

	Zone of <i>A. spinatus</i> , Layers 1 to 16.	Zone of <i>A. spinatus</i> and <i>A. margaritatus</i> (mixed), Layers 17 to 30.	Zone of <i>A. margaritatus</i> , Zone 31 to bottom.
<i>Quenstedtia</i> , sp.	*		
<i>Gryphaea</i> , sp.		*	
<i>Sphæra</i> (<i>Corbis</i>)	*		
<i>Terebratula</i> , sp.		*	
<i>Rhynchonella tetrahedra</i> , Sow.		*	
<i>Rhynchonella</i> , sp.		*	
<i>Cythere</i> , sps.		*	
<i>Cytherella</i> , sps.		*	
<i>Pentacrinus</i> , sp.		*	
<i>Nodosaria mucronata</i>		*	
<i>N. pauperata</i> , D'Orb.		*	
<i>N. consobrina</i> , D'Orb.		*	
<i>N. raphanus</i> , Lin.		*	
<i>Cristellaria recta</i> , D'Orb.		*	
<i>C. varians</i> , Born.		*	
<i>C. crepidula</i> , F. and M.		*	
<i>Marginulina raphanus</i> , L.		*	
<i>Fronicularia excavata</i> , Terq.		*	
<i>Amnodiscus incerta</i> , D'Orb.		*	
<i>Scalpellum</i> , sp.		*	

FOSSILS FOUND AT THE BASE OF THE UPPER LIAS IMMEDIATELY ABOVE
HANDLEY'S PIT.

Ammonites serpentinus.
A. Thourense.
A. annulatus.
Chemnitzia, sp.

Astarte, sp.
Dentalium elongatum.
Inoceramus dubius.
Cerithium, sp.

IV.—ON SOME FOSSIL ENTOMOSTRACA FROM SOUTH AMERICA.

By Professor T. RUPERT JONES, F.R.S., F.G.S.

(PLATES X AND XII.)¹

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PART I.

§ I. INTRODUCTION.

There are now in the British Museum (Natural History Branch) several specimens of fossil *Estheriæ* from South America, beside

¹ Pls. X and XI will appear in the July Number with the second part of this paper.

those described and figured in the "Monograph of Fossil *Estheria*" (Palæontographical Society), 1862, pp. 109–111, pl. iv, figs. 8–11.

1. There are some from the same locality as those already dealt with, namely, *Estheria Forbesii*, Jones, from Cacheuta in the province of Mendoza, Argentine Republic.

2. Others collected by David Forbes at another place, namely, Arica,¹ Department of Arequipa, in Southern Peru.

3. An interesting series from Brazil; partly described and illustrated in the GEOLOGICAL MAGAZINE for May, 1897, pp. 195–202, Pl. VIII.

From Cacheuta and Challao (both in the province of Mendoza) more or less similar specimens have been described by H. B. Geinitz and R. A. Philippi; and the latter has treated of a species, probably from the district of Lebu, Chili, like that which Dr. Forbes found at Arica. These, therefore, have to be compared. The Brazilian specimens referred to above belong to four new species, including three of *Estherina*, gen. nov., elsewhere described.

The close similarity that many *Estheria* have one to another in the shape of the carapace, the only part of the animal remaining, when fossil, for the geologist to examine, makes the determination of fossil species very difficult. The limbs and soft parts having perished, the features of the valves, such as shape and contour, the lines of growth and their interstices, are all that give the means of judging specific differences. In the more or less crushed or otherwise modified state in which the fossil carapaces often occur the difficulties are multiplied.

The sex of individuals influences the carapace; and the successional stages of growth are accompanied by differences of outline. Many such modifications and variations of form are recognizable in published works treating of these Phylloponds. For example, G. O. Sars, of Christiania, has well illustrated and explained the gradational changes, from the egg to the adult form, in *Cyclestheria Hislopi*² and *Estheria Packardi*.³

§ II. GEINITZ, 1876.

In 1876 Professor Dr. H. B. Geinitz described and figured several fossil *Estheria* from the Rhætic carbonaceous shales and associated dark-grey clays of Challao and elsewhere in the Mendoza province, Argentine Republic. All these specimens he referred to *Estheria Mangaliensis*, Jones: see "Beiträge zur Geologie und Palæontologie des Argentinischen Republik," II, Palæontologischer Theil, Abth. 2; "Ueber Rhaetische Pflanzen- und Thier-Reste in den Argentinischen Provinzen La Rioja, San Juan, und Mendoza," 1876, p. 3, pl. i, figs. 1–6.

¹ Now held by the Chilians as an indemnity for war expenses, or taken by them in 1886.

² Christiania Vidensk.-Selsk. Forhandl. 1887, No. 1.

³ Archiv Math. og Naturv. Attende Bind, Første Hefte, June, 1896, Kristiania. In this memoir on *E. Packardi* is given the complete history of the growth of an *Estheria* and its valves.

He states that "In the Universal Exhibition at Paris in 1867, the Argentine Republic exhibited bituminous shales (Brandschiefer), containing numerous shells of an *Estheria*, together with other bituminous substances, such as 'Carbon de Piedra,' from the district of San Lorenzo, province of Mendoza. Professor Stelzner has collected specimens of a similar Brandschiefer or bituminous shale at different places in the Sierra of Mendoza, as near Challao,¹ at the Agua salada, west of the town, at the Cerro de Cacheuta, south of the same, and at the Agua de la Zorra in the Sierra de Uspallate. These shales are full of the same *Estheria*." The specimens illustrated by Dr. Geinitz, if regarded as showing their true shape, would represent more than one species, very difficult to identify with any known forms. They all seem, however, to have been more or less distorted by pressure, and to this cause, rather than to natural proportions, it appears likely that the diverse positions of the umbo, in relation to the antero-dorsal corner of the test, and the modifications of the concentric ridges, and the differences in the outlines, may possibly be due.

On careful consideration, it is evident that his fig. 4 is, of all the series, the most like *E. Mangaliensis*, Jones, and that figs. 1 and 2 may belong to the same species, but have been obliquely narrowed by pressure. Of the other three, fig. 5 is most like *E. Forbesii*, Jones, as to outline and number of ridges, but has been narrowed vertically by pressure. Figs. 3 and 6 differ from the others, and from each other, by the position of the umbo, number of ridges, and general shape. In explanation of the above remarks, the following notes are given:—

§ III. (1) *ESTHERIA MANGALIENSIS*, JONES.

Estheria Mangaliensis, Jones, "Monogr. Foss. *Estheriæ*": Pal. Soc. 1862, p. 78, pl. ii, figs. 16–23.

———— Geinitz (*pars*), Palæontographica, Suppl., iii, Palæont. Theil ii, Abth. 2; Beiträge, etc., 1876, p. 3, pl. i, fig. 4 and figs. 1 and 2?

———— Middleton, Intellect. Observer, No. xxi, October, 1862, p. 317.

———— Medlicott and Blandford, "Manual Geol. India," 1879, p. 130, woodcut; 2nd edit., 1893, p. 170, woodcut.

¹ In his "Reise durch die La Plata Staaten," etc., 2 vols., 1861, at page 277 of vol. i, H. Burmeister observed at some places "remnants of Cypridinen-Schalen, with the little Crustaceans characteristic of the Coal-formation of Europe." In his "Description physique de la République Argentine," 5 vols., 1876–8, in vol. i (1876), p. 262, Burmeister states that "on the eastern side of the mountains, towards the plain of the Pampa, is a small ravine opening out above the Bath of Challao; and in it are some black, irregularly flaking shales, like the Coal-shales; and these contain here and there traces of carbonized leaves, and on other surfaces impressions of little shells, like the valves of *Cypridina*, that remarkable Crustacean genus, belonging to the Phyllopora, near the genus *Estheria*, and so characteristic of the Coal-beds of Europe." Burmeister here evidently alluded to the "Cypridinen-Schiefer" (*Entomis*-shales) characteristic of the Devonian (not the Carboniferous) of Europe from Russia to England.

Adult carapace-valves, broadly subovate in outline. Length 8·3, height 5·6 mm. Young forms, subtriangular or suboblong. Its resemblance to *E. Gihoni* is mentioned at p. 78, op. cit.

The original was from Mangali in Central India, probably of Rhætic age. Dr. Geinitz's specimens (see above) were from Challao and elsewhere¹ in the Mendoza province of the Argentine Republic; accompanied by *E. Forbesii* if we take Geinitz's fig. 5, pl. i (1876), to represent the latter species. Of the six figures referred by Dr. H. B. Geinitz to *E. Mangaliensis* (op. cit. 1876), one, namely fig. 4, seems to represent this species, and figs. 1 and 2 may also belong to it.

	CONCENTRIC RIDGES.	MESHES FROM RIDGE TO RIDGE.
<i>E. Dahalacensis</i>	14-15 . . .	6-7
<i>E. Gihoni</i>	14-15 . . .	6-7 adult, but not so old as the others.
<i>E. Mangaliensis</i>	16-17 . . .	7-8
<i>E. Forbesii</i>	22-23 . . .	17-18

E. Forbesii (numbers imbedded in a brownish shale) was brought to England by David Forbes in 1861 from Cacheuta, in the province of Mendoza.

Professor Philippi's specimens of *E. Mendocina*, referred to further on, also came from near Cacheuta in Mendoza. It bears a close resemblance to *E. Forbesii*, and measures 11 × 8 mm.

§ IV. STELZNER; CACHEUTA, 1885.

The Cerro de Cacheuta, on the eastern slope of the Andes, 3500-4000 feet above the sea, is about twenty miles S. by W. of Mendoza city (33° S. lat.), in the Argentine Republic. Its geological structure is shown in Stelzner's map and sections (pl. iii) in his "Beiträge zur Geologie und Palæontologie des Argentinischen Republik," I, Geologischer Theil, 1885, p. 76, etc.; in Fischer's "Palæontographica," Suppl. iii, Lieferung ii, Heft 1, "Ueber die geognostischen Verhältnisse der Umgegend von Mendoza," etc.

This hill of Cacheuta consists mainly of gneiss and mica-schist, with a central mass of intrusive igneous rocks ("trachyte, andesite, and basalt"). On one flank of the hill strata of variegated sandstone, with clay and carbonaceous shale, lie in a broken syncline with steep sides. These beds are referred to the Rhætic series.

§ V. PHILIPPI, 1887.

In his "Die Tertiären und Quatären Versteinerungen Chiles," etc., 1887, Dr. R. A. Philippi described and gave some small figures of two kinds of *Estheria*, p. 223, pl. L, figs. 11 and 12. The little outline, fig. 11 (16 × 12½ mm.) is described as a suborbicular form, like "*Estheria Dahalacensis*" (probably by accident or error), slightly oblique, very thin, almost flat, with irregularly concentric wrinkles; one margin nearly straight, with the umbo at two-fifths of its length. Philippi named it *Estheria? Chilensis* (reproduced

¹ Of the six specimens it is stated, at p. 16, that they came from Agua de la Zorra, Challao, Agua salada, Cerro de Cacheuta, and San Lorenzo.

in Pl. X, Fig. 5); and stated that it came *probably* from the district of Lebu. This is on the sea-coast in the province Arauca, Chili, 37° 36' (or 37° 39') S. lat., and is said to be on a Tertiary formation, in which are seams of lignite or coal, associated with shales bearing Tertiary marine shells. Stelzner intimates that Philippi's researches (1878 and 1883) prove the existence there of both an Eocene and a later Tertiary formation. See also Philippi, "Tert. u. Quat. Verst. Chiles," 1887, p. 17.

The little sketches in fig. 12 (11 × 8 mm.) have in their general aspect the look of *E. Forbesii*, being subovate, with a long, straight back; and, although the curvatures of the ends do not correspond (possibly having been squeezed), the specimens shown by fig. 12 (reproduced in Pl. XI, Fig. 2) may safely be referred to the above-mentioned species. Philippi mentions that they came from Cacheuta in Mendoza, and named them *E. ? Mendocina*. Unfortunately, he stated that they are like a "*Posidonia*." Most probably by some accident "*Posidonia*" and "*E. Dahalacensis*" were erroneously misplaced one for the other by the author in writing his notes on these two species.

To make the subject quite clear the following notes are necessary :

§ VI. (2) ESTHERIA FORBESII, JONES.

PLATE XI, Fig. 2.

Cypridina, Burmeister, 1861, "Reise durch die La Plata Staaten," vol. i, p. 77; "Descrip. Phys.," etc., vol. i, 1876, p. 262.

Estheria Forbesii, Jones, "Monogr. Foss. *Estheriæ*": Pal. Soc. 1862, p. 109, pl. iv, figs. 8-11.

E. Mendocina,¹ Philippi, "Tert. u. Quat. Verst. Chiles," etc., 1887, p. 223, pl. L, fig. 12.

E. Megalensis (pars), Geinitz, "Beiträge zur Geologie und Palaeontologie des Argentinischen Republik," II, Palaeont. Theil, Abth. 2; "Ueber Rhaetische Pflanzen- und Thier-Reste in den Argentinischen Provinzen La Rioja, San Juan, und Mendoza," 1876, p. 3, pl. i, fig. 5.

This straight-backed *Estheria* is suboblong when adult ("Monogr. Foss. *Esth.*," pl. iv, fig. 8), with about twenty-two concentric ridges; their interspaces reticulate, with about seventeen meshes from ridge to ridge. In the young state (fig. 9, with 13 ridges; and fig. 10, with only seven) the shape is subcircular or subquadrate, as in other young *Estheriæ*. The adult form (fig. 8) measures—length 11·2, height 7 mm.

E. Forbesii much resembles several other known *Estheriæ* in general shape and in style of ornament; but there are points of difference in all these cases. Some varieties of the Triassic *E. minuta* may be alluded to: such as "Monogr.," pl. ii, fig. 9, var. *Brodieana*;

¹ The province of Mendoza, indicated by the name *Mendocina*, formerly belonging to Chili, and so referred to by Philippi, was previously known as Cuyo, and part of La Plata. It is now described by geographers as belonging to the Argentine Republic, the mutual boundary having been settled by a treaty in 1881. The limit passes along the crest of the Andes down to the Magellan Straits.

also fig. 16, *E. Mangaliensis*; and *E. minuta* var. *latitexta*, GEOL. MAG. 1890, PL. XII, Fig. 8. These approach one another in outline and ornament, but appreciable differences are readily discernible.

Among recent species, *Estheria Dahalacensis*, Straus-Durckheim, and *E. Gihoni*, Baird, are also straight-backed forms, with reticulate ornaments between the ridges, but there are differences in outline and surface.

§ VII. (3) *ESTHERIA ARICENSIS*, sp. nov.

PLATE X, Figs. 1-3.

This species is based on some specimens which the late David Forbes, F.R.S., brought to England, in 1861, from Arica in Southern Peru (now held by the Chilians), in 18° 25' S. lat., 70° 15' W. long. These fossils have been placed in the British Museum (Nat. Hist. Branch) since *Estheria Forbesii* was described by me in 1862. They are illustrated by Figs. 1-3, and are obliquely subcircular (not unlike some forms of *Posidonomya*), with the longest diameter at an angle of about 60° to the hinge-line. This latter is usually about half the length of the valve, but sometimes two-thirds. The umbo is in the anterior third of the cardinal margin, and rather prominent above the hinge-line.

The concentric ridges are numerous (16 or more), mostly large and coarse, but somewhat obscured by pressure and the granular sandy condition of the matrix. In one large hollow mould (unfortunately imperfect, Fig. 3), vertical barrolets, or small transverse ridgelets, are visible in the broader interspaces.

These specimens from Arica measure—

Fig. 2, length 9.4 mm., height 8.0 mm.

Fig. 1, length 13.63 mm., height 9.45 mm.

Fig. 3 (imperfect), length 17.0 mm., height 15.02 mm.

From a fractured internal cast of a valve, the thickness of the closed carapace of a large individual may have been about 4 mm.

They occur on the bed-planes of a hard, black, irregularly fissile, sandy shale, which has weathered brown inwards to some distance from the surface. According to David Forbes's label they came from "Bed F, Morro de Arica." The hill near the town rises to about 500 feet above the sea-level. He was there in 1857, and on May 27, 1861.

In the Quart. Journ. Geol. Soc., vol. xvii, 1861, pp. 35-6, he described the section as exhibiting a succession of interstratified shales and porphyries, to which, although regarded as Carboniferous by D'Orbigny, D. Forbes hesitated to assign any definite age, for want of evidence.

These *Estheriæ* from Arica differ from Philippi's *E. Chiliensis*¹ by the greater obliquity of the valves and more definite hinge-line. Philippi's published sketch, op. cit., 1887, pl. L, fig. 11, gives, however, poor data for a decision. (See Pl. X, Figs. 4 and 5.)

¹ 1887; see above, p. 262.

The obliquity of these suborbicular valves (about 60°) approximates to that of *Cyclestheria*, as defined by G. O. Sars¹; but the latter is much more nearly circular in outline (Fig. 6).

The more protuberant umbo, further from the anterior corner, and the more distinctly level straightness of the hinge-line behind it, are distinctive characteristics, as well as the somewhat more prolate antero-dorsal region of the valve in front of the umbo.

(To be concluded in our next Number.)

NOTICES OF MEMOIRS.

I.—ON THE DISTRIBUTION OF MARINE MAMMALS.² By P. L. SCLATER, M.A., Ph.D., F.R.S., Sec. Zool. Soc.

(Read before the Zoological Society, March 16, 1897.)

I. Introductory Remarks.—Most of the recent writers on Geographical Distribution have confined their attention to terrestrial mammals, or at any rate have but casually alluded to the marine groups of that class. On the present occasion I wish to call your attention to some of the principal facts connected with the distribution over the world's surface of the marine or aquatic members of the Class of Mammals.

Aquatic mammals, which pass their lives entirely, or, for the greater part, in the water, are, of course, subject to very different laws of distribution from those of the terrestrial forms. As regards aquatic mammals, land is of course an impassable barrier to their extension, and, subject to restrictions in certain cases, water offers them a free passage. Just the opposite is the case with the terrestrial mammals, to which in most cases land offers a free passage, while seas and rivers restrain the extension of their ranges.

The groups of aquatic mammals that are represented on the earth's surface at the present time are three in number, viz.: (1) the suborder of the Carnivora, containing the Seals and their allies, generally called the Pinnipedia, which are semi-aquatic; (2) the Sirenia, which are mainly aquatic; and (3) the Cetacea, which never leave the water, and are wholly aquatic. We will consider briefly the principal representatives of these three groups, following nearly the arrangement of them employed in Flower and Lydekker's "Mammals, living and extinct."

¹ Christiania Vidensk.-Selsk. Forhandl. 1887, No. 1, pl. i, figs. 1-3. Dr. Baird gave a rather more symmetrical form to this subcircular species (Proc. Zool. Soc. 1859, p. 232; and 1860, p. 188, pl. lxiii, fig. 1), triangular on the dorsal and rounded on the ventral margin. His figure, if placed with the hinge-line horizontal, shows a subcentral umbo, with the hinge-line almost level behind it, and equal to half of the transverse diameter of the valve. There is a rapid slope in front, meeting the anterior part of the more than semicircular free margin.

² For the Land-Provinces proposed by the author for the Geographical Distribution of Birds, see Dr. P. L. Sclater's paper in Journ. Proc. Linn. Soc. (Zoology) 1858, vol. ii, pp. 130-45; also Rep. Brit. Assoc. 1860, Trans. Sec., pp. 121, 122; H. Woodward, Geol. Mag. 1885, Decade III, Vol. II, p. 315, and Proc. Geol. Assoc. 1886, vol. ix, No. 5, p. 366.