the border districts of the Ethiopian and Palæarctic Regions (Red Sea coasts), *Rh. midas* from the shore of the Persian Gulf. These, as well as the four truly "Mediterranean" species, are undoubtedly of Oriental origin. Worth noticing is the close faunistic connexion between the Spanish Peninsula and N.W. Africa (Algeria) : the same race (*obscurus*) of *ferrum-equinum*.

Central Europe :—*Rh. ferrum-equinum typicus* ; *Rh. hipposiderus typicus*.—The Central European *Rh. hipposiderus* is slightly different from the Mediterranean form.

British Islands :—*Rh. ferrum-equinum* ; *Rh. hipposiderus minutus*.—Both of the Central European species have reached the British Islands. *Rh. hipposiderus*, as being the more hardy of the two species, as having spread over the whole of England and to several places in Ireland, and as having become to a certain slight degree different from the continental form, was probably the earliest comer. The range of *Rh. ferrum-equinum* is restricted to the southern part of England.

The whole Area of the Genus.—All the now-existing species can be referred to six "types." All the types can be traced back to some part or other of the Oriental Region. From there they have spread eastwards as far as Eastern Australia and Japan, south-westwards over the whole of the Ethiopian Region, westwards to Southern and Central Europe.

LXXIV.—*On the Oscules of* Cinachyra.

By R. Kirkpatrick.

[Plate XIV.]

While engaged in the investigation of specimens of *Cinachyra barbata*, Sollas, obtained by the 'Discovery' from the Antarctic, I was led to examine examples of that species obtained by the 'Challenger' from Kerguelen and described by Sollas in his Report on the Tetractinellida.

Specimens of this species are spheroidal or ovoidal in shape and with a root-tuft ; the surface bristles with a pile-like coat of spicules, which are mostly protriænes. Arranged round the sides of the sponge are flask-shaped recesses with oval or circular orifice and with the margins guarded by a

fringe of needles rising above the general surface; on the upper part of the surface are smaller orifices, likewise surrounded by a spicular fringe.

Sollas (9, pp. xxxv, 27) regarded the flask-shaped recesses as being either vestibules or cloacas, though he failed to find any structural differences in them, and for convenience of description he called them all oscules. The smaller orifices and pits near the summit were considered to be young undeveloped vestibules and cloacas of the same kind as those on the rest of the surface.

The good state of preservation of numerous specimens from the Antarctic has enabled me to clearly distinguish two kinds of depressions—vestibular and cloacal; and later I was able to note the same distinction in the 'Challenger' specimens.

Cinachyra barbata in its adult condition (Pl. XIV. fig. 1) shows three zones:—(1) a basal root-tuft zone; (2) a broad "equatorial" zone of poral vestibules; and (3) a superior or "polar" zone of oscules (*sensu stricto*). In good specimens these zones are clearly obvious to the naked eye, for the surface pile of spicules is higher and looser in the poral than in the oscular zone and slopes downwards; the pile in the oscular area is shorter and denser and points vertically upwards, presenting, in fact, a stubble-like appearance.

The orifices of the poral vestibules are usually wide open, though even large ones may be closed; but in almost every instance the oscules are tightly shut, the marginal fringes being closed over them in the form of conical stacks.

The shape of many of the specimens from Kerguelen is oval and the poral zone and oscules are arranged obliquely to the long axis. Often, too, at first sight no trace of oscular fringes or oscules is apparent; but by rubbing off the surface pile at the superior end of the body, so as to leave a tonsure-like patch, the oscules become visible as minute dark pin-points on the surface (Pl. XIV. fig. 3).

Prof. Sollas has given such a full account of the poral vestibules that there is no need to say anything further about them here. The oscules are few in number in comparison with the vestibules; in one specimen there are seven of the former arranged in an open spiral on the summit and over forty of the latter.

Usually the oscules appear as low monticules each with a shallow crater-like cup, but occasionally they may be flush with the surface. On making a section so as to cut vertically through an oscule, usually, owing to the extreme state of contraction, no passage can be seen, but simply a break in the continuity of the white cortex, the fleshy tissues of the

oscular channel being pale reddish. On dissection and magnification, however, a simple canal with deep longitudinal folds is easily made out; below the cortex the passage leads into a main exhalant canal coming from the centre and into large lateral canals (Pl. XIV. fig. 2).

As regards the homologies of the poral vestibules and the shallow, crater-like, oscular depressions, these both seem to be ectodermal invaginations, and the vertical intracortical preoscular tube to be the terminal exhalant canal (or gastral cavity?).

Lendenfeld (7, p. 26), who records eight species of *Cinachyra*, gives as the definition of the genus :—"Ausströmungsöffnungen klein, zu Gruppen vereint am grunde kahler, schalen-, kelch-, oder sackförmiger Einsenkungen der Oberfläche." Obviously this definition must be emended, since in *C. barbata*, the type of the genus, the oscules are simple and separate and open each into a single intracortical channel, which latter receives the main exhalant canals. If for "Ausströmungsöffnungen" the word "Poren" were substituted, the definition might stand.

On referring to the descriptions and figures of other species of *Cinachyra* it seems to me possible that misinterpretations concerning the pores and oscules may have been made in some of them also. In *Cinachyra Schulzei*, Keller, from the Red Sea, Keller (3, p. 337, pl. xix. figs. 41, 42) figures a sponge with numerous depressions all apparently alike in general character: fig. 42 depicts an enlarged view of a section showing the surface of one of these depressions; here we see pores with inhalant canals radiating out from them into the body of the sponge; at the base of the depression are slightly larger orifices opening into wider canals. Keller assumes that the larger orifices are the oscular openings of exhalant canals. The latter, except that they are a little wider, look very like the inhalant ones, and, *à priori*, it seems unlikely that excrementitious orifices should be situated in the floor of a deep pit surrounded by inhalant orifices, natural selection tending to keep the inhalant and exhalant systems each out of the way of the other. A comparison with *C. barbata* would lead one to suggest that the depressions in *C. Schulzei* are poral vestibules, and that extremely contracted oscules situated elsewhere (probably near the summit) have escaped notice.

Cinachyra eurystoma, Keller (3, p. 338, pl. xix. figs. 46, 48), from the Red Sea, looks like a young immature form; young specimens of *C. barbata* have several relatively large

vestibules, with, perhaps, only one minute oscule. The figure of a section of a depression (3, fig. 48) shows small openings leading each by a narrow tube to moniliform canals; possibly here also the vestibules are purely poral, and a careful search might reveal a much contracted oscule. Similarly the circular zone of depressions shown in the figure of *C. trochiformis*, Keller (3, p. 340, pl. xix. figs. 44, 45), from the Red Sea, is possibly vestibular, and an examination of the conical summit might show the existence of oscules in the form of minute contracted points.

Cinachyra amboinensis (Kieschnick), from Amboina (4, p. 556), is globular or egg-shaped and has a zone of poral depressions and a single osculum at the summit.

Cinachyra hirsuta (Dendy) (2, p. 75), from the Gulf of Manaar, is spheroidal and firmly attached by a broad base to a piece of rock. Here there is a zone of depressions and one large osculum situated to one side of the summit. Dendy believed that some of the depressions were pore-areas, others oscular areas; after an examination of the specimen I have come to the conclusion that all the depressions are poral vestibules. The variation in shape and depth, some being shallow and hemispherical, others deep and tubular, appears to me to result from differences in age and in the degree of contraction.

Cinachyra Voeltzkowi, Lendenfeld (6, p. 101, pl. ix. fig. 39), from Zanzibar, appears, at first sight, to present in the arrangement of its pores and oscules a complete exception to what is found in other species of *Cinachyra*. The three specimens are spherical. Two of the examples are only 8 mm. in diameter and have only one depression each; a larger one, 2 cm. in diameter, has fifteen depressions. Lendenfeld observes (6, p. 101):—"An der oberfläche finden sich allenthalben Poren, doch sind in den Weingeistexemplaren nur jene an den konvexen, pelztragenden Teilen offen, die, wie es scheint kleineren und zahlreicheren, in den kahlen Vertiefungen dagegen, geschlossen. Von den ersteren ziehen offene Kanäle herab, welche die rinde durchsetzen."

Lendenfeld regards the "Poren" on the general surface as inhalant and those in the depressions as exhalant, and describes one of the depressions themselves as "glattwandiger praeoscularraum" (*l. c.* p. 129). He observes (*l. c.* p. 103) that very possibly pores are present on the surface of *C. bar-*

bata outside the depressions and that they have been overlooked by Sollas. I have carefully searched for these pores and have not been able to detect any; indeed, it would be surprising if pore-canals could penetrate the dense palisade of cortical oxeas. Since the depressions are smooth-walled and the pores in their walls are smaller and more numerous than those on the general surface, I think that probably the depressions are poral vestibules similar to those of *C. barbata*, that some of the "Poren" on the surface are oscules, possibly much contracted, and that this kind will be found occupying a more or less definite area.

An eighth species of *Cinachyra* mentioned in Lendenfeld's list, viz. *C. robusta* (Carter), from Mergui (1, p. 79), remains to be noticed. The Natural History Museum possesses one half of the type specimen. Judging from its appearance, I should take it to be a macerated specimen of *Tetilla* which has become much worn down with age and rough usage from strong currents, so that the whole of the cortex has become denuded, leaving large open spaces and caverns between the radiating fibres of the skeleton. Carter (*l. c.* p. 79) writes:— "The spicules of the interior, which project so abundantly as to produce a hispid condition of the surface, are so matted together by the mud in which the sponge has grown on the subjacent rock that, in taking off this crust, the 'forks' and 'anchors,' together with the projecting ends of the 'body-spicules,' *all come away with it.*" Sollas's designation (9, p. 48), viz. *Tetilla robusta*, of Carter's *Tethya cranium*, var. *robusta*, seems to me correct.

Apparently only one of the seven species at present retained in the genus *Cinachyra* has a cortex with a dense palisade of oxeas, though several of the others appear to possess a thick fibrous cortex.

Very young specimens of *Cinachyra* are conical and have only one large poral vestibule, situated inferiorly and at one side, the one oscule being at or near the summit. This asymmetrical arrangement calls to mind the sponge *Spongocardium Gilchristi*, Kirkp. (5, p. 224), from South Africa. I now think that *Spongocardium* must be regarded as a synonym of *Fangophilina*, O. Schmidt (8, p. 73, pl. x. fig. 3), in spite of the fact that *F. submersa* has a well-developed root-tuft, and *F. Gilchristi* appears not to possess this appendage, though a root-tuft may have been torn off in dredging.

F. Gilchristi has two deep depressions, poral vestibular and cloacal, the former having smooth walls perforated by minute pores and the latter having orifices of oscules in its base.

Judging from his description and figure, Schmidt, I believe, mistook the nature of these depressions, describing the poral as cloacal and *vice versâ*; for the smooth-walled deep depression of *F. Gilchristi* is undoubtedly a poral vestibule and not a cloaca. Without a knowledge of the development it would be difficult to say whether the openings in the floor of the cloacal depression in the latter species are to be regarded as an assemblage of oscules or as orifices of exhalant canals opening into a cloaca terminating in one oscule; the first hypothesis seems the more probable one.

To sum up: the depressions on the surface of the seven species of *Cinachyra* are probably in every instance poral vestibules, the oscules being separate and distinct.

Literature.

(1) Carter, H. J. "Report on the .... Sponges from .... Mergui Archipelago ...." Journ. Linn. Soc., Zool. 1887, vol. xxi.
(2) Dendy, A. "Report on a Second Collection of Sponges from the Gulf of Manaar." Ann. & Mag. Nat. Hist. 1889, (6) iii.
(3) Keller, C. "Die Spongienfauna des rothen Meeres.—II." Zeitschr. f. wiss. Zool. 1891, Bd. lii.
(4) Kieschnick, O. "Kieselschwämme von Amboina. Zool. Forschungsreisen Semon." Denkschr. Gesellsch. Jena, 1900, Bd. v., Text.
(5) Kirkpatrick, R. "Descriptions of South African Sponges.—I." 'Marine Investigations in South Africa,' 1902.
(6) Lendenfeld, R. von. "Spongien von Sansibar." Abhand. Senckenberg. Gesellsch. 1899, Bd. xxi.
(7) ——. 'Das Tierreich.' Lief. 19. 1903. Porifera Tetraxonia.
(8) Schmidt, O. 'Die Spongien des Meerbusen von Mexico.' 1879.
(9) Sollas, W. J. "Report on the Tetractinellida collected by H.M.S. 'Challenger.'" Zoology, vol. xxv. 1888.

EXPLANATION OF PLATE XIV.

Fig. 1. *Cinachyra barbata*, Sollas, from the Antarctic, natural size. *a*, zone of poral vestibules; *b*, zone or area of oscules.

Fig. 2. Vertical section through an oscule, × 5. *a*, oscule; *b*, cortex; *c*, main excurrent canal; *d*, foraminiferan shell.

Fig. 3. *Cinachyra barbata* from Kerguelen ('Challenger'). The surface pile of spicules has been rubbed off in the oscular region to show the oscules, which are here contracted to pin-points. *a*, oscules.