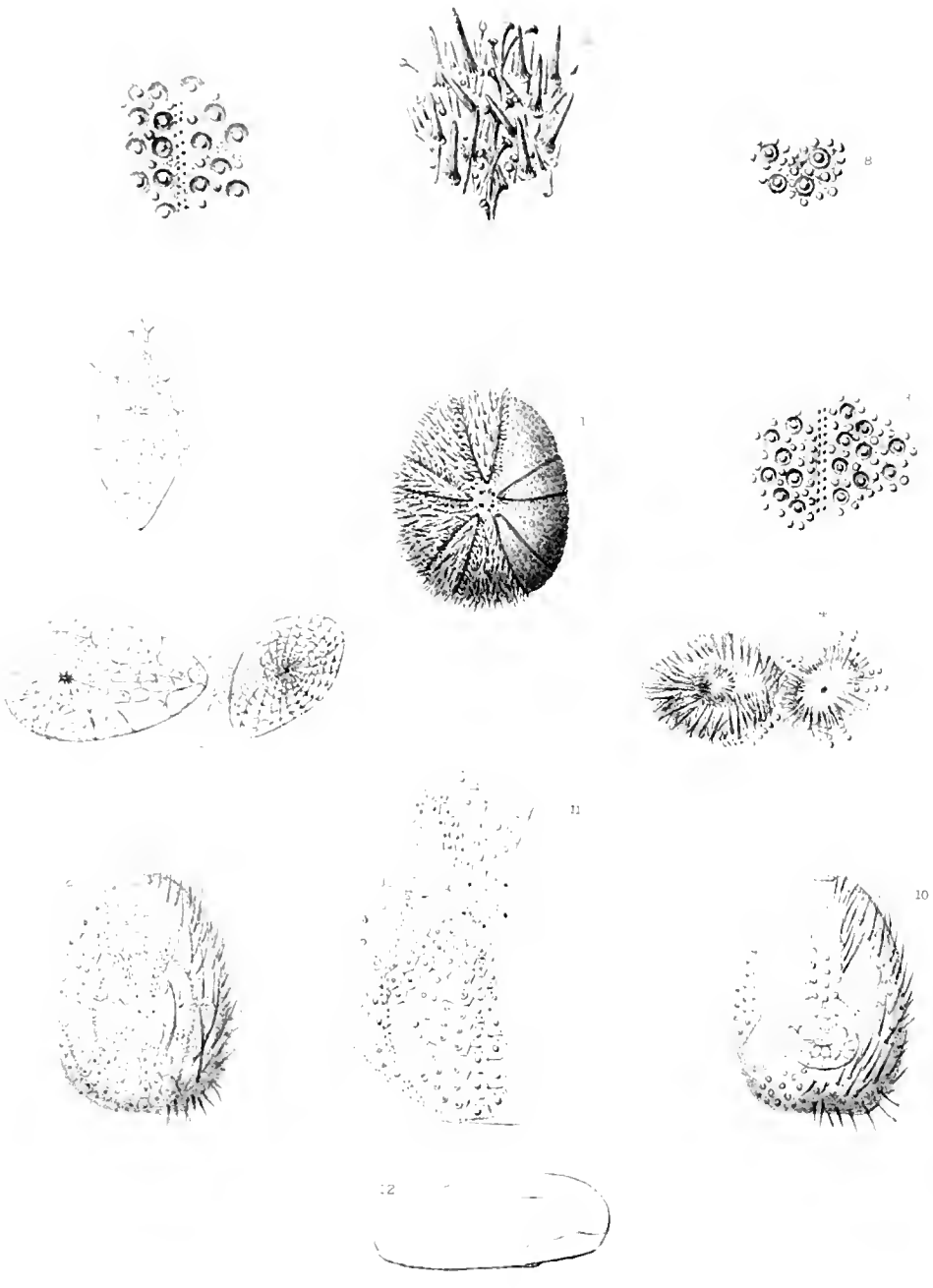
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PLATE XIV[a].

Spatangus purpureus, *f. 1.*

1. Abactinal system, and part of ambulacral system, from interior of test, magnified $1\frac{5}{1}$.

Echinobrissus recens, *f. 2–4.*

2. Seen from abactinal pole, denuded, magnified $\frac{3}{1}$.
3. Same, from interior of test.
4. Actinal part of test, seen from interior.

Echinonëus cyclostomus, *f. 5–10.*

5. Seen from abactinal pole, magnified $2\frac{5}{1}$.
6. Same seen from actinal side.
7. Same, abactinal part of test, seen from interior.
8. Same, actinal part of test, seen from interior.
9. Magnified cluster of tubercles of abactinal part of test.
10. Magnified cluster of tubercles of actinal part of test.

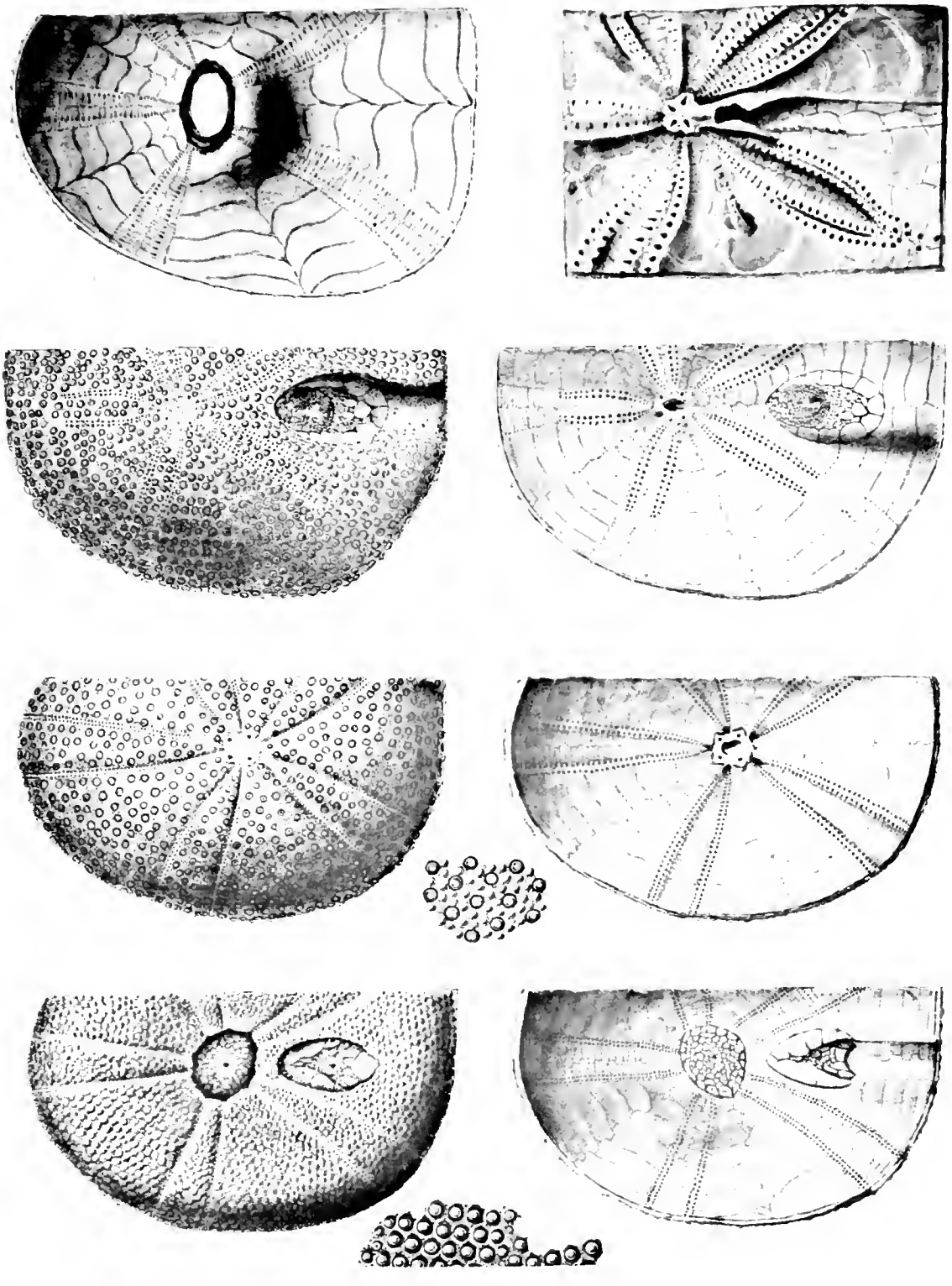


PLATE XV.

Rhynchopygus caribaearum, *1–4*.

1. Section showing actinostome and lower part of test from interior, $\frac{4}{1}^{5}$ in diam.
2. Same, test denuded, from above, $\frac{4}{1}^{5}$ in diam.
3. Same, actinal side, showing bare pitted median band, $\frac{4}{1}^{5}$ in diam.
4. Section showing abactinal part of test from the interior, $\frac{4}{1}^{5}$ in diam.

Echinclampas Hellei, *5–11*.

5. Seen from above, nat. size.
6. Actinostome of same, enlarged, showing bourrelets and phyllodes, slightly inclined.
7. Anal system of same, enlarged.
8. Actinostome of same, somewhat less magnified than fig. 6.
9. Actinostome, seen from interior of test, enlarged.
10. Abactinal system, seen from interior of test, enlarged.
11. Abactinal system, seen from above, enlarged.

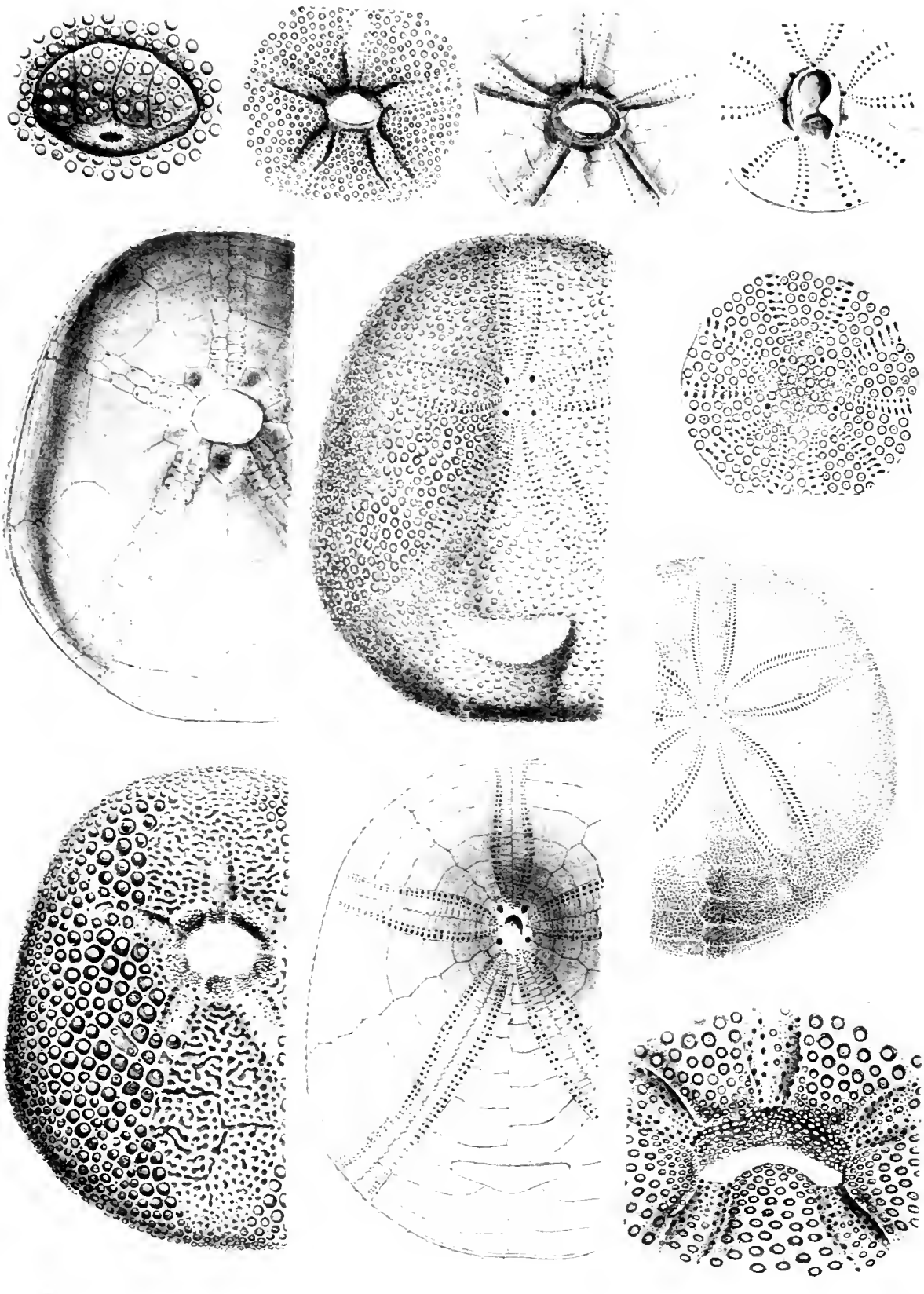


PLATE XV[a].

Rhynchopygus pacificus, *f. 1, 2.*

1. Partly denuded, seen from the abactinal side.
2. Same, seen from the actinal side.

Eupatagus Valenciennesii, *f. 3, 4.*

3. Seen from the abactinal side.
4. Seen from the actinal side.

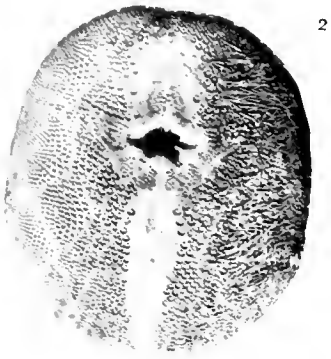
Echinolampas Hellei, *f. 5, 6.*

5. From the abactinal pole.
6. From the actinal side.

Breynia Australasiae, *f. 7 – 9.*

7. Seen from above.
8. Seen in profile.
9. Seen from the actinal side.

(*All Figs. natural size.*)



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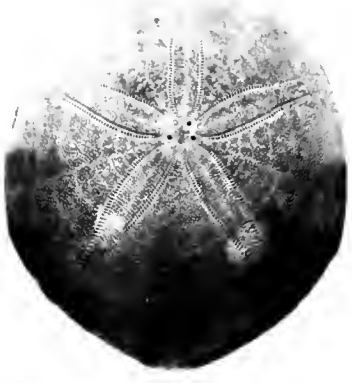

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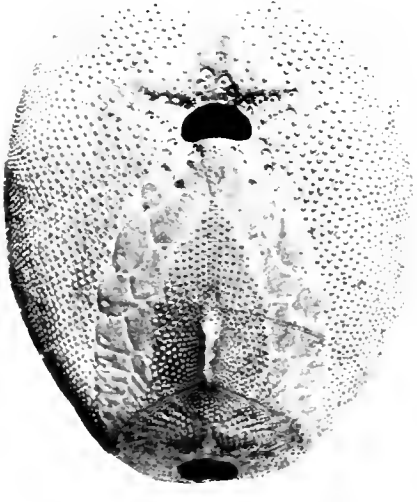

PLATE XVI.

Echinolampas depressa.

1. Young specimen, seen from above, 4.0$^{mm.}$ in diam.
2. Same, from the actinal side.
3. Same, seen in profile.
4. Magnified part of test of same.
5. Anal plates of same.
6. Part of ambulacral rosette of specimen measuring 7.9$^{mm.}$ in diam., showing commencement of petaloid ambulacra.
7. Ambulacral rosette of specimen measuring 12.7$^{mm.}$ in diam., somewhat more petaloid than previous figure.
8. Young specimen, seen from above, measuring 12.7$^{mm.}$ in diam.
9. Same, from actinal side.
10. Same, seen in profile.
11. Magnified part of test of same.
12. Still more magnified part of test of same.
13. Part of test of same, with spines and suckers fully expanded.
14. Anal plates of same.
15. Pedicellaria of same.
16. Spine of same from the interambulacral area.
17. Young Echinolampas depressa, nat. size, from above.
18. Same from actinal side.
19. Profile of same.
20. Magnified actinostome, showing first trace of bourrelets.
21. Magnified part of ambulacral rosette of same.
22. Magnified part of petaloid portion of poriferous zone.

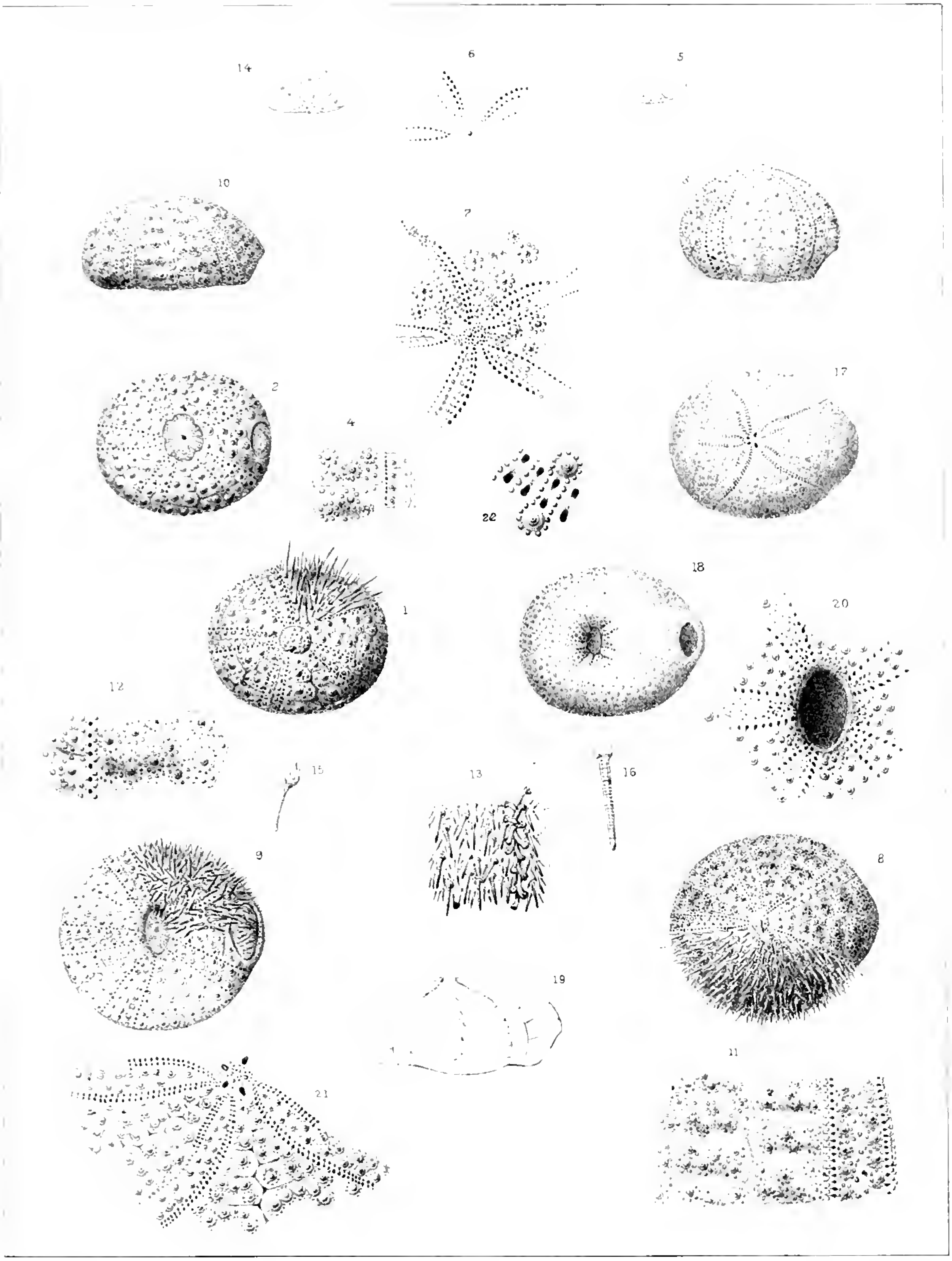

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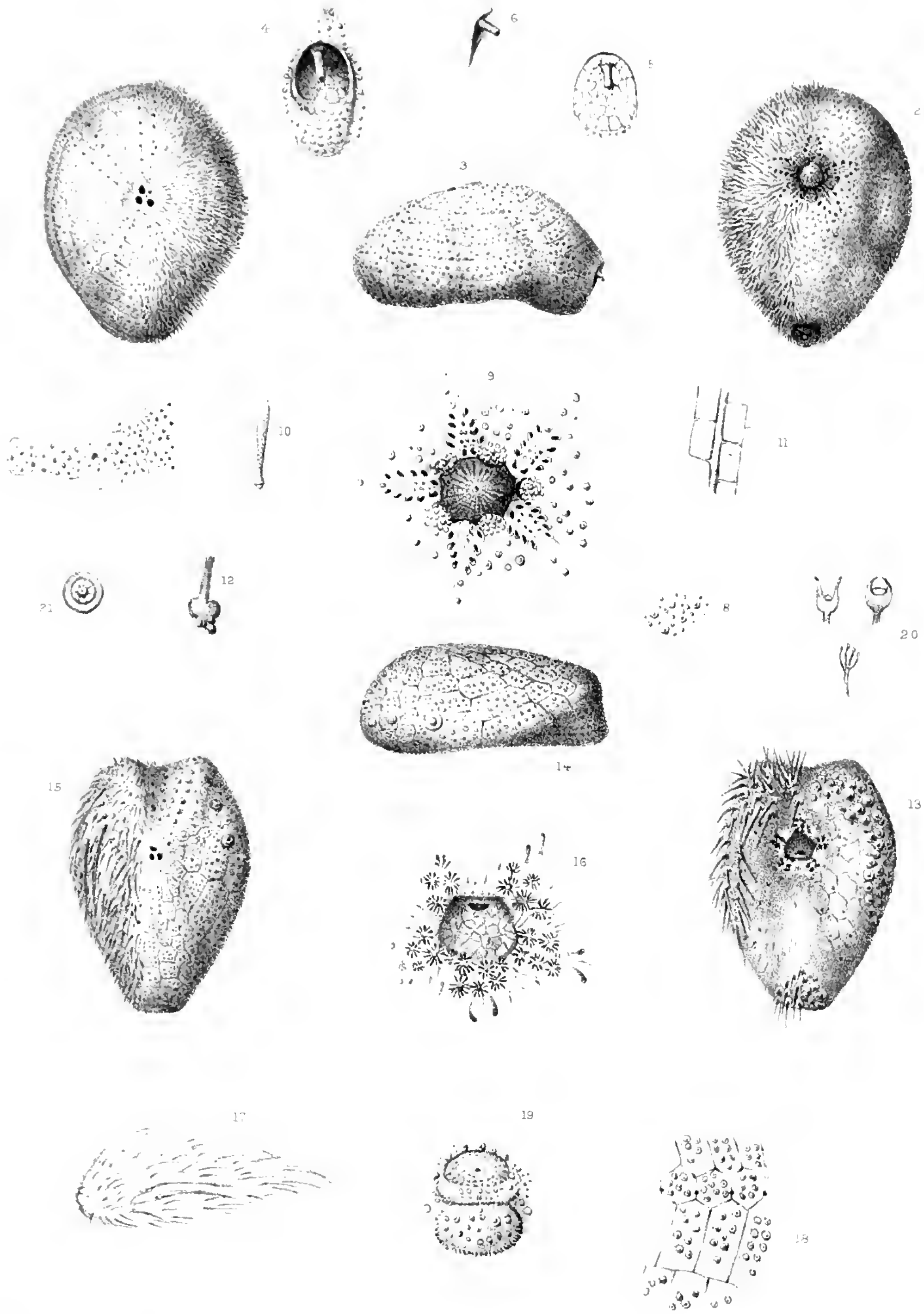
PLATE XVII.

Neolampas rostellata, *f. 1 – 12.*

1. Specimen measuring 14.7$^{mm.}$ in long. diam., seen from abactinal side.
2. Specimen measuring 14.7$^{mm.}$ in long. diam , seen from actinal side.
3. Specimen measuring 14.7$^{mm.}$ in long. diam., seen in profile.
4. Showing the anal system and tube, further magnified.
5. Showing plates composing anal system.
6. Part of Fig. 4 in profile.
7. Part of test to show tubercles.
8. Part of test more enlarged.
9. Enlarged view of actinostome.
10. Spine.
11. Part of ambulacral tube.
12. Ovary, dry.

Homolampas fragilis, *f. 13 – 21.*

13. From below, measuring 9.3$^{mm.}$ in diam.
14. In profile, measuring 9.3$^{mm.}$ in diam.
15. From above, measuring 9.3$^{mm.}$ in diam.
16. Magnified actinostome.
17. Fragment of specimen, measuring 15.5$^{mm.}$ in diam , showing Lovenia-like spines.
18. Part of test magnified.
19. Anal system and subanal fasciole.
20. Young gills adjoining actinostome.
21. Perforated crenulated tubercle, from anterior edge of test, magnified.

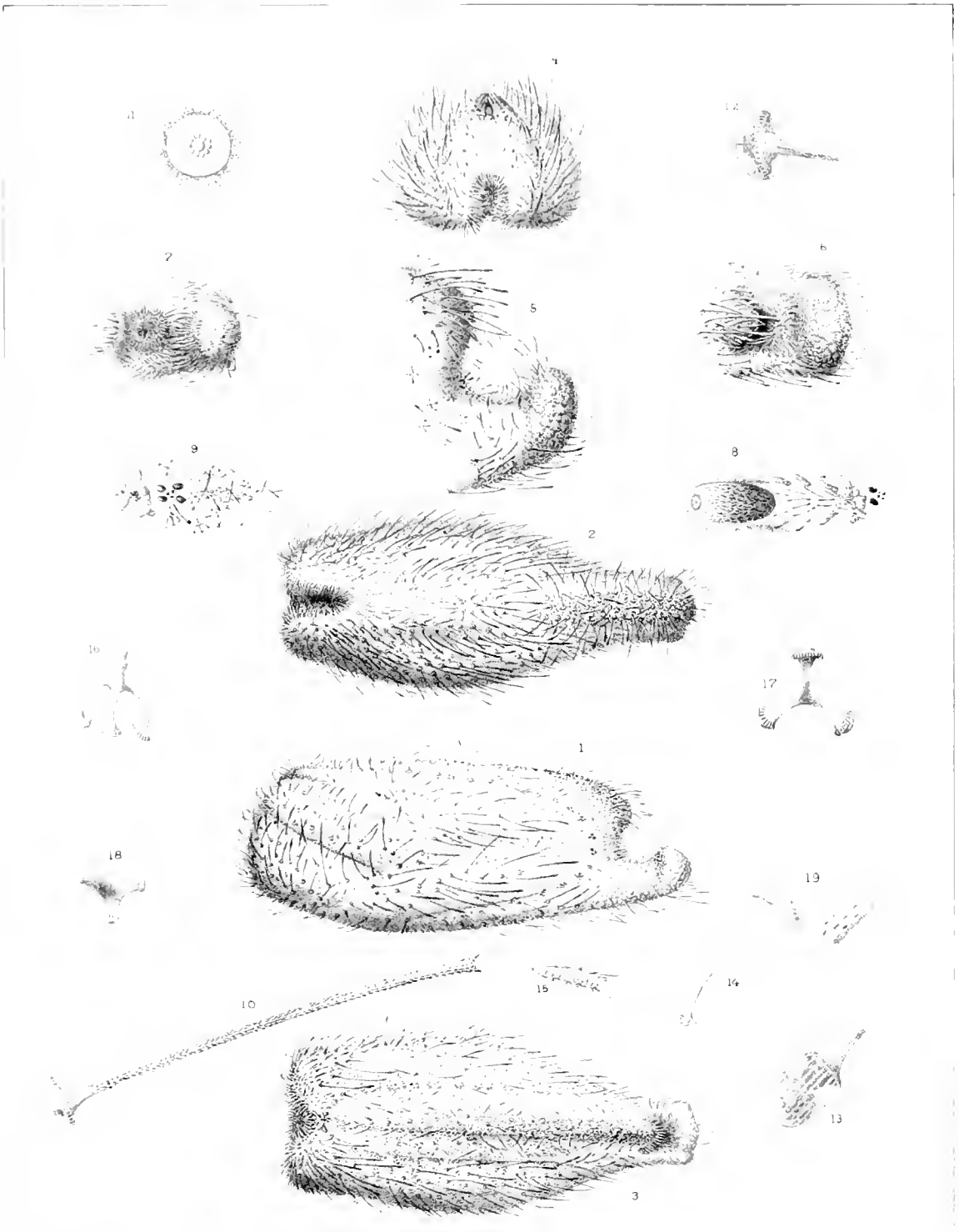


F. [illegible] lithog   Alex Agassiz del.   Print by H.W. Longfellow.

PLATE XVIII.

Pourtalesia miranda.

1. Seen in profile, magnified 3.5 in diam.
2. Same seen from actinal side.
3. Same seen from abactinal side.
4. Same seen endways from the anterior extremity.
5. Posterior extremity, seen in profile, somewhat more magnified than preceding fig.
6. Posterior extremity, seen from the abactinal side.
7. Posterior extremity, seen obliquely from above to show anal opening.
8. Anterior extremity seen obliquely to show actinostome and odd anterior ambulacrum.
9. Magnified view of abactinal system, with expanded tentacles.
10. One of the long slender spines greatly magnified.
11. Imperforate crenulated tubercle, with broad scrobicular circle, carrying large spines.
12. Base of large spine seen in profile with attachment.
13. Base of large spine, with tubercle, showing mode of attachment to scrobicular circle.
14. One of the small flattened short spines of test, greatly magnified.
15. Extremity of one of the smaller fan-shaped spines like fig. 10, magnified.
16. Extremity of one of the large tridactyle pedicellariæ, fully expanded, in profile.
17. Same from above.
18. Same contracted, from above.
19. A couple of the large tentacles of the odd anterior ambulacrum, magnified.



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Print. by H.W. Longfellow

PLATE XIX.

Brissopsis lyrifera, *f. 1 – 9.*

1. Specimen, measuring 5.6$^{mm.}$ in diam., from abactinal side.
2. Specimen, measuring 5.6$^{mm.}$ in diam., in profile.
3. Specimen, measuring 5.6$^{mm.}$ in diam., from actinal side
4. Older specimen, showing branch leading from subanal fasciole to peripetalous fasciole.
5. Posterior extremity, profile of same.
6. Profile of specimen measuring 22.5$^{mm.}$
7. Peripetalous fasciole of young specimen, measuring about 3.6$^{mm.}$ in long. diam.; 4 : 3 pairs of pores in anterior, 2 : 3 in posterior lateral ambulacra.
8. Peripetalous fasciole of specimen intermediate between figs. 7 and 9.
9. Peripetalous fasciole of specimen measuring 27.9$^{mm.}$ in long. diam., showing partial confluence of lateral ambulacra.

Echinocardium cordatum, *f. 10 – 17.*

10. Seen from abactinal side, measuring 7.9$^{mm.}$ in long. diam.
11. Same from actinal side.
12. Outline in profile of same.
13. Actinostome of same magnified.
14. Anal and subanal fascioles of same.
15. Ambulacral rosette of same.
16. Ambulacral rosette of older (fully grown) specimen, showing confluent lateral ambulacra.
17. Disconnected anal and subanal fascioles of specimen of fig. 16.

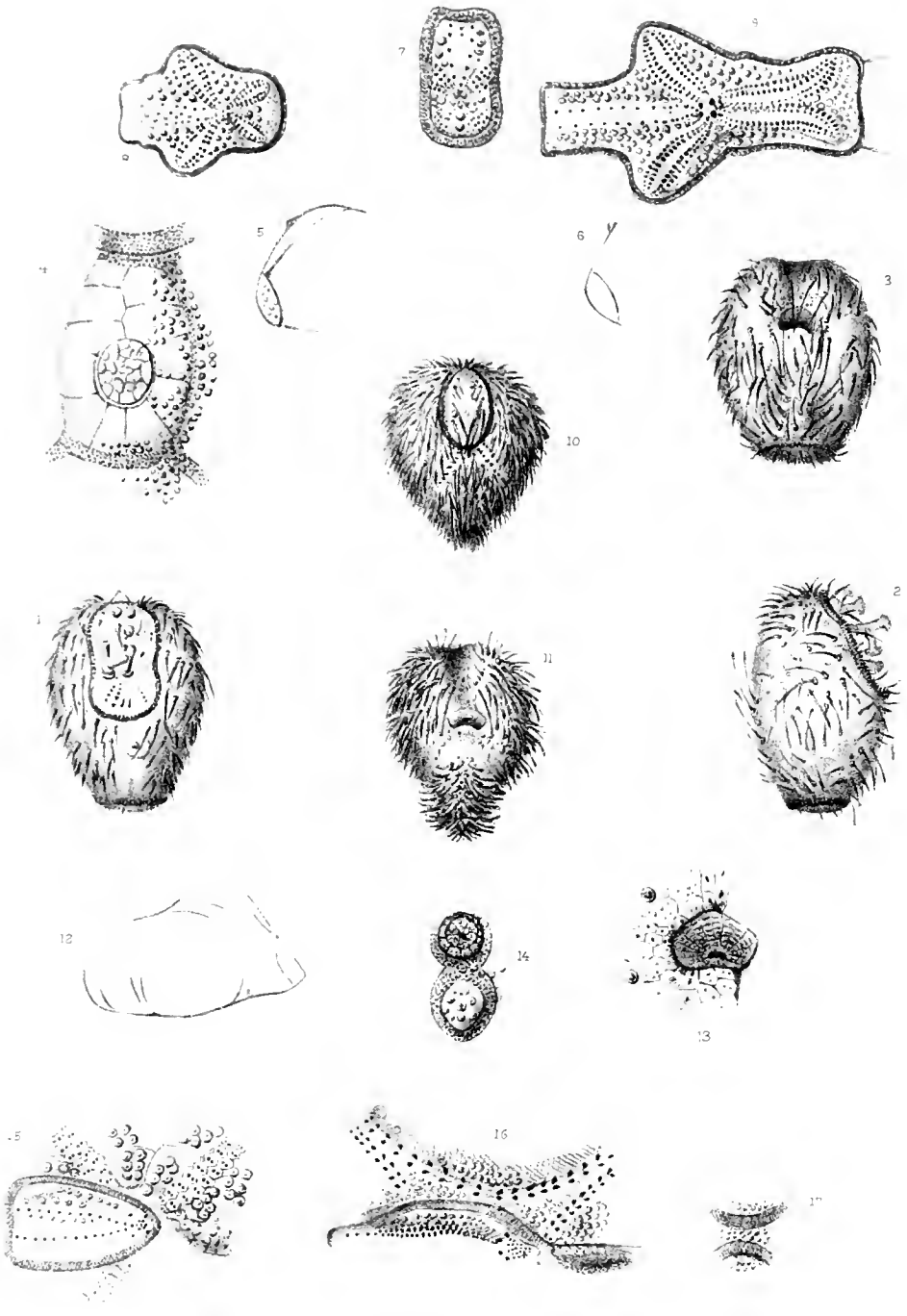
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PLATE XIX[a].

Agassizia scrobiculata, *f. 1–3.*

1. Seen from the abactinal pole, nat. size.
2. Same, seen in profile.
3. Same, seen from the actinal side.

Faorina chinensis, *f. 4–6.*

4. Seen from above, $\frac{3}{4}$ nat. size.
5. Seen in profile, $\frac{3}{4}$ nat. size.
6. Seen from the actinal side, $\frac{3}{4}$ nat. size.

Linthia australis, *f. 7–9.*

7. Seen from the abactinal pole, nat. size.
8. Same, seen in profile, nat. size.
9. Same, seen from the actinal side, nat. size.

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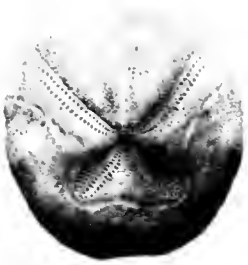

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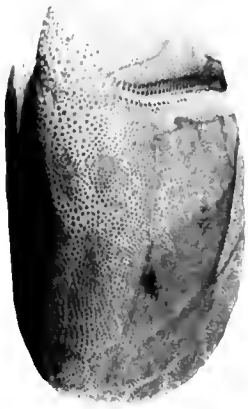

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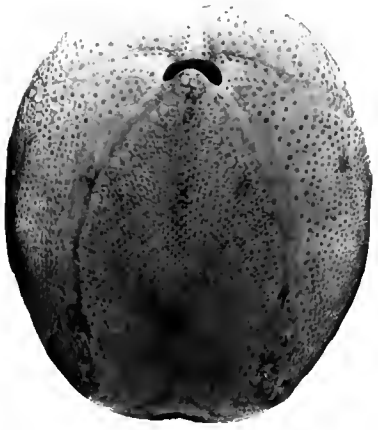


PLATE XIX^b.

Agassizia scrobiculata, *f. 1–3.*

1. Young specimen, seen from the abactinal side, $\frac{2}{1}\frac{5}{5}$.
2. Same, seen in profile, $\frac{2}{1}\frac{5}{5}$.
3. Same, seen from the actinal side, $\frac{2}{1}\frac{5}{5}$.

Nucleolites epigonus, *f. 4–6.*

4. Seen from the abactinal pole, $\frac{1}{1}\frac{5}{5}$.
5. Seen from the actinal side, $\frac{1}{1}\frac{5}{5}$.
6. Seen in profile, $\frac{1}{1}\frac{5}{5}$.

Maretia planulata, *f. 7–12.*

7. Denuded test, seen from the abactinal side.
8. Same, seen from the actinal side.
9. Somewhat smaller, covered with spines, abactinal side.
10. Same, from the actinal side.
11. Young specimen, from the abactinal side.
12. Same specimen, from the actinal side.

(*Figs.* 7 – 12 *natural size.*)

A. Sonrel, Pinx.

American Photo-Engr. & Co., Boston, Mass.

PLATE XIX^{c}.

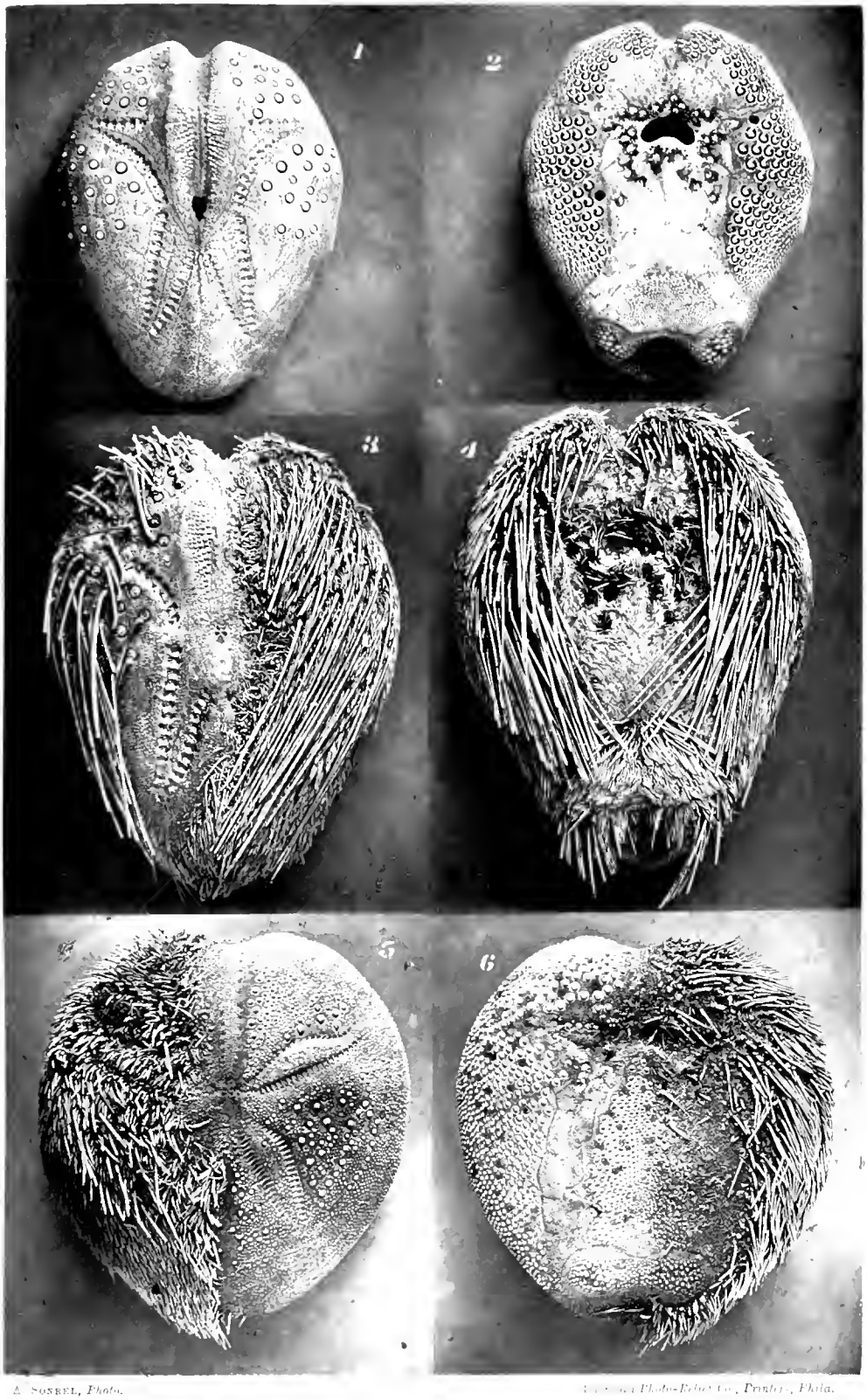
Lovenia elongata, *f. 1–4.*

1. Denuded, seen from above.
2. Same, from the actinal side.
3. Larger specimen, covered with spines, from the abactinal side.
4. The same, seen from the actinal side.

Spatangus purpureus, *f. 5, 6.*

5. Seen from the abactinal pole.
6. Seen from the actinal side.

(*Figs.* 1 – 4 *natural size;* 5, 6, *three fourths natural size.*)



A. SOSBEE, Photo. [illegible] Photo-Relief Co., Printers, Phila.

PLATE XX.

Echinocardium pennatifidum, *f. 1, 2.*

1. From above.
2. In profile.

Echinocardium flavescens, *f. 3–4.*

3. Seen from above.
4. Seen from actinal side.

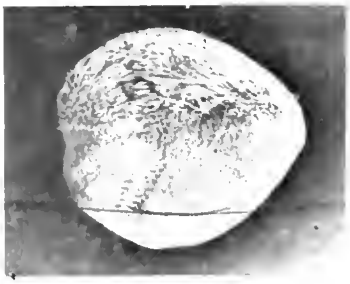
Echinocardium cordatum, *f. 5–7.*

5. Seen from above.
6. Profile of same.
7. Actinal view of same.

Meoma ventricosa, *f. 8.*

8. Seen in profile, $\frac{3}{4}$ nat. size.

(*All figs. natural size, except fig.* 8.)



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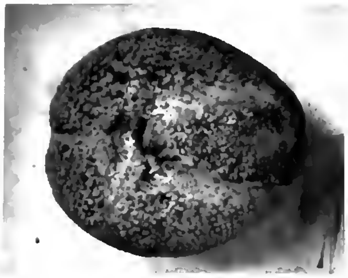

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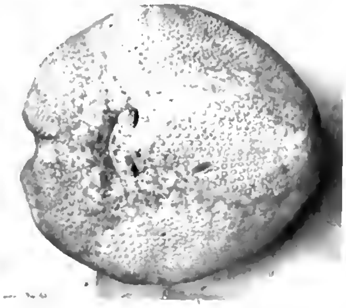

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A. Sonrel, Ph. American Photo-Relief Co., Printers, Phil[illegible]

PLATE XXI.

Brissopsis lyrifera, *f. 1, 2.*

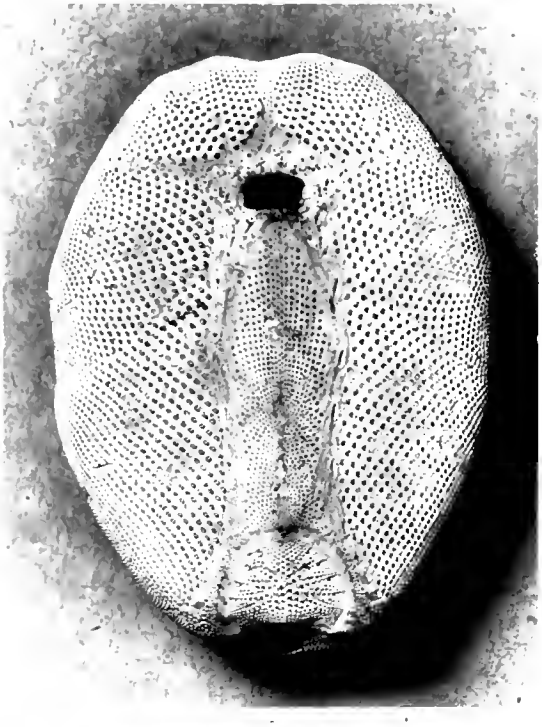
1. Seen from actinal side, nat. size (from Norway).
2. Seen from above, nat. size.

Schizaster fragilis, *f. 3.*

3. Seen from above, nat. size (from Norway).

Metalia pectoralis, *f. 4, 5.*

4. Seen from actinal side, $\frac{2}{3}$ nat. size.
5. Seen from abactinal pole, $\frac{2}{3}$ nat. size.



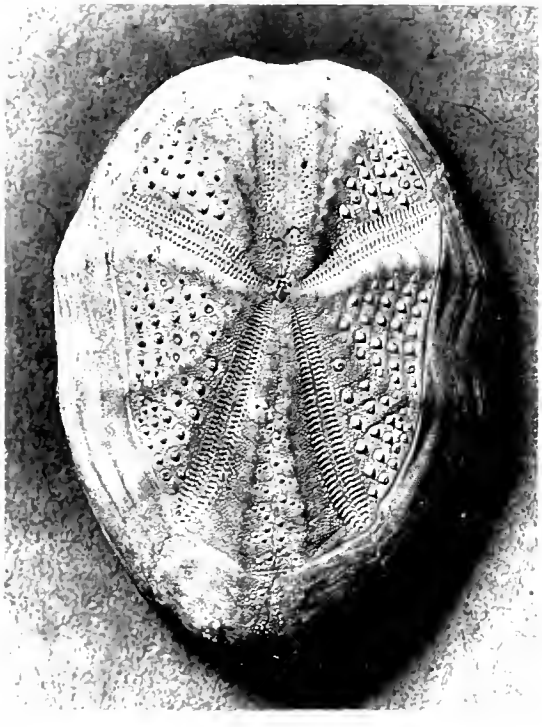


PLATE XXI[a].

Brissus carinatus, *f. 1–3.*

1. Seen from above, denuded.
2. Same, in profile.
3. Same, seen from the actinal side.

Metalia sternalis, *f. 4–5.*

4. Seen from the abactinal pole.
5. Seen from the actinal side.

(*All Figs. two thirds natural size.*)

Pl. XXI^{a}.

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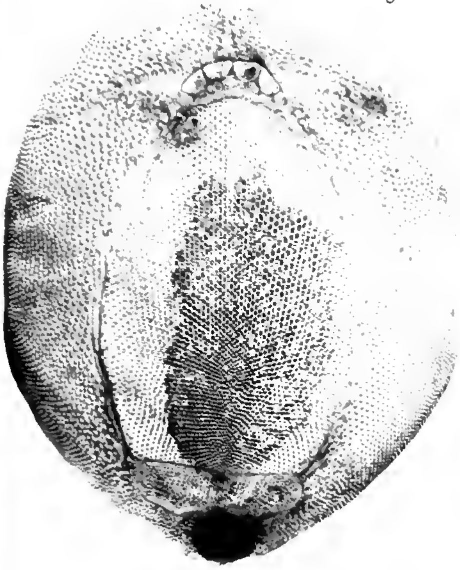

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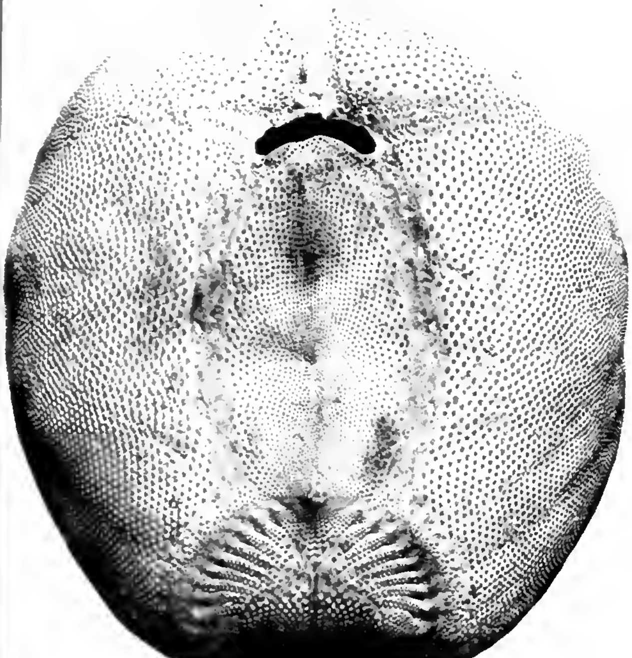

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A. Sonrel Phot.

Bierstadt, Albertype.

PLATE XXI^b.

Echinobrissus recens, *f. 1, 2.*

1. Seen from the actinal side, $\frac{1}{1}\frac{5}{5}$.
2. Same, from the abactinal pole, $\frac{1}{1}\frac{5}{5}$.

Platybrissus Roemeri, *f. 3, 4.*

3. From the abactinal side, nat. size.
4. From the actinal side, nat. size.

Linthia australis, *f. 5 – 7.*

5. Seen from the abactinal side, nat. size.
6. Same, from the actinal side, nat. size.
7. Same, seen in profile, nat. size.

Metalia maculosa, *f. 8, 9.*

8. Seen from the actinal side, $\frac{3}{4}$ nat. size.
9. From the abactinal pole, $\frac{3}{4}$ nat. size.

1

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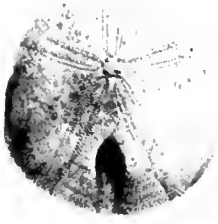

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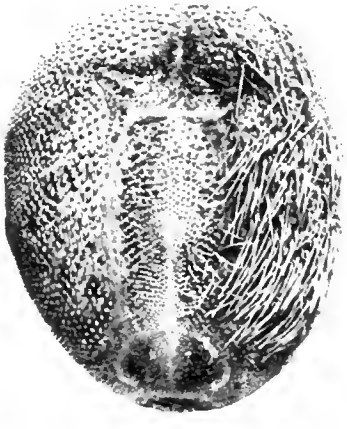

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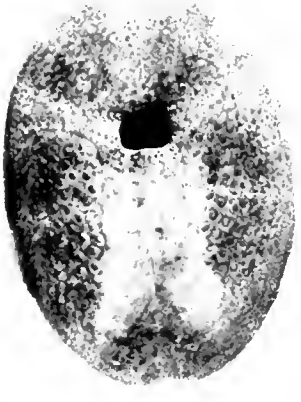

PLATE XXIV.

Hemiaster cavernosus, *f. 1, 2.*

1. Seen from above.
2. Same, seen from the actinal side.

Hemiaster australis, *f. 3.*

3. Seen from the abactinal side.

Tripylus excavatus, *f. 4.*

4. Seen from the abactinal pole.

Metalia sternalis, *f. 5–9.*

5. Seen from above covered with spines; young specimen.
6. Seen from the actinal side denuded.
7. Same, seen in profile.
8. Same, seen from the abactinal pole.
9. Section to show internal structure of the abactinal side.

(*All Figs. natural size.*)

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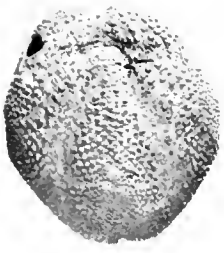

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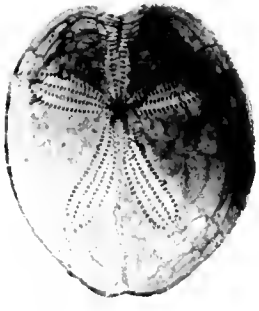

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PLATE XXII.

Brissus unicolor, *f. 1, 2.*

1. Seen from abactinal pole, nat. size.
2. Seen from actinal side, nat. size.

Meoma ventricosa, *f. 3, 4.*

3. Seen from abactinal pole partly denuded, $\frac{3}{4}$ nat. size.
4. Seen from actinal side, $\frac{3}{4}$ nat. size.

2

1

4

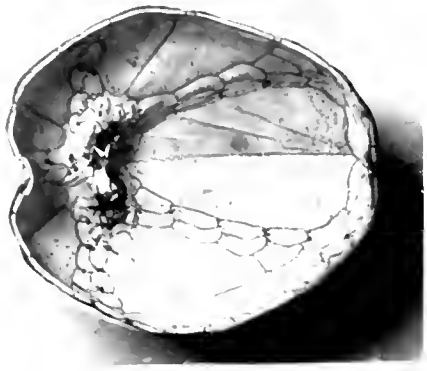
3

PLATE XXIII.

Moira atropos.

1. Horizontal section, showing arrangement of plates round actinostome.
2. Longitudinal section.
3. Horizontal section, showing the petaloid ambulacra as seen from the interior of test.
4. Seen from actinal pole.
5. Seen from abactinal pole.
6. Profile.

(*All figs. nat. size.*)



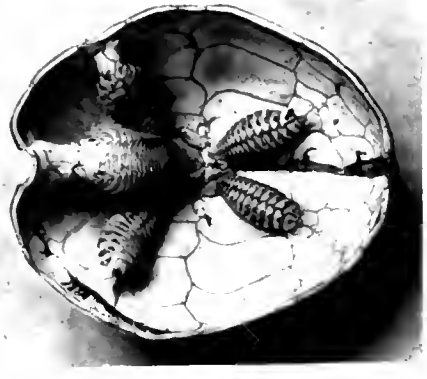


PLATE XXIII[a].

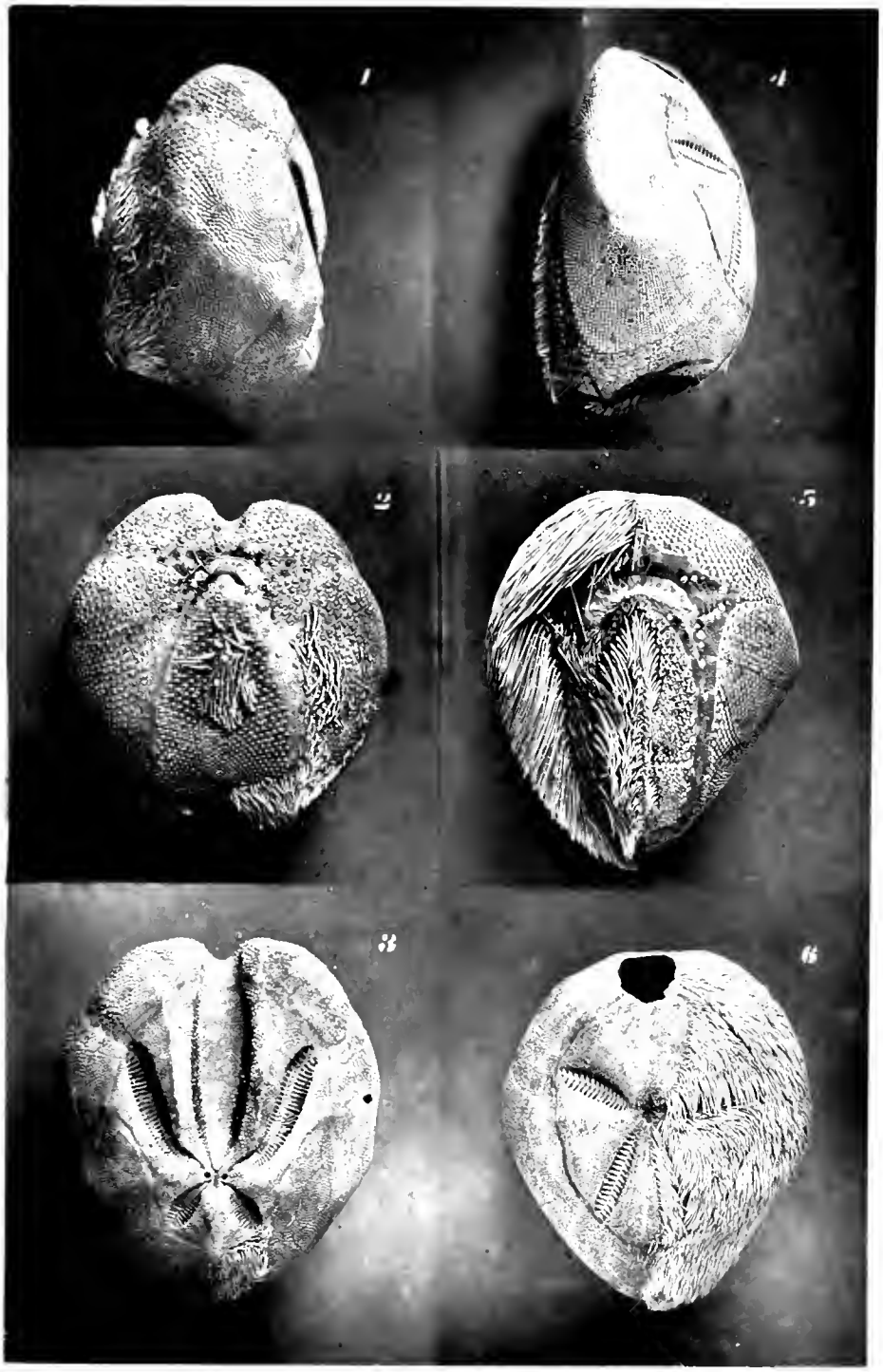
Schizaster canaliferus, *f. 1 – 3.*

1. Seen in profile.
2. Same, seen from the actinal side.
3. Same, seen from the abactinal pole.

Rhynobrissus pyramidalis, *f. 4 – 6.*

4. Seen in profile.
5. Same, seen from the actinal side.
6. Same, seen from the abactinal pole.

(*All Figs. natural size.*)



A. SONREL, Phot.

American Photo-Relief Co., Printers, Phila.

Stomopneustes variolaris, *f. 31, 32.*

31. Interior of large-headed, long-stemmed interambulacral pedicellaria.
32. Interior of prong of a stout, short-stemmed actinal pedicellaria.

Echinothrix calamaris, *f. 33 – 36.*

33, 34, 36. Interior views of single prongs of large-headed, long-stemmed interambulacral pedicellariæ of different sizes, $\frac{1}{1}\frac{6}{6}$.

35. Limestone rod of interior of stem.

Centrostephanus Rodgersii, *f. 37, 37′.*

37. Tip of prong of large-headed, long-stemmed pedicellaria, $\frac{5}{1}\frac{0}{0}$.
37′. Interior of stout-headed, short-stemmed actinal pedicellaria, $\frac{3}{1}\frac{2}{2}$.

Diadema setosum, *f. 38 – 39.*

38, 38′. Interior of prong of large-headed, long-stemmed pedicellaria.
39. Small, short-stemmed actinal pedicellaria.

Astropyga radiata, *f. 40.*

40. Profile of prong of long-stemmed, large-headed actinal pedicellaria.

(*Unless otherwise mentioned, all figures are magnified about twenty diameters.*)

PLATE XXIV.

Dorocidaris papillata, *f. 1 – 8.*

1, 2, 3, 4. Different stages of the long-stemmed, slender ambulacral pedicellariæ.
3a. Internal view of Fig. 3, the front prong removed.
5. One of the short-stemmed, stout pedicellariæ of the abactinal system.
6. Internal view of one of the prongs of Fig. 5.
7. One of the short, long-stemmed ambulacral pedicellariæ.
8. Side view of one of the prongs of Fig. 7.

Phyllacanthus baculosa, *f. 9.*

9. Interior view of one of the forks of a short, long-stemmed ambulacral pedicellaria.

Phyllacanthus dubia, *f. 10.*

10. Interior view of one of the forks of a short, long-stemmed ambulacral pedicellaria.

Porocidaris purpurata, *f. 11.*

11. Head of one of the short, long-stemmed ambulacral pedicellariæ.

Goniocidaris geranioides, *f. 12, 13.*

12. Internal view of one of the short-stemmed interambulacral pedicellariæ.
13. Outside view of same.

Asthenosoma varium, *f. 14.*

14. Terminal portion of one of the forks of a long-stemmed interambulacral pedicellaria.

Strongylocentrotus Dröbachiensis, *f. 15 – 24.*

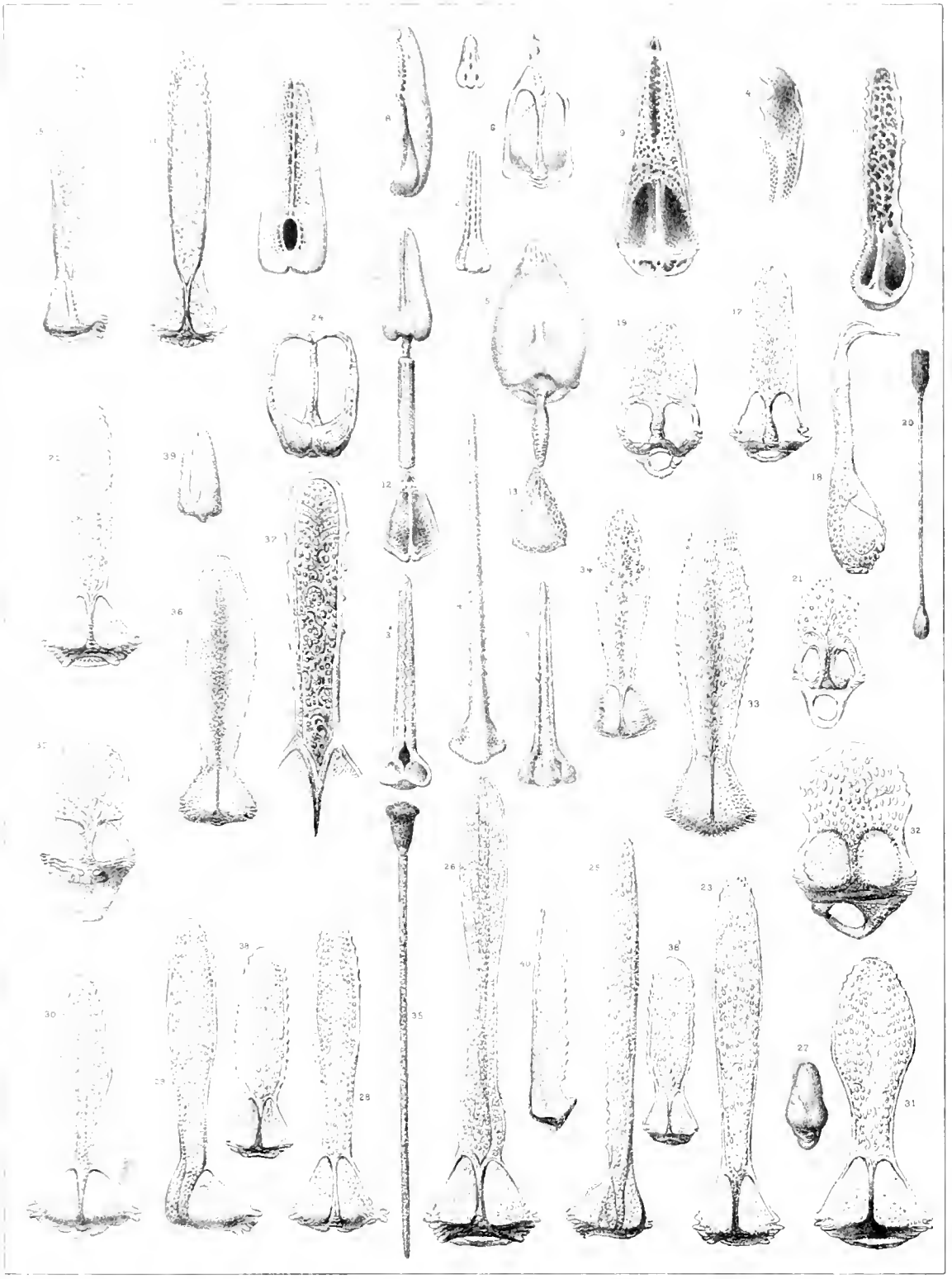
15. Side view of prong from one of the large-headed, long-stemmed pedicellariæ.
16. Interior view of same.
17. Interior of a prong of younger pedicellaria.
18. Profile of one of prongs of Fig. 24.
19. Interior of prong of a stout-headed actinal pedicellaria.
20. Limestone rod of stem of large-headed pedicellaria.
21. Interior of prong of young actinal pedicellaria.
22, 23. Interior of prong of two stages of large-headed pedicellariæ.
24. Tridactyle, long-stemmed interambulacral pedicellaria.

Strongylocentrotus lividus, *f. 25.*

25. Profile of large-headed, long-stemmed interambulacral pedicellaria.

Strongylocentrotus nudus, *f. 26 – 30.*

26. Interior of prong of long-stemmed, large-headed interambulacral pedicellaria.
27. One of the stout-headed, short-stemmed actinal pedicellariæ.
28, 29. Interior and profile of prong of a large-headed, long-stemmed pedicellaria somewhat younger than Fig. 26.
30. Interior of a prong of a still younger pedicellaria.



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Echinocardium mediterraneum, *f. 29, 30.*

29. Tip of prong of long-headed pedicellaria.
30. Single prong of open-headed pedicellaria.

Lovenia elongata, *f. 31.*

31. Profile of long-headed interambulacral pedicellaria.

Breynia Australasiae, *f. 32.*

32. Interior of prong of an interambulacral pedicellaria.

Maretia planulata, *f. 33, 34.*

33, 34. Profile and interior of prong of long-stemmed pedicellaria.

Spatangus Raschi, *f. 35.*

35. Interior of prong of stout-headed, short-stemmed pedicellaria.

Brissus carinatus, *f. 36, 37.*

36, 37. Profile and interior of long-headed pedicellaria.

Echinarachnius parma, *f. 38 – 41.*

38, 39, 40, 41. Different stages of bifid marginal pedicellariæ.

(*All Figs. magnified about twenty diameters unless otherwise stated.*)

PLATE XXV.

Temnopleurus Hardwickii, *f. 1, 2.*

1. Interior of prong of stout-headed, short-stemmed actinal pedicellaria.
2. Profile of prong of open-headed, long-stemmed interambulacral pedicellaria.

Phymosoma crenulare, *f. 3 – 5.*

3. Stout-headed, short-stemmed actinal pedicellaria.
4. Profile of single prong of open-headed, long-stemmed interambulacral pedicellaria.
5. Profile of large-headed, long-stemmed interambulacral pedicellaria.

Hipponoë variegata, *f. 6, 7.*

6. Profile of prong of large-headed, long-stemmed interambulacral pedicellaria.
7. Interior of prong of stout, short-stemmed actinal pedicellaria.

Pseudoboletia granulata, *f. 8 – 10.*

8. Interior of prong of a long-headed, long-stemmed interambulacral pedicellaria.
9. Interior of prong of a stout, short-stemmed actinal pedicellaria.
10. Tip of open-headed, long-stemmed interambulacral pedicellaria.

Echinus miliaris, *f. 11.*

11. Interior of prong of long-headed, long-stemmed interambulacral pedicellaria.

Echinus acutus, *f. 12 – 16.*

12, 13. Long-headed, long-stemmed interambulacral pedicellaria, $\frac{4}{1}^{0}$.
14. Interior of prong of a stout, short-stemmed pedicellaria, $\frac{4}{1}^{0}$.
15. End view of base of same.
16. Single prong of open-headed, long-stemmed interambulacral pedicellaria.

Toxopneustes variegatus, *f. 17 – 19.*

17. Prong of open-headed, long-stemmed pedicellaria.
18. Prong of long-headed, long-stemmed interambulacral pedicellaria.
19. Prong of stout, short-stemmed actinal pedicellaria.

Toxopneustes pileolus, *f. 20, 21.*

20. Single prong of open-headed, long-stemmed pedicellaria.
21. Single prong of stout, short-stemmed actinal pedicellaria.

Echinanthus rosaceus, *f. 22. 23.*

22, 23. Profile and interior of interambulacral pedicellaria.

Clypeaster subdepressus, *f. 24, 25, 25'.*

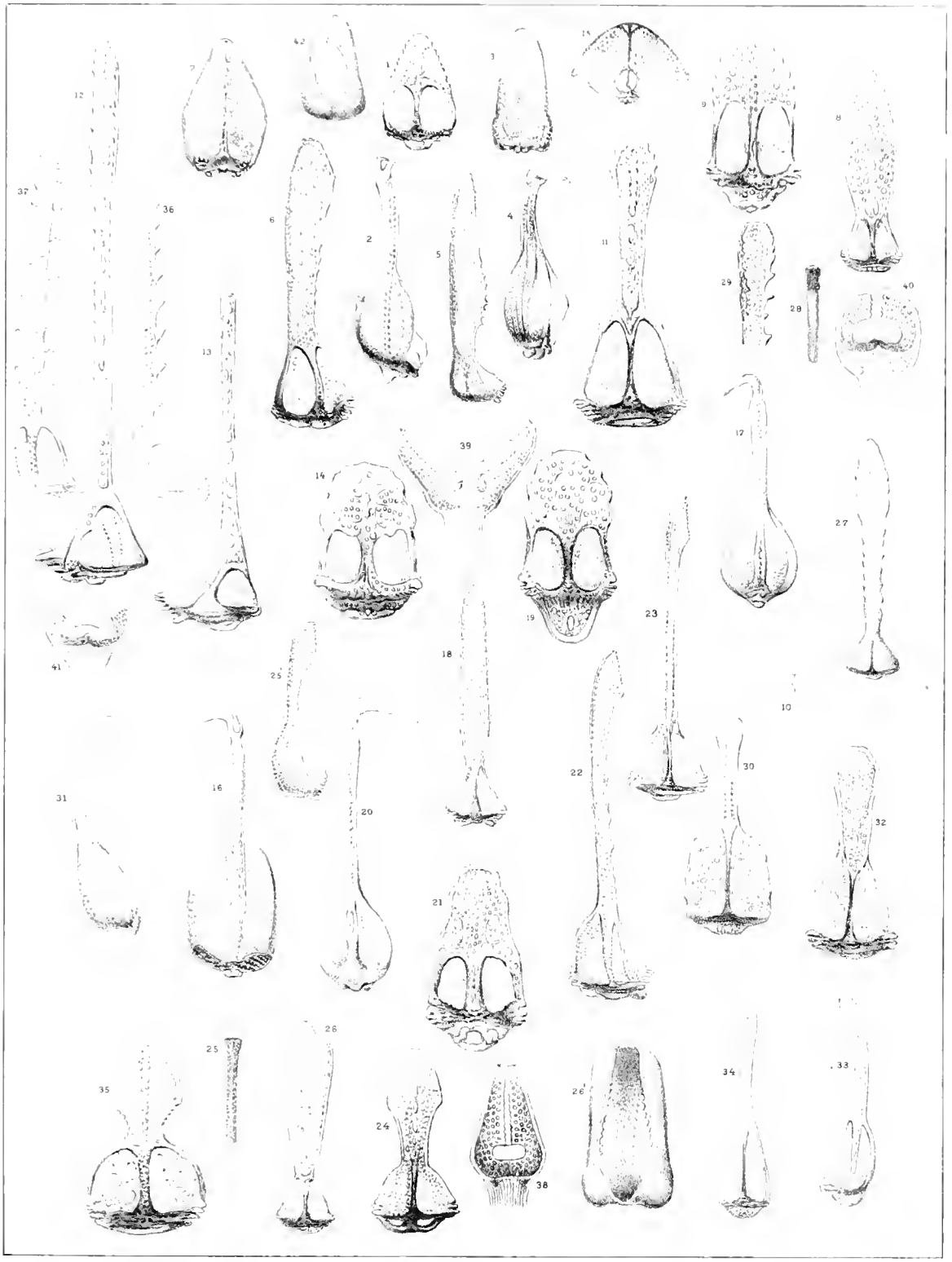
24. Interior of prong of a stout-headed, long-stemmed pedicellaria.
25. Stem of base of Fig. 24.
25'. Profile of stout-headed pedicellaria of Fig. 24.

Echinocardium flavescens, *f. 26, 26'.*

26'. Long-stemmed actinal pedicellaria.
26. Long-headed, long-stemmed interambulacral pedicellaria.

Echinocardium cordatum, *f. 27, 28.*

27. Interior of prong of a long-headed, long-stemmed interambulacral pedicellaria.
28. Tip of calcareous rod supporting head.



Meoma ventricosa, *f. 31 – 34.*

31, 32. Interior and profile of prong of a long-headed, long-stemmed pedicellaria.
33, 34. Profile and interior of prong of a stout-headed, short-stemmed pedicellaria.

Lovenia elongata, *f. 35, 36.*

35, 36. Interior and profile of prong of a stout-headed pedicellaria.

Brissus carinatus, *f. 38.*

38. Profile of prong of a stout-headed pedicellaria.

Schizaster Philippii, *f. 40, 41.*

40. Interior of prong of long-headed pedicellaria.
41. Profile of prong of stout-headed pedicellaria.

Schizaster fragilis, *f. 42.*

42. Interior of prong of stout-headed pedicellaria.

(*All Figs. magnified about twenty diameters.*)

PLATE XXVI.

Heterocentrotus mammillatus, *f. 1, 2.*

1. Long-headed, long-stemmed interambulacral pedicellaria.
2. Profile of prong of pedicellaria older than Fig. 1.

Arbacia punctulata, *f. 3 – 7.*

3. Long-stemmed pedicellaria.
4. Short-stemmed pedicellaria.
5. Single prong of Fig. 3, in profile.

6, 7. Rudimentary spines in bare interambulacral space.

Echinometra viridis, *f. 8 – 10.*

8. Interior of prong of stout, short-stemmed actinal pedicellaria.
9. Profile of long-headed, long-stemmed interambulacral pedicellaria.
10. Interior of prong of open-headed, long-stemmed interambulacral pedicellaria.

Echinometra subangularis, *f. 11 – 13.*

11. Young, long-headed, long-stemmed pedicellaria.
12. Interior view of prong of pedicellaria older than Fig. 11.
13. Interior view of prong of pedicellaria still older than Fig. 12.

Heterocentrotus trigonarius, *f. 14.*

14. Open-headed, long-stemmed pedicellaria, single prong.

Echinarachnius parma, *f. 15 – 18.*

15, 16, 17, 18. Different attitudes of various bifid marginal pedicellaria.

Echinocardium mediterraneum, *f. 19.*

19. Interior of prong of open-headed actinal pedicellaria.

Breynia Australasiae, *f. 20.*

20. Interior of prong of long-stemmed actinal pedicellaria.

Maretia planulata, *f. 21, 22.*

21, 22. Interior and profile of prong of long-stemmed pedicellaria.

Spatangus Raschi, *f. 23.*

23. Interior of large-headed, short-stemmed pedicellaria.

Spatangus purpureus, *f. 24 – 27.*

24. Large-headed actinal pedicellaria.
25. Interior of prong of Fig. 24.

26, 27. Prong of long-headed, long-stemmed pedicellaria.

Meoma nigra, *f. 28 – 30, 37.*

28, 29. Exterior and profile of stout-headed pedicellaria.
30. Interior of long-headed, long-stemmed pedicellaria.
37. Large stout-headed pedicellaria.

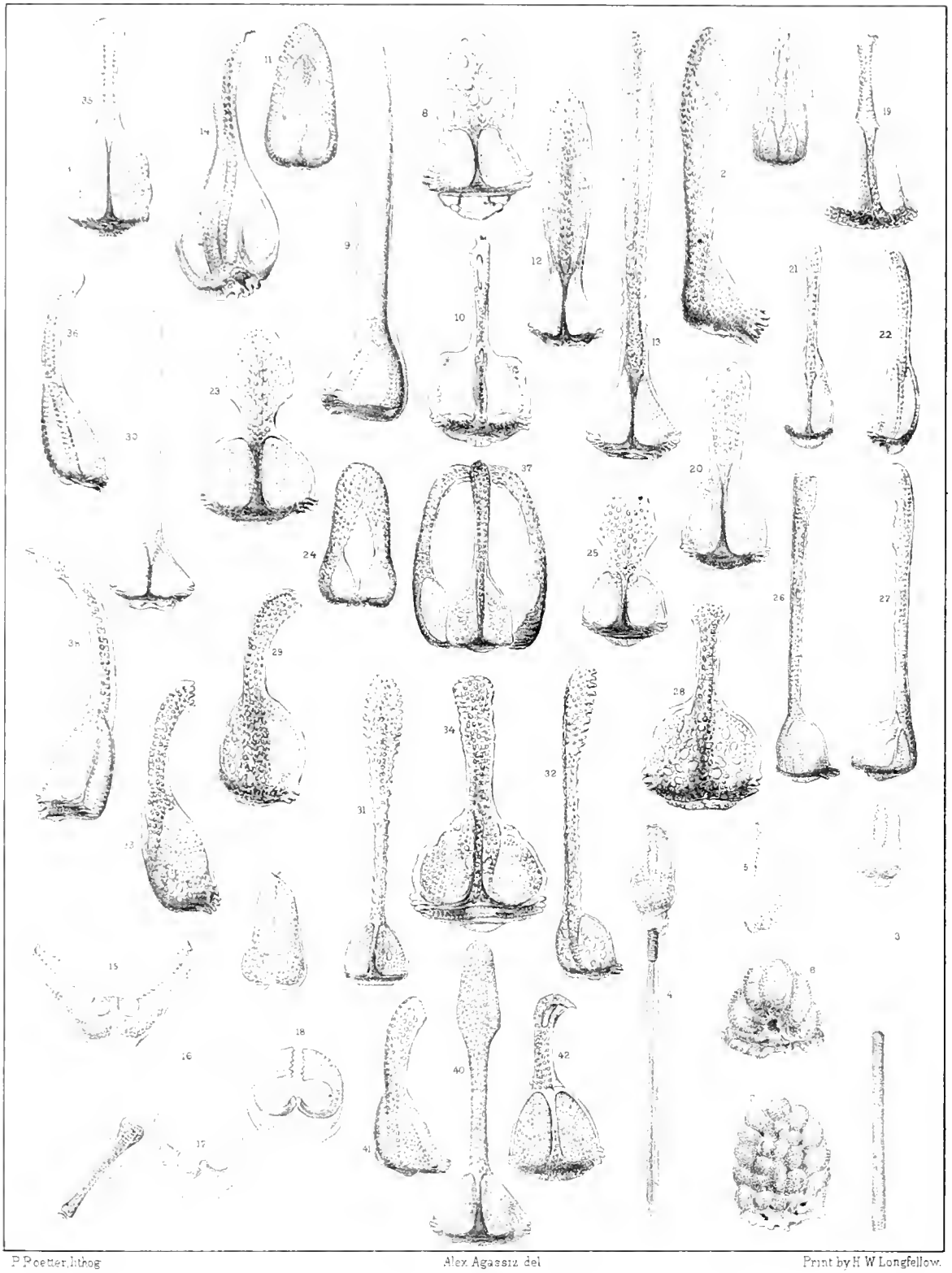


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PLATE XXVII.

Strongylocentrotus Dröbachiensis, *1 – 4.*

1. Interior of test, section of test across the equator. *a*, auricles ; *j*, soft part of jaw ; *m*, muscles supporting pyramid ; *i'*, œsophagus ; *i''*, part of intestine attached to broad flat mesentery ; *i*, abactinal loop of intestine across ambulacra ; *i'''*, i^{IV}, loops of intestine, nearer anal extremity, filled with pellets ready to be cast out ; i^5, actinal loop of intestine.
2. Interior of abactinal part of test, showing the ovaries, *o*, *o'*, and origin of stone canal ; *a*, *a''*, *a'''*, ambulacral plates ; *ia'*, *ia''*, interambulacral plates ; *z''* *z''*, *z'''* *z'''*, poriferous zones.
3. Interior of abactinal part of test, showing position of intestine and ovaries ; *o*, *o'*, *o''*, *o'''*, o^{IV}, o^5, ovaries ; *i'*, part of intestine leading to anal opening ; *i''*, one of the loops of the digestive canal.
4. The abactinal part of the test removed. *g*, genital ring ; *o*, *o'*, *o''*, *o'''*, ovaries ; *i*, *i''*, *i'''*, loops of intestine.

Diadema setosum, *5.*

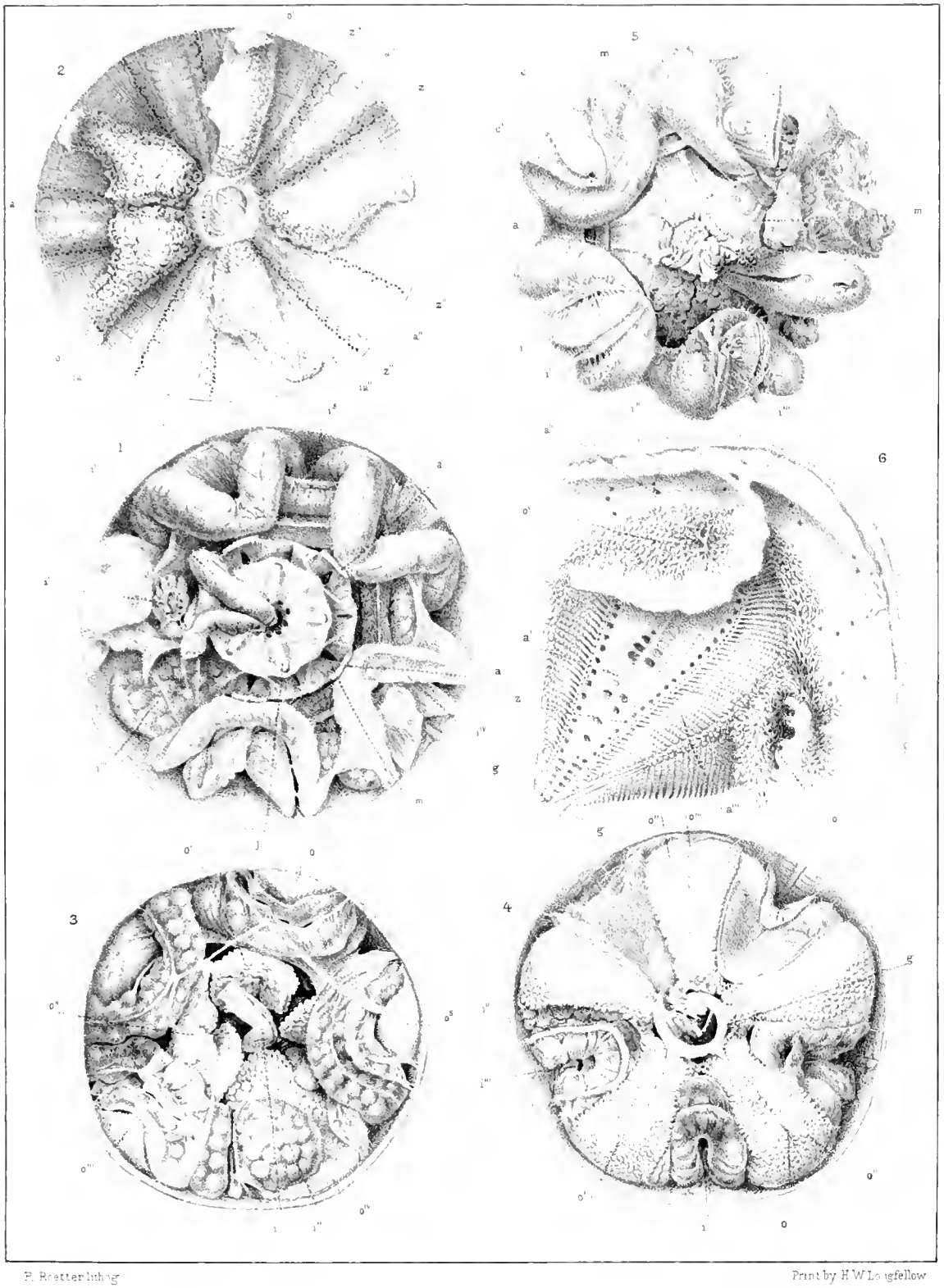
5. Showing course of intestine, abactinal part of test removed. *a*, auricles ; *m*, *m*, muscles of attachment of pyramid to the auricles ; *c*, *c'*, bracket supporting muscles extending to auricles ; *i''*, œsophagus attached to flat mesentery : *i*, *i'*, *i'''*, flat folds of intestine.

Echinanthus rosaceus, *6.*

6. Interior of part of test showing one of the petals. *g g*, genital ring with tubes leading to ovaries, *o*, *o'* ; *a'*, median ambulacral space ; *z*, inner edge of poriferous zone ; *a''*, ambulacral pores beyond petal ; *a'''*, row of pores of petals.

(*All Figs. natural size except* 6, *which is two thirds natural size.*)

The Drawings are made from preparations by A. AGASSIZ and N. BOWDITCH.



P. Bretterbühng Print by H W Longfellow

PLATE XXVIII.

Echinanthus rosaceus, *1*, *2*.

1. Interior of test, the lower floor removed. *j*, *j'*, pits upon which jaws articulate on the auricles; *j''*, line of junction of adjacent parts of pyramid; *o*, *o'*, *o''*, *o'''*, part of ovaries which have been forced between the intestine and the jaws; *i'*, commencement of intestine, passing to *i''*, then to *i*, *i'''*, i^{IV}, i^{5}, to the anal opening; *v*, *v'*, *v''*, main vessel following the course of the intestine.
2. Abactinal floor removed. *a v*, ambulacral vessel; *v'*, vessel following the course of the intestine; *a v* to *v*, œsophagus; *i''*, *i'''*, i^{IV}, *i*, i^{5}, course of the intestine; *o*, *o'*, *o''*, *o'''*, o^{IV}, ovaries; *j*, *j'*, line of junction of adjacent parts of the pyramid; *p*, *p*, *p'*, partition separating the intestinal cavity from the main actinal cavity.

Cidaris tribuloides, *3*, *4*.

3. Abactinal part of test and ovaries removed. *a*, anal opening; *i*, *i'*, *i''*, *i'''*, i^{IV}, intestine.
4. Abactinal part of test removed. *g*, genital ring; *o*, *o'*, ovaries; *i*, *i'*, loops of intestine.

Diadema setosum, *5*.

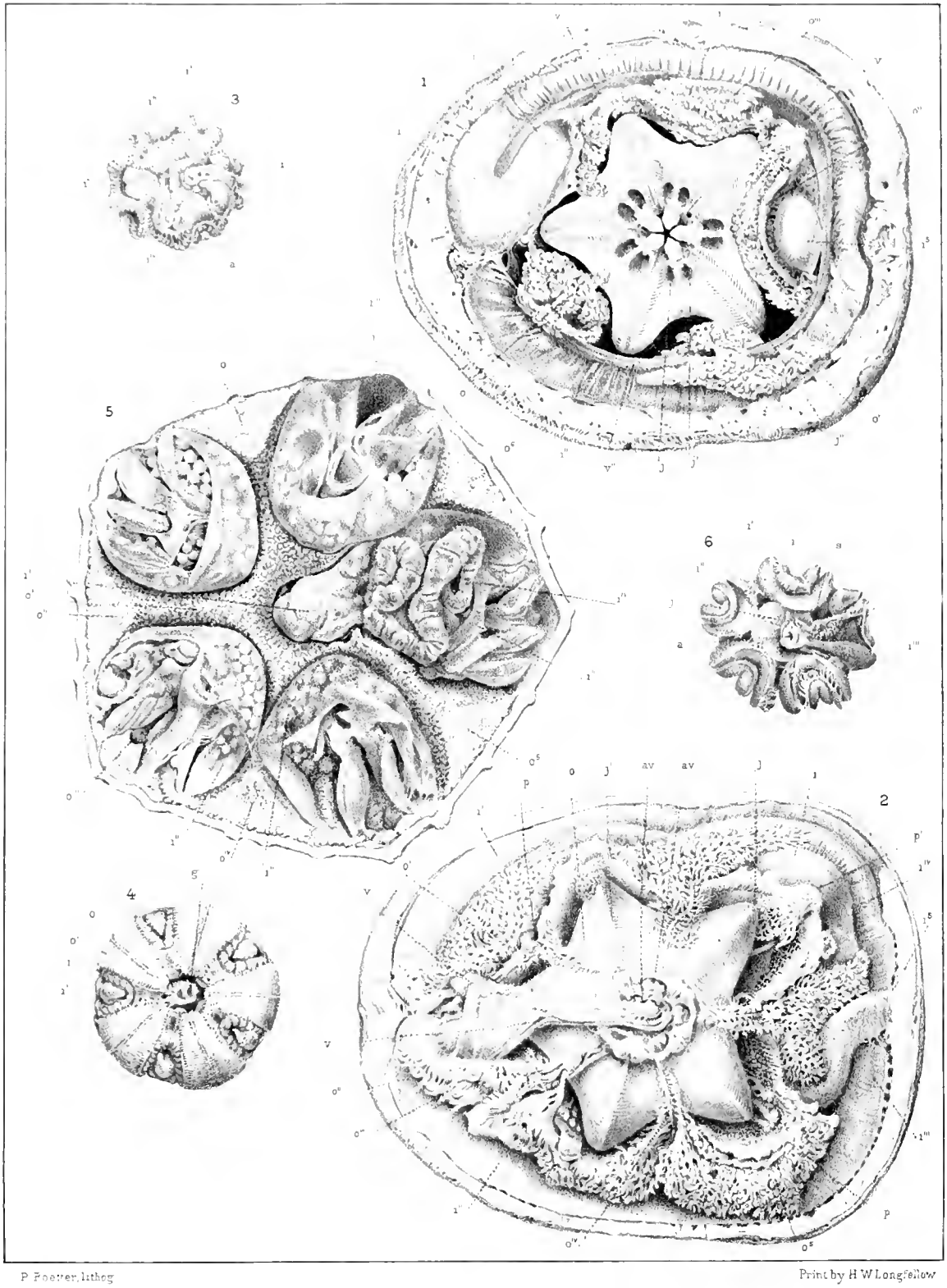
5. Section across equator showing abactinal part of interior. *o*, *o'*, *o''*, *o'''*, o^{IV}, o^{5}, o^{6}, ovaries; *i*, *i'*, *i''*, *i'''*, i^{IV}, abactinal loops of intestine.

Arbacia pustulosa, *6*.

6. Abactinal part of test and ovaries removed. *j*, jaws; *s*, stone canal; *a*, anal opening; *i i'*, *i''*, *i'''*, loops of intestine.

(*Figs.* 1, 2, *two thirds natural size*; *Figs.* 3–6, *natural size.*)

The Drawings are made from preparations by A. AGASSIZ and N. BOWDITCH.



P Foerer, lithog Print by H W Longfellow

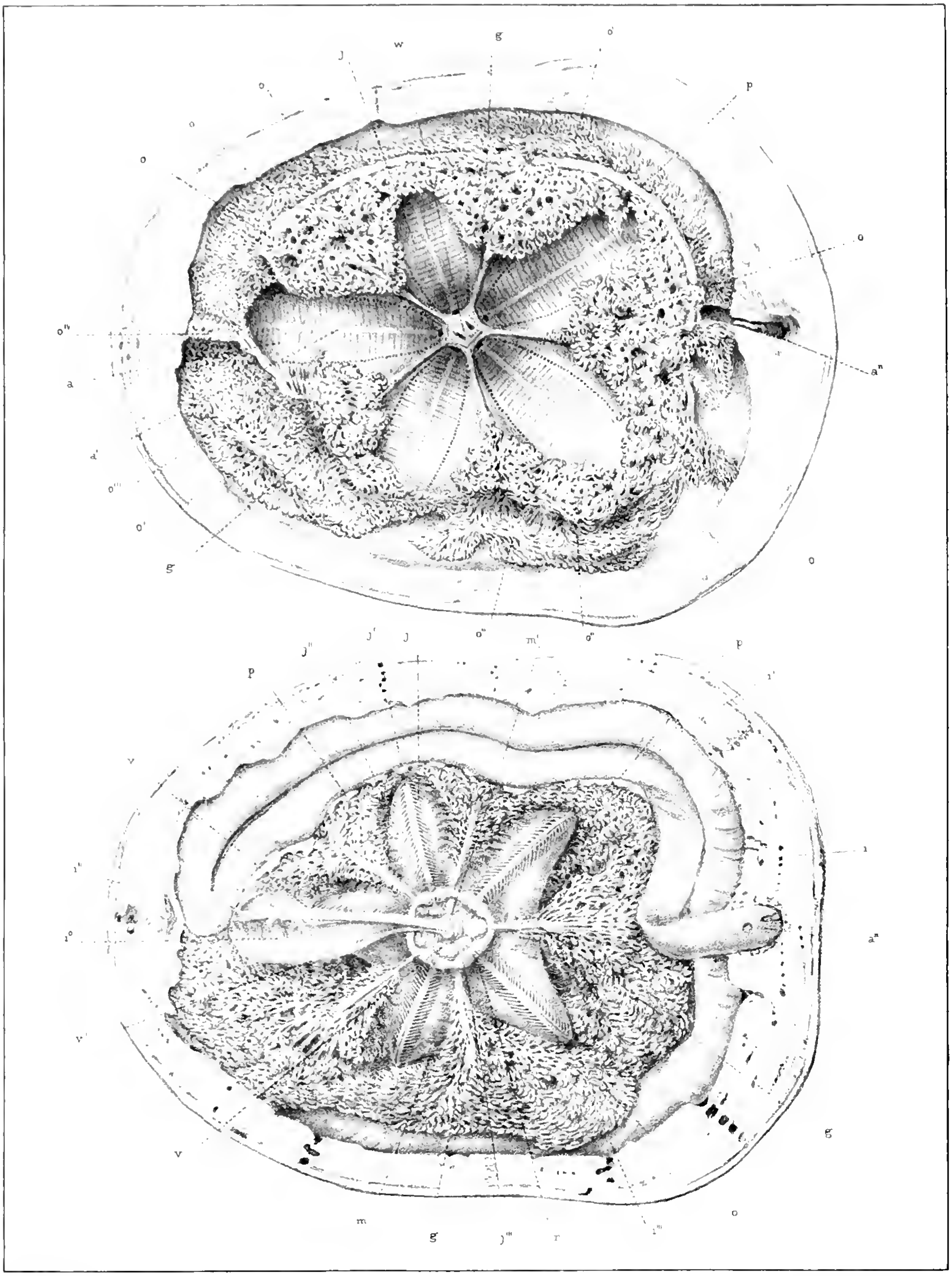
PLATE XXIX.

Clypeaster subdepressus.

1. (Upper figure.) Abactinal part of test seen from the interior, to show the position of the ovaries and principal partition (p) between the ambulacral and digestive cavities, o, o, o', o'', o''', o^{IV}, o^5, ovaries ; a', median ambulacral spaces ; a, j, ambulacral furrows of petals ; g, g, genital tubes leading to ovaries ; a^n, pit leading to anal opening ; w, attachment of stone canal.
2. (Lower figure.) Abactinal part of test removed, to show the trend of alimentary canal ; m^i, entrance to œsophagus ; i^o, termination of œsophagus leading to digestive canal, i''', i' ; i'', point of flexure of canal to i, leading to anal opening, a^n ; pp, partition ; g, genital tubes leading to ovaries ; v, v', vessel along œsophagus and intestine ; j, lateral half of pyramid ; j', central line of contact ; j'', median part ; j''', basal portion ; r, rotule.

(*Both Figs. natural size.*)

The Drawings are made from preparations by A. AGASSIZ and JAMES E. MILLS.



P. Roetter, lithog.

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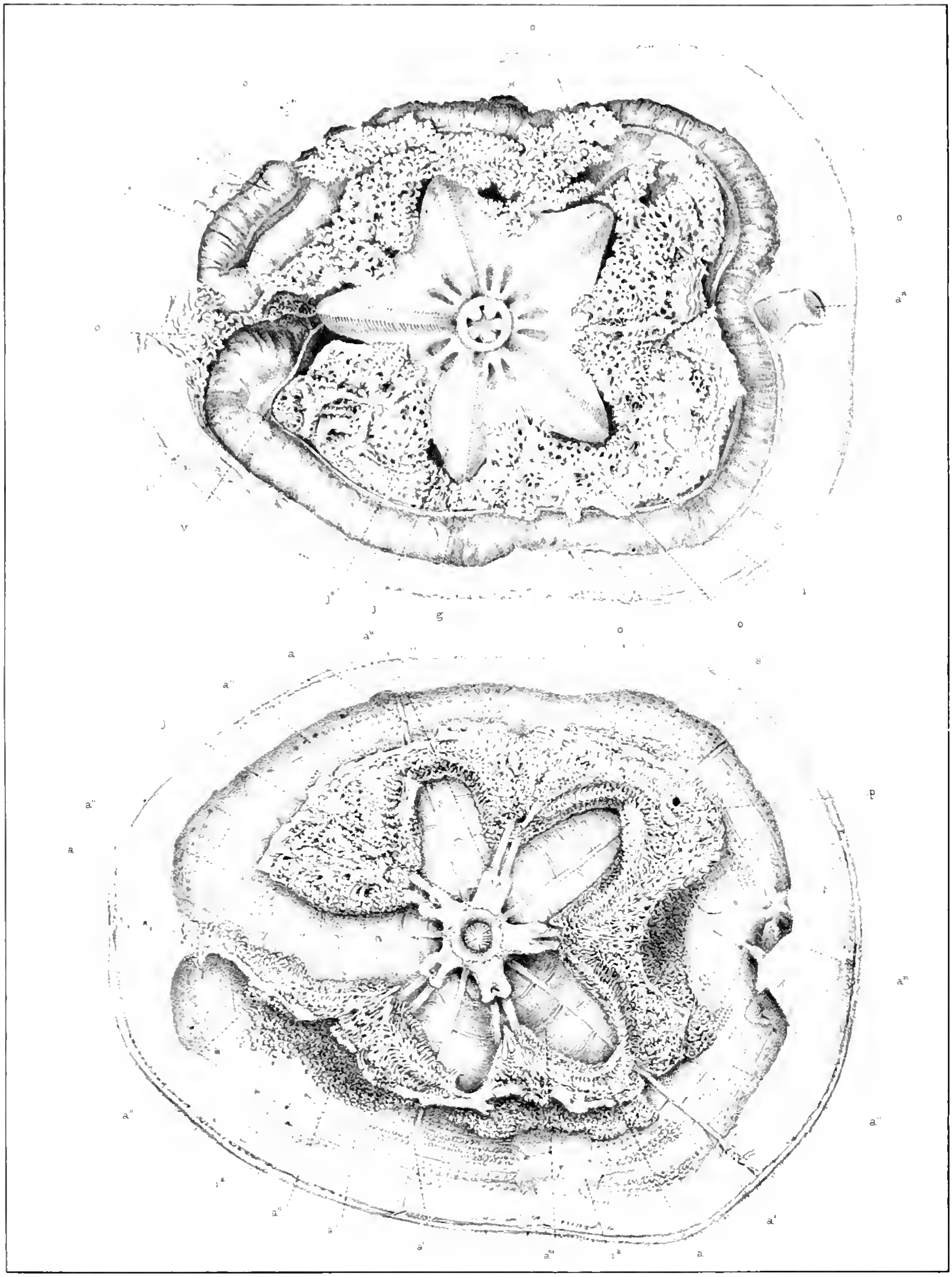
PLATE XXX.

Clypeaster subdepressus.

1. (Upper figure.) The lower floor is removed, to show the course of the alimentary canal, i, i, to its reflex point, i'', where it runs to i', and ends at a^n, the anal opening; o, o, o, o, ovaries forced to the lower floor; r, vessel following course of alimentary canal; g, line of contact of adjacent pyramids of jaws; j, lateral edges of same; j^o, pits for auricles.
2. (Lower figure.) Section to show interior of lower floor, the alimentary canal and jaws removed; o, ovaries; a^u, auricles; a', a', a', median ambulacral tube; a'', a'', a'', a'', lateral ambulacral plates; i^a, i^a, interambulacral plates; j, circular ring; p, partitions; a^n, anal opening.

(*Both Figs. natural size.*)

The Drawings are made from preparations by A. AGASSIZ and JAMES E. MILLS.



P. Roetter lithog.		Print by H. W. Longfellow

PLATE XXXI.

Echinarachnius parma.

1. Seen from above, with spines and suckers expanded. Nat. size.
2. Actinal floor removed to show course of alimentary canal and of the principal vessel sending branches to the water-tubes both in the ambulacral and interambulacral spaces.
3. Part of edge of test of young specimen, with suckers and pedicellariæ ; measuring $6^{mm.}$
4. Part of ambulacral petal of young specimen measuring $6^{mm.}$
5. Ambulacral tubes of petaloid portion of adult specimen.
6. Ambulacral suckers of petaloid portion of same specimen as Fig. 3.

7, 8, 9. Different views of ambulacral suckers from petaloid portion of adult specimen.

10. Water-tubes from the median ambulacral part of the petals.
11. Water-tubes from the interambulacral space.
12. Terminal disk of the suckers of the ambulaera from the petaloid portion.
13. Single ambulacral sucker of petal to show the mode of junction of the two parts of the suckers leading from the ambulacral pores.
14. Part of the ambulacral edge of the mouth showing the simple suckers of the buccal rosette (from young specimen, Fig. 3).
15. The two large buccal tentacles, somewhat more magnified, same as Fig. 14.
16. Spine of edge of test of Fig. 3, magnified.
17. One of the pedicellariæ of the edge of the test of Fig. 3.

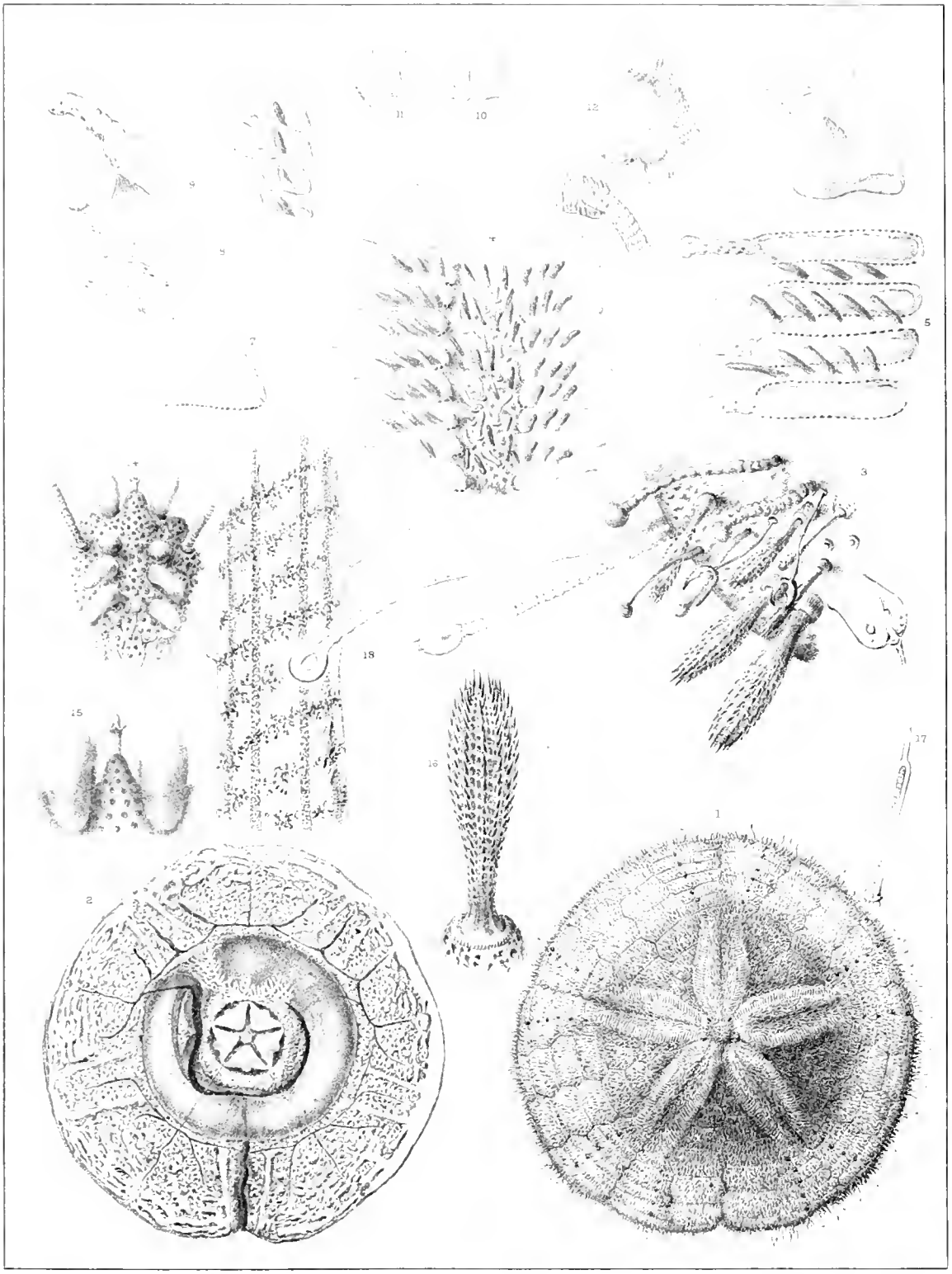

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PLATE XXXII.

Rhynchopygus pacificus, *1 – 10.*

1. Abactinal part of the test removed, to show the position of the upper part of the digestive cavity. i^a, anal part of digestive cavity (intestine proper); i^d, diverticula of intestine near the actinostome (see Fig. 5). Digestive cavity runs from i'''' to i', parallel with the actinal floor (see Fig. 3), turns upon itself at the anterior extremity to i'', passes under intestine i^a to i''', and leads to anal opening by i^a.
2. Shows the position of the four lateral genital branches.
3. Shows the course of the digestive cavity parallel to the actinal floor (actinal part of test removed) the œsophagus widens rapidly at i^d, which sends out the diverticula (Figs. 1 i^d, 5 i^d) to the broad digestive cavity $i'i'$; at i'' it turns upon itself and opens into the broader stomach i'' i''' of Fig. 1. A mesentery extends completely across the actinal floor, and is edged by a vessel v.
4. Section showing in profile the successive course of the digestive cavity i'' i''' i^a, the position of the ovaries o, and of the stone-canal c.
5. The interior of the test round the actinostome, showing the phyllodes and the trend of the œsophagus leading to the diverticula i^d, which is over the odd ambulacral region.
6. Ambulacral tube from petaloid portion, from above.
7. Same as Fig. 6 in profile.

8, 9, 10. Sucker of phyllodes.

Metalia sternalis, *11, 12.*

11. Part of test round actinostome showing the large pouch of actinostome running to the œsophagus, extending over the odd interambulacral space.
12. Interior of test round abactinal pole, showing the position of the four ovaries.

Palaeostoma mirabilis, *13 – 15.*

13. Seen from above (n. s.), copied from Gray.
14. Actinostome.
15. Anal pyramid.

Echinocardium pennatifidum, *16.*

16. One of the pedunculated ambulacral suckers round the actinostome.

Spatangus purpureus, *17, 18.*

17. Abactinal part of test removed. oc, anal extremity of alimentary canal; i i', intestine; d, diverticulum (anus above).
18. Actinal floor removed. a, œsophagus; $i'i''$, digestive canal; v, vessel communicating from ambulacral system with the water-system; s, limestone support near actinostome for support of main mesentery (mouth anterior).

17, 18 copied from Hoffmann, two thirds natural size.

(*Figs.* 1 – 4, 11, 12, *natural size; others magnified.*)

All Figs. not otherwise credited, drawn from nature by A. AGASSIZ.

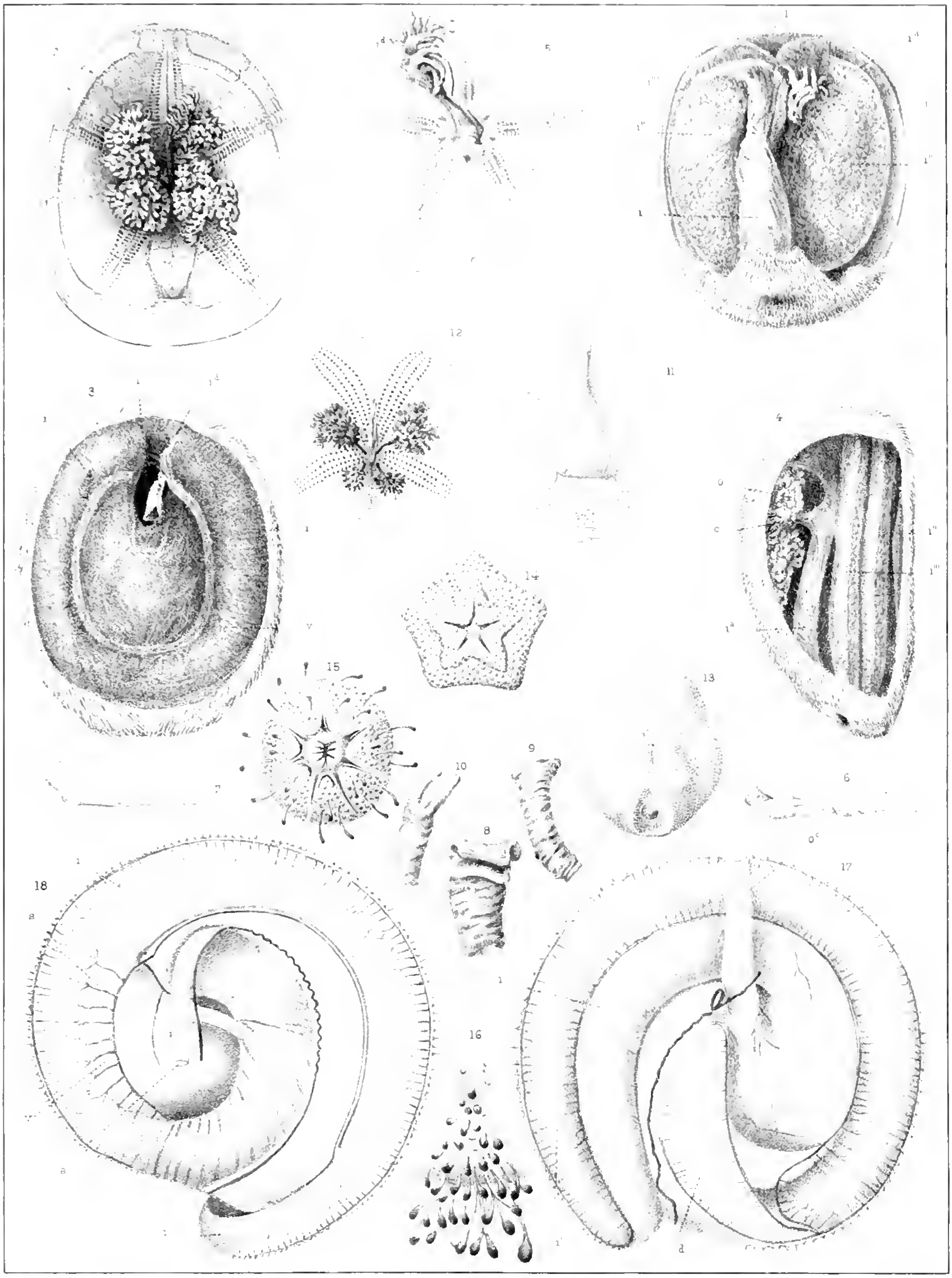

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PLATE XXXIII.

Rhynchopygus pacificus, *f. 1, 2.*

1. Interior view of actinal surface.
2. Interior view of abactinal surface.

Laganum depressum, *f. 3, 4.*

3. Interior view of actinal floor.
4. Interior view of abactinal surface.

Rotula Augusti, *f. 5.*

5. Seen from above, to show the actinal floor.

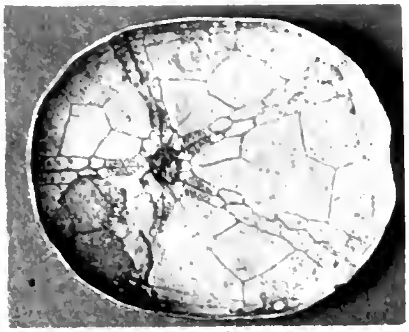
Echinocardium cordatum, *f. 6.*

6. Abactinal part of the anterior odd ambulacrum seen from the interior of the test.

Schizaster canaliferus, *f. 7.*

7. Petals seen from the interior of the test.

(*All Figs. natural size.*)



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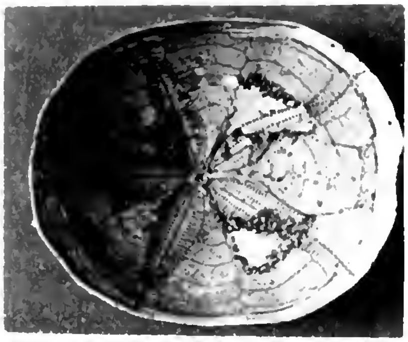

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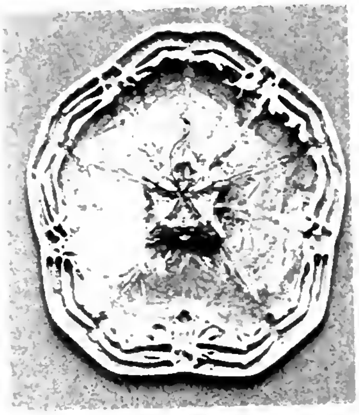

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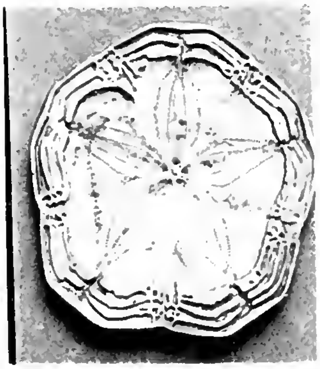

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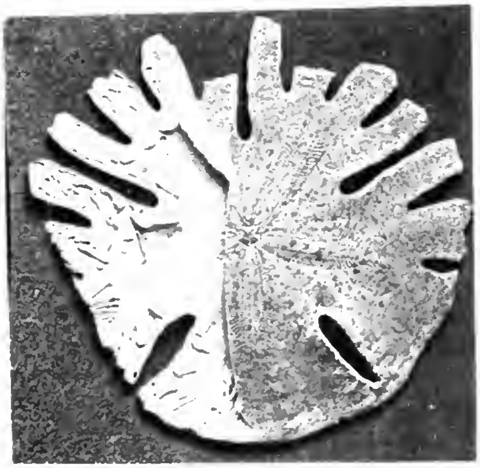

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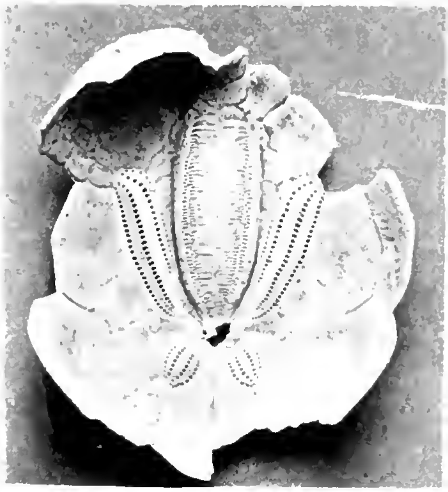

A. Sonrel, Phot.g. J. R. Osgood & Co., Heliotype

PLATE XXXIV.

Meoma grandis, *f. 1, 2.*

1. Interior of abactinal surface, to show the petals.
2. Interior of test, to show the actinal floor.

Spatangus purpureus, *f. 3, 4.*

3. Interior of abactinal surface, to show the petals.
4. Interior of test, to show the actinal floor.

(*All Figs. three fourths natural size.*)

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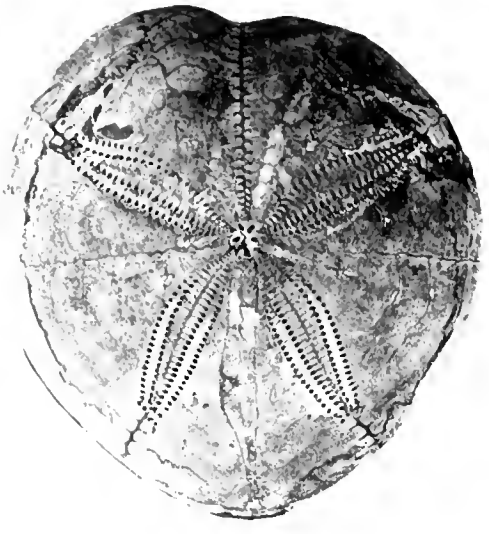

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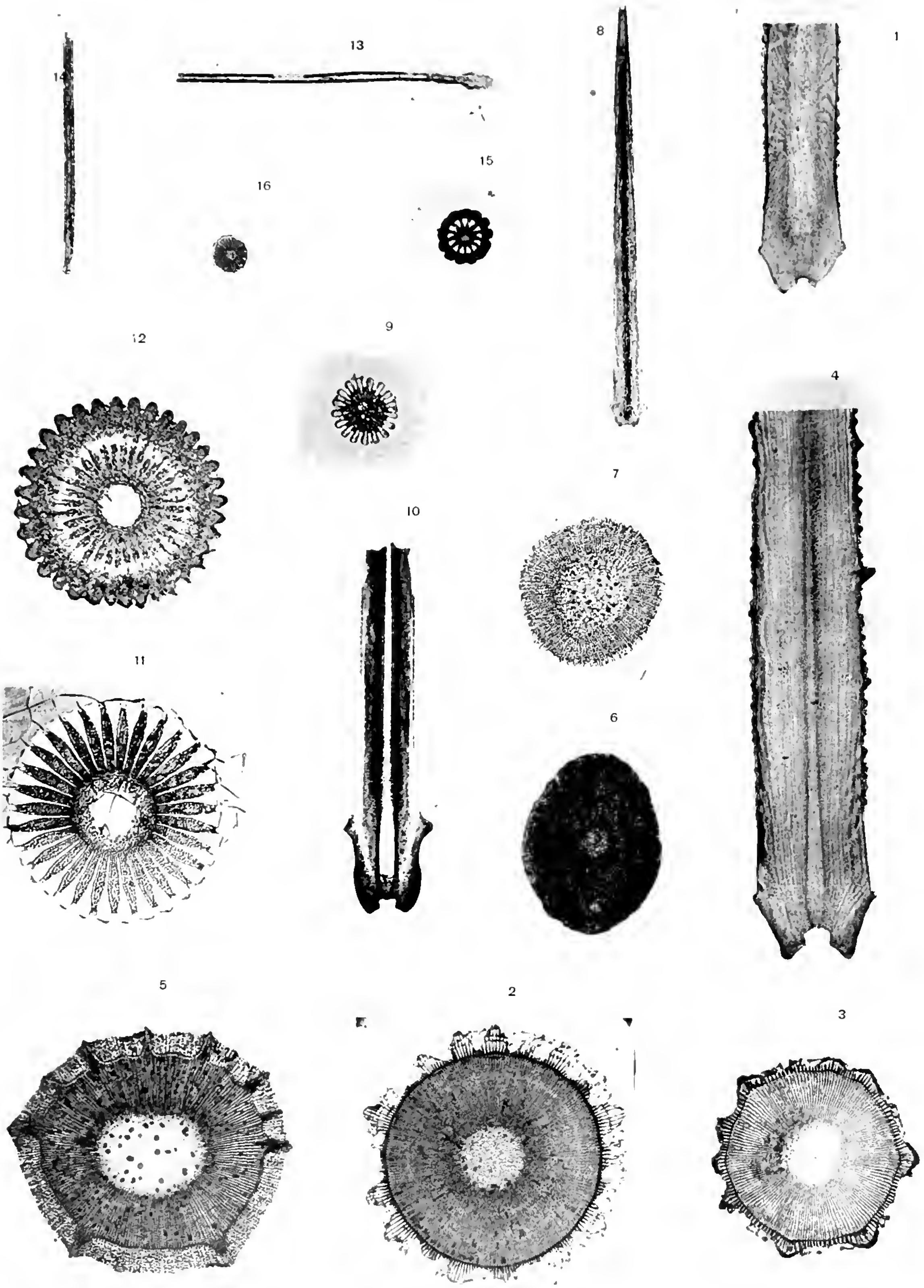
PLATE XXXV.

1. **Cidaris tribuloides.** Longitudinal section of base of large primary interambulacral spine.
2. **Cidaris Thouarsii.** Transverse section of shaft of large primary interambulacral spine.
3. **Cidaris metularia.** Transverse section of shaft of large primary interambulacral spine.
4. **Phyllacanthus baculosa.** Longitudinal section of base of large primary interambulacral spine.
5. **Goniocidaris geranioides.** Transverse section of shaft of large primary interambulacral spine.
6. Transverse section of shaft of spine of **Acrosalenia** from the Jurassic formation.
7. **Arbacia spatuligera.** Transverse section near base of large primary interambulacral spine.
8. **Arbacia punctulata.** Longitudinal section of large primary interambulacral spine.
9. **Arbacia punctulata.** Transverse section near tip of shaft of large primary interambulacral spine.

Echinothrix calamaris, *f. 10–15.*

10. Longitudinal section of base of large primary interambulacral spine.
11. Transverse section of Fig. 10 near base.
12. Transverse section of Fig. 10 near middle of shaft.
13. Longitudinal section of small interambulacral spine.
14. Longitudinal section of part of small ambulacral spine.
15. Transverse section of ambulacral spine.
16. **Salenia varispina.** Transverse section of large primary interambulacral spine.



A. Sonrel, Lithog. | J. H. Osgood & Co., Heliotyp.

PLATE XXXVI.

1. **Echinometra lucunter.** Transverse section of shaft of primary interambulacral spine.
2. **Stomopneustes variolaris.** Transverse section of shaft of primary interambulacral spine.
3. Longitudinal section of primary interambulacral spine of **Stomopneustes variolaris.**
4. **Strongylocentrotus tuberculatus.** Transverse section of primary interambulacral spine.
5. **Echinometra oblonga.** Longitudinal section of primary interambulacral spine.
6. **Colobocentrotus atratus.** Longitudinal section of primary interambulacral spine from ambitus.
7. Longitudinal section of short abactinal primary interambulacral spine of **Colobocentrotus atratus.**
8. **Heterocentrotus mammillatus.** Transverse section of shaft of large primary interambulacral spine.
9. **Strongylocentrotus purpuratus.** Transverse section of primary interambulacral spine.
10. **Phymosoma crenulare.** Longitudinal section of large primary interambulacral spine.
11. Transverse section of primary interambulacral spine of **Phymosoma crenulare.**
12. **Hemipedina cubensis.** Transverse section of large primary interambulacral spine.
13. **Trigonocidaris albida.** Transverse section of large primary interambulacral spine.
14. **Temnopleurus Hardwickii.** Longitudinal section of primary interambulacral spine.

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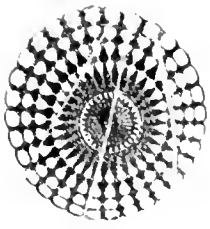

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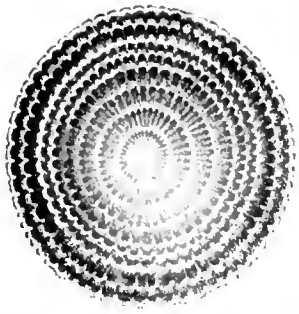

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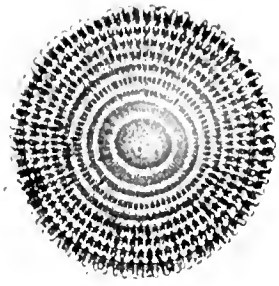

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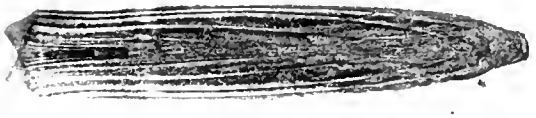

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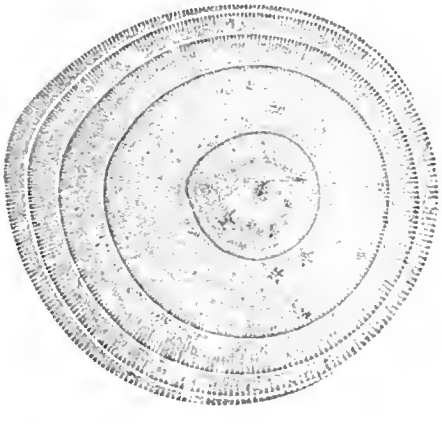

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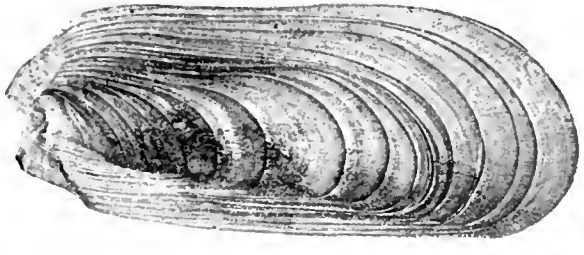

PLATE XXXVII.

1. **Mellita testudinata.** Club-shaped spines of the abactinal surface.
2. **Mellita testudinata.** Spines of the actinal surface.
3. **Peronella decagonalis.** Spines of the actinal surface.
4. **Echinodiscus biforis.** Club-shaped spine of the abactinal surface.
5. **Echinodiscus biforis.** Transverse section of same.
6. **Echinodiscus biforis.** Transverse section of smaller spine.
7. **Echinarachnius mirabilis.** Spine of abactinal surface.
8. **Echinarachnius mirabilis.** Transverse section of same.
9. **Echinanthus rosaceus.** Longitudinal section of spine.
10. **Echinanthus rosaceus.** Transverse section of same.
11. **Echinanthus rosaceus.** Magnified base of spine.
12. **Rhynchopygus pacificus.** Transverse section of spine near ambitus.
13. **Maretia planulata.** Transverse section of long spine from abactinal surface.
14. **Marieta planulata.** Spines of abactinal interambulacral surface.
15. **Echinocardium australe.** Transverse section of abactinal interambulacral spine.
16. **Spatangus purpureus.** Longitudinal section of abactinal interambulacral spine.
17. **Lovenia elongata.** Tip of one of the serrated spines of the abactinal surface.
18. **Lovenia elongata.** Small, curved, and spathiform spine of actinal surface.
19. **Brissus unicolor.** Interambulacral spine from the abactinal surface.
20. **Metalia sternalis.** Interambulacral spines from the abactinal surface.

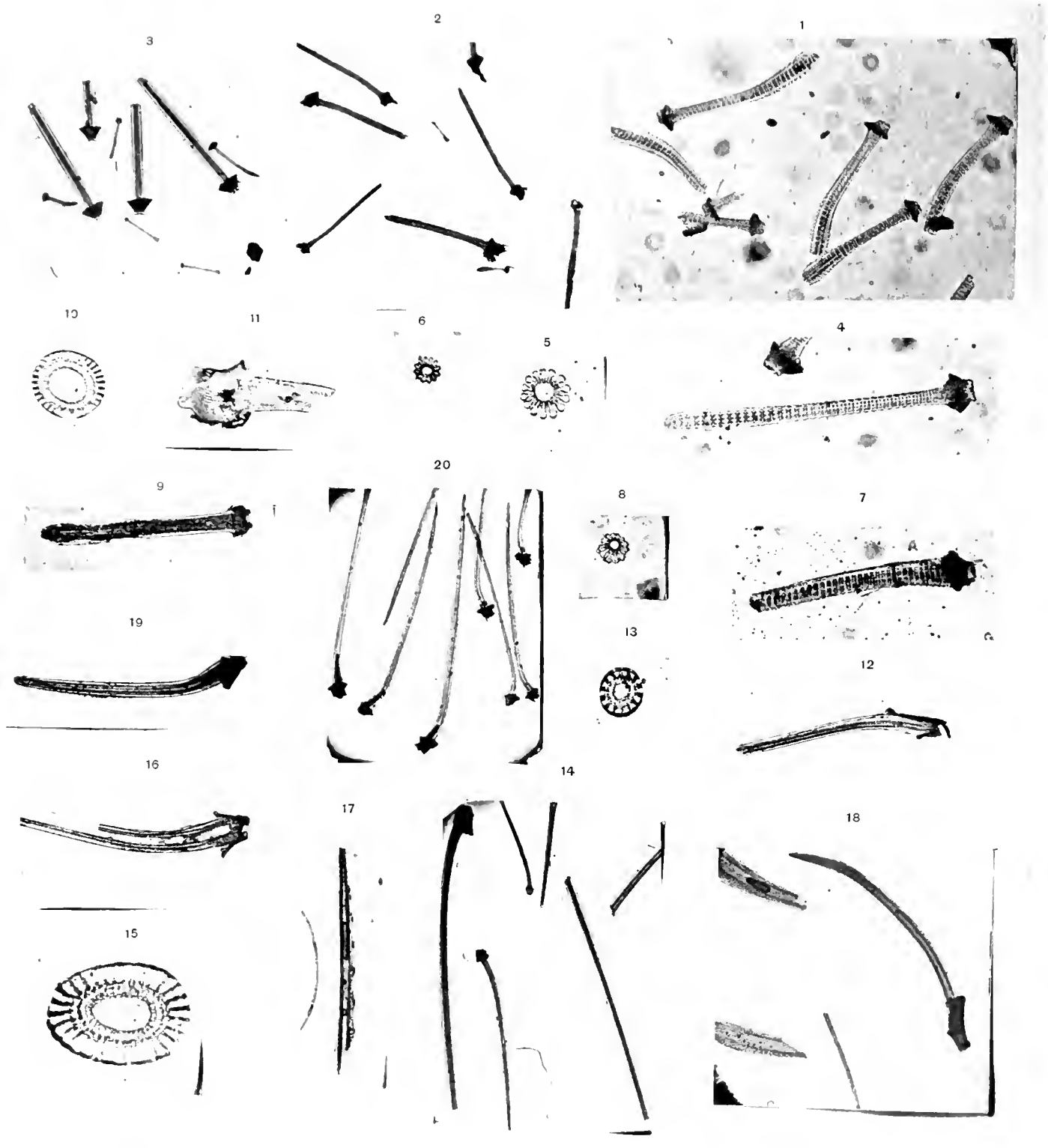
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PLATE XXXVIII.

1. **Cidaris Thouarsii.** A plate of disk from ambulacral tube.
2. **Cidaris Thouarsii.** Spicule, from ambulacral tube.
2a-c. **Cidaris tribuloides.** Spicules from mesentery of intestine. (Stewart.)
3. **Diadema mexicanum.** Plate from ambulacral tubes.
4, 5, 6. **Diadema mexicanum.** Spicules from ambulacral tube.
7, 8, 9. **Asthenosoma hystrix.** Spicules from ambulacral tubes.
10. **Arbacia punctulata.** Plate from ambulacral tube.
10a-c. **Arbacia pustulosa.** Spicules from ambulacral tube. (Perrier.)
11. **Colobocentrotus atratus.** Plate from ambulacral tube.
12. **Colobocentrotus atratus.** Spicule from ambulacral tube.
12a-h. **Echinometra.** Spicules from ovaries. (Stewart.)
12i-m. **Echinometra.** Spicules from ambulacral tubes. (Stewart.)
13. **Strongylocentrotus Dröbachiensis.** Plate from ambulacral tube.
14, 14c-d. **Strongylocentrotus Dröbachiensis.** Spicules from ambulacral tubes.
14a-b. **Strongylocentrotus Dröbachiensis.** Spicules from ovaries.
15. **Toxopneustes pileolus.** Plate from ambulacral tube.
16, 17. **Toxopneustes pileolus.** Spicules from ambulacral tubes.
18. **Phymosoma crenulare.** Plate from ambulacral tube.
19. **Phymosoma crenulare.** Spicule from ambulacral tube.
20. **Amblypneustes griseus.** Plate from ambulacral tube.
21. **Amblypneustes griseus.** Interambulacral abactinal pedicellaria.
22. **Mespilia globulus.** Interambulacral abactinal pedicellaria.
22c. **Mespilia globulus.** Plate from ambulacral tube.
22a-b. **Mespilia globulus.** Spicules from ovaries. (Stewart.)
23. **Salmacis globator.** Plate from ambulacral tube.
24, 25. **Meoma ventricosa.** Spicules from actinal ambulacral tubes of phyllodes.
26. **Echinoneus semilunaris.** Spicule from ambulacral tube.
27. **Lovenia elongata.** Spicule from actinal ambulacral tube of phyllodes.
28. **Lovenia elongata.** Interior view of part of actinal floor.
28'. **Lovenia elongata.** Interior view of lateral interambulacral space.
29. **Metalia maculosa.** Spicules from actinal ambulacral tubes of phyllodes.
30, 30a, 31. **Echinobrissus recens.** Spicules from ambulacral tubes. (Perrier.)
32, 33. **Echinocardium flavescens.** Spicules from ambulacral tubes. (Perrier.)
34, 35. **Spatangus purpureus.** Spicules from ambulacral tubes. (Perrier.)
36-38. **Brissopsis lyrifera.** Spicules from ambulacral tubes. (Perrier.)