‘EDWARD HERON-ALLEN FRS: SCIENTIST’
PROCEEDINGS OF THE 4TH HERON-ALLEN SYMPOSIUM, 2004

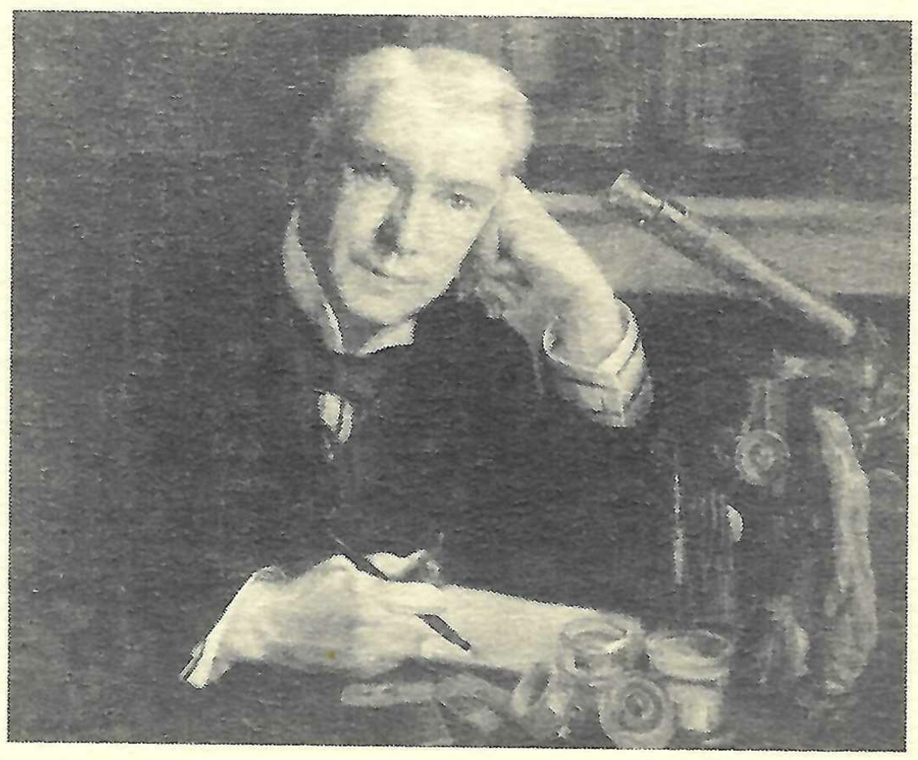
Edited by

JOHN E. WHITTAKER

TALKS DELIVERED AT THE
FOURTH HERON-ALLEN SYMPOSIUM,
THE NATURAL HISTORY MUSEUM LONDON,
JULY 2004

BY

RICHARD L. HODGKINSON, MICHAEL A. KAMINSKI,
CLIVE JONES AND
ANDREW S. HENDERSON & JOHN E. WHITTAKER



Opusculum VII
Heron-Allen Society

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‘Edward Heron-Allen FRS: Scientist’: Proceedings of the 4th Heron-Allen Symposium, 2004: Talks delivered by Richard L. Hodgkinson, Michael A. Kaminski, Clive Jones, Andrew S. Henderson and John E. Whittaker at the Fourth Heron-Allen Symposium, The Natural History Museum, London, July 2004.

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Cover: Edward Heron-Allen, the scientist, in his library at “Large Acres”, Selsey, surrounded by his microscope, samples and foraminiferal slides. From a photograph of an original painting by Winifred E.B. Hardman, dated 1922.

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THE FOURTH HERON-ALLEN SYMPOSIUM AT THE NATURAL HISTORY MUSEUM, LONDON

by JOHN E. WHITTAKER

The theme of the Society's 4th Annual Symposium, held on Saturday 3rd July 2004, was 'Edward Heron-Allen FRS: scientist', and where better to hold it than The Natural History Museum, London. It was at the Museum that Heron-Allen spent thirty years as a researcher on the Foraminifera, much of that time in collaboration with Arthur Earland.

Following an introduction to the Foraminifera (Hodgkinson), the second talk (Kaminski) dealt with Heron-Allen's theory, deemed controversial at the time by some, on purpose and "intelligence" in the Foraminifera, one of the mysteries that so attracted him to the group. Since 1925 the Museum has held Heron-Allen's magnificent scientific library and the third talk (Jones) concentrated on some of its treasures. The final offering (Henderson & Whittaker) was a travelogue of an actual scientific expedition, the Clare Island Survey of 1911, based on archive documents and Heron-Allen's own Travel Journal. To create the right ambience, some of the talks were illustrated by genuine Heron-Allen lantern-slides, using a 1910 Lantern Slide Projector.

Ample opportunity was given to visit the Heron-Allen Library in the Department of Palaeontology, and to see the few items of furniture that remain from his scientific room at the Museum, including the 'Hepplewhite' chairs which he had inherited from his directorship of the Westminster Fire Office. Thanks to the cooperation of the Mineralogy Department of the Museum, a cabinet of Heron-Allen's rock and mineral donations was displayed, including the infamous 'Purple Sapphire' and the curious Hangchow pseudo-meteorite.

AN INTRODUCTION TO THE FORAMINIFERA

by RICHARD L. HODGKINSON

Edward Heron-Allen first became interested in the study of the Foraminifera at Preparatory School, but he was unable to devote the necessary time to it until he retired from his grandfather's legal firm. He then asked for help from Fortescue William Millett and Charles Elcock, both well known amateur foraminiferologists, and through them also began his long partnership with Arthur Earland. This story has already been told by Hodgkinson & Whittaker (2003).

WHAT ARE FORAMINIFERA?

Foraminifera belong to the same group as the *Amoeba* and to the larger grouping variously known as Protozoa or Protista. They are unicellular and normally enclosed in a perforated shell, which gives them their name the "pore bearers", from the Latin. They are blind in the way we perceive blindness, but respond to tactile and chemo-stimuli. Some are free living, some sedentary. The body is a blob of living material called the cytoplasm, controlled by a central nucleus which houses all the genetic material; we call the cytoplasm and nucleus together, the protoplasm. The protoplasm is surrounded by a membrane which controls its shape. In nearly every case this membrane is contained within a chambered shell (called the test), which gives overall protection. Foraminifera are not dynamic so the student needs patience (and preferably some time-lapse photography) to observe their lifestyle. They are usually very small in size (less than 1mm), so a good microscope is needed to examine them. Nevertheless, some are known to grow to over 15cm in diameter (the so-called "larger foraminifera"), remarkable for a single-celled animal.

To distinguish between one species and another, the only thing we can do is to look at the differences in their shell shape and composition. We know a little about their genetics but, to date, only the DNA of a relatively few species has been examined, giving clues to their relationships.

The shells are not only very beautiful, but their formation and composition are wonders of nature. Shells are formed in two principal ways. Some species collect sand grains or specific minerals from their environment and stick them to the containing membrane and to each other, to make a strong shell. Others extract calcium carbonate (chalky material) from the water to build their shell. These latter can build shells in two dimensions, for every time a chamber is added the wall is thickened with another layer making it extremely strong, or it can add lateral chambers. Except in the most simple of foraminifera, this shell is not like that of a mollusc (snail) - which is just one continuous chamber - but more like that of the ammonite or nautilus and is multi-chambered.

They grow by building new chambers. Once the foraminifer builds a shell it needs to have a big opening (the aperture) to enable the cytoplasm to get in and out and for voiding dissolved waste products, and small pores to let in air which is dissolved in the water, and for light to support symbiotic algae. A new chamber is added to the previous chamber and they continue to be added throughout life. The cytoplasm occupies all the chambers and the one nucleus is found somewhere in the middle of the shell. It is unlike the nautilus which lives in the last chamber and whose earlier chambers are filled with gas for buoyancy. The many different ways chambers are added results in the wide variety of shell shapes that we can observe. For instance, the genus *Alveolinella* has developed along the lines of a Swiss roll, the new chambers being pulled out in the long axis and the whole shell attaining a length of 1inch (2.5cm). Heron-Allen would

have observed a similar, but smaller fossil genus (*Alveolina*) in the Mixon rocks, off Selsey. In some foraminifera the chambers are added alternately (e.g. *Bolivina*), in others they build in two planes: one set of chambers being added in the horizontal plane, whilst adding another set - the lateral chambers - in the vertical plane (*Lepidocyclina*). Some build a series of chambers in a straight line (*Dentalina*), a great many use the form of a coil, either in a planispire (*Elphidium*), or in a low trochospire (*Ammonia*), whilst a few branch and then seem to go haywire and double-back on what they have already built (*Placopsilina*). There are even some foraminifera that comprise but a single chamber and look like a Greek amphora (*Lagena*). The Heron-Allen Society Christmas Card of 2003 well illustrates the vast variety of these shapes (Fig. 1). It is a photograph, suitably doctored by Clive Jones, of a composite foraminiferal slide in the Heron-Allen Collection.

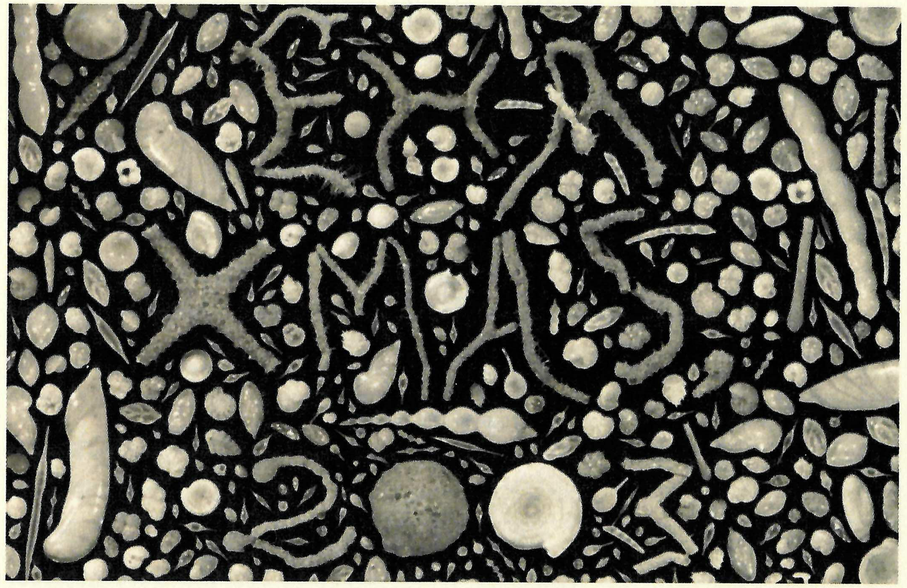

Fig. 1 The Heron-Allen Society Christmas Card of 2003, showing a vast range of foraminifera. Digitally modified from a slide exchanged between Edward Heron-Allen and Arthur Earland in 1912. Magnified x5.

A closer look at the details of the living arrangements and lifestyle in a typical specimen will explain the above even better. The shell has an opening to the exterior called the aperture. This is a doorway without a door and so it cannot be closed; it can be subdivided to appear like as portcullis, through which extend threads of the living jelly contained in the membrane, called the pseudopodia (false feet). These are not only used to help the shell move, by extension and retraction, but also for feeding. Their shape is determined by the use (Fig. 2). For feeding they tend to be very fine, like fishing lines or nets and are able to stick to food, which may be larger than themselves. They are very strong and can be under considerable tension. Food can be pulled back to the aperture to be drawn into the shell, or it may just stick to the pseudopod and be moved towards the mouth by a process like that of a conveyor belt. Extracellular digestion can take place whilst the food is in contact with the pseudopodia. We are not

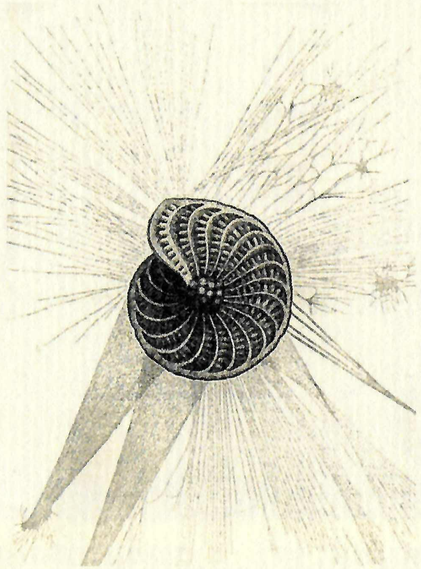

Fig. 2 The living foraminifer *Elphidium*, showing various types of pseudopodia emerging from the apertures in the shell. From an original Heron-Allen lantern-slide. Magnified x30.

sure how the prey dies, whether by predigestion or by exhaustion as it struggles to escape (rather like the spider's method of feeding). What happens to the prey once it is drawn into the shell is a complicated process within vacuoles, which are little sacs containing enzymes, and then the energy produced fuels the animal's metabolism. For moving, on the other hand, the pseudopodia tend to be rather more robust and when they are not moving they act as anchors to the substrate.

THE LIFE CYCLE

How does a foraminifer pass on its genes to the next generation? They live in estuaries or in the ocean. They live in mud, attached to sea-weeds, or are floating free. Procreation is a very chancy business to an almost non-motile, blind (but chemically aware) animal. How do they reproduce?

They have two methods, but the penalty of reproduction is normally their own death, because almost all the protoplasm leaves the shell. Bacterial decomposition takes care of the rest. What is left is the empty shell, which we find washed up on the beach or in our geological samples. These are the remains that Heron-Allen found when collecting on the beach at Selsey or when he processed samples from the Chalk.

The first method of reproduction is asexual. The cellular body (nucleus and cytoplasm) divide up and recombine into equal portions. Each portion then forms a tiny rudimentary shell of two or three chambers and releases itself from the parent shell. All these offspring contain the same genetic information as the parent and are miniature look-alikes. This type of division is known as mitosis. Each offspring then settles on a suitable substrate and begins to feed and grow. The interesting thing to the foraminiferologist is that the initial chamber is usually quite large. This animal is referred to as the megalospheric form of the species, and tells us what type of reproduction it has undergone.

The second means of reproduction is sexual. It is normally less common because it involves the fusing of gametes in the open sea, a risky and uncertain process. Within the nucleus is housed the genetic material called chromatin. This cleverly splits itself so that each portion contains half the genetic material of the parent, and is surrounded by a little blob of cytoplasm within the membrane. This produces double the number of units, all containing the same genetic information (mirror halves), a division known as meiosis. This material on its own is useless. However as the parent releases these little units (called gametes) into the water, so do all the other parental foraminifera of the same species. The gamete of one fuses with that of another and a new foraminifer is formed, with half the genetic material of each parent, the genes chemically bonding in correct sequence with its opposite number. The first chamber thus formed is very tiny. This foraminifer is referred to as the microspheric form, and we know from this how it was formed. It grows and grows by adding chambers and can become quite large, often much bigger than its asexual counterpart. The asexual method can continue as a repetitive cycle, only to be broken by a sexual phase. The sexually produced form reproduces asexually and the whole process carries on with little apparent weakening of the strain; this we call the alternation of generations. As we know, continual inbreeding can propagate weaknesses which might end in extinction because of a failure to correct a genetic malfunction. On the other hand, it may lead to the production of a new variety and perhaps, ultimately a new species. It is possible that sexual reproduction might never take place, but if it does it strengthens the stock. In many geological samples two generations of foraminifera are found together, indicating a thriving community in that area over a considerable period of time.

HABITAT

Foraminifera are predominantly marine, although they do make incursions into brackish water (but never freshwater). They can conveniently be separated into two groups - those which float in the surface waters of the ocean, the planktonic foraminifera, and those which live on or in the substrate, the benthonic foraminifera.

The planktonic foraminifera are very small, the shell being about 0.5 mm in size. They are often spiny, and surround themselves with frothy cytoplasm to enhance buoyancy. Since they float freely in the ocean they are truly cosmopolitan and are very useful to the geologist as time horizon markers. The benthonic group might burrow beneath the sea floor, live around thermal vents, attach themselves to seaweed, or cling onto shells or other creatures. Many do not move at all, but most move very slowly, at a maximum of about 6mm per hour. Where they need to attach, the peudopodial bonding is very strong and they are hard to dislodge. Some seem to be permanently attached and are probably unable to move, escaping only by reproduction.

FORAMINIFERA, THE TIME SURVIVORS

We cannot be sure when they first appeared, dates of over 500 million years being a conservative estimate. The earliest forms were primitive and simple, many with a protective coating of mineral grains. By the time of the Carboniferous period (350 million years ago), there were certainly multi-chambered forms with a calcareous shell, and the first really large foraminifera (the fusulines) with shells rolled like a Swiss roll. The latter seemed to have lived in warm, shallow seas and become so structurally complex and prolific over a relatively short space of time, that the various forms are very useful to the palaeontologist when trying to date the rocks in which they occur. Somewhat later, in Cretaceous time (when the Chalk

was laid down and dinosaurs flourished on land) there was another Swiss-roll foraminifer (*Loftusia*), this time with a shell made of glued-together sand grains and the size of a fat cigar, which flourished over a very short period of geological time. In Eocene times, in particular about 55-35 million years ago, nummulites (coin-sized and shaped foraminifera) were extremely common. These had been found by Heron-Allen on the beach at Selsey, washed from rocks in the area now occupied by the Solent. Today, this group has close relatives living in warm equatorial waters.

Foraminifera have often evolved rapidly and are widespread in their distribution. Moreover, because of their small size they occur in large numbers in most types of sedimentary rocks. For these reasons they are very useful to the palaeontologist, especially in the Oil Industry, for dating purposes.

FINALE

It must be said that Heron-Allen was less interested in the use of foraminifera for dating rocks and reconstructing past environments. It was the aesthetic beauty of their shell and the many mysteries of the living organism that made him lose his heart to them. He was to go on and (co)-publish over 70 papers on them over nearly 50 years of active research (see Hodgkinson & Whittaker, 2004), and for this expertise he was elected a Fellow of the Royal Society in 1919.

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EDWARD HERON-ALLEN AND HIS THEORY OF 'PURPOSE AND INTELLIGENCE' IN THE FORAMINIFERA

by MICHAEL A. KAMINSKI

INTRODUCTION

In 1915, during the dark winter days of the Great War, the membership of the venerable Royal Microscopical Society was treated to an ingenious exchange of wit between two of the great natural historians of the day. The Society was host to a debate between its newly elected President, Edward Heron-Allen, who was regarded as more of an "amateur" naturalist, and his long-time friend, the eminent biologist and systematic zoologist, Professor Sir E. Ray Lankester. The "debate", if one can call it that, centred upon the suggestion put forward by Heron-Allen that the selectivity exhibited by several species of "arenaceous" (or agglutinating) foraminifera in building the unique architecture of their tests (shells) revealed…."the possession in these organisms of faculties akin to Purpose and Intelligence" (Heron-Allen, 1915c).

In a richly illustrated lantern slide presentation given to the Society in October of that year, its President-elect concluded that…."there appears to be no organism in the Animal Kingdom, however simple be its structure, which lives a life of its own independently of any other organism, which is not capable of developing functions and behaviour, which in the Metazoa might be called the Phenomena of Purpose and Intelligence".

My talk to you today seeks to trace the development of Heron-Allen's ideas on the "Phenomena of Purpose and Intelligence" as he put it, recall the reactions of his peers and their written replies, and examine whether or not his theory was unique at the time. From the perspective of the period the

entire matter of whether or not the single-celled foraminifera are capable of making any conscious decisions now seems esoteric. Nevertheless, the phenomenon of "grain selection" among agglutinated foraminifera remains a matter of scientific investigation. The generic-level taxonomy of certain groups of these foraminifera is based upon their remarkable capability to build their shells out of certain materials selected from the sediment upon which they live. My presentation reveals that Edward Heron-Allen was not alone in suggesting that protozoa exhibit behaviour that in the higher animals might be considered "intelligent".

HERON-ALLEN'S EARLY OBSERVATIONS ON "SELECTIVE POWERS" AMONG THE FORAMINIFERA

Edward Heron-Allen became interested in the study of Foraminifera while still a schoolboy. One of the reasons why he later chose to live at "Large Acres" in Selsey, was to be near the shore, where foraminiferal-bearing sands could easily be collected during a stroll on the beach. In fact, Heron-Allen himself recalls in his War Journal (Harvey & Fitzgerald, 2002):

> "I am thankful that from my earliest years, whilst I was by profession a lawyer, I have always had some strongly pursued 'hobby' which occupied all my leisure hours, and have carried these hobbies to the point of minute study resulting in a considerable number of published volumes. I refer to the violin, the hand, Umar Khayyám, and the Foraminifera which latter have occupied my attention off and on since I was a boy at Harrow in 1876, and of late years have kept me continuously employed."
>
> - Edward Heron-Allen's War Journal, 21st November 1914.

Heron-Allen's collaboration with Arthur Earland was particularly fruitful. Between 1908 and 1911, this pair of enthusiasts managed to document the foraminifera from the shore sands of Selsey, a work that was published in eight parts in the *Journal of the Royal Microscopical Society*. This is the point where Edward Heron-Allen's affiliation with that Society begins - an affiliation that culminated in his election to

the office of President in January, 1916. As the reputation of this foraminiferal partnership grew, Heron-Allen & Earland were invited to collaborate on other scientific projects, such as the description of the fauna and flora of the Kerimba Archipelago, the Clare Island Survey, the *Goldseeker* deep-sea dredgings, and later, the R.R.S. *Discovery* expeditions. Soon the pair were examining and documenting the foraminifera from various parts of the North Atlantic, Indian, and Southern Oceans.

Among the many studies that Heron-Allen & Earland undertook over the years, perhaps the most thought-provoking were their investigations of agglutinated foraminifera from the North Sea and from the deeper waters of the northern Atlantic. Around 1908-1909, Heron-Allen established a working relationship with Professor D'Arcy Thompson, who was then the Director for the International Committee for Investigation of the North Sea (Scotland). The Heron-Allen & Earland team received sediment samples from some of the deeper dredgings recovered during the *Goldseeker* cruises, and in a series of papers described some of the unusual agglutinated foraminifera that live in the deeper waters surrounding the British Isles. Among the new species discovered in this material was a small tubular species of *Technitella* that was given the name *T. thompsoni*, in honour of Heron-Allen's friend who had provided the sample material. In their paper communicated at the Quekett Microscopical Club in the April

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[Next two pages]

Figs 1-2. Foraminifera from the North Sea, dredged by the Fisheries Cruiser *Goldseeker*. Reproduction of the original lithographic plates from Edward Heron-Allen & Earland (1913), illustrating the selection of varied materials from which these simple agglutinating foraminifera constructed their shell walls. Magnifications between x30 and x40.

1

2

of 1909, Heron-Allen & Earland noted the remarkable ability of this organism to select only echinoderm plates of a certain size and neatly cement them together to build a tubular shell. In the discussion to their paper, they remarked:

"Of all the arenaceous foraminifera, *Technitella* is the neatest builder, and displays the highest development of selective power in the choice of material. There is, however, a considerable range of skill shown … and *T. thompsoni* must unquestionably take first rank for selective power and neatness of construction."

However, in this early study the authors did not go beyond describing observable facts, and as they noted in the introduction to their paper (Heron-Allen & Earland, 1909), "no attempt is made to explain either the processes by which the tests of the arenaceous foraminifera are constructed, or the idiosyncracies displayed by many of the genera and species in the choice of their materials".

In another paper based on the study of the Fisheries Cruiser *Goldseeker* samples published in the *Journal of the Royal Microscopical Society* in 1913, Heron-Allen & Earland studied some of the most primitive and simple agglutinated foraminifera that can be found in the British offshore. The genus *Psammosphaera* and *Saccammina* are nothing more than simple "balls of sand" as the name *Psammosphaera* implies. Such simple, single-chambered forms have been found in the geological record extending back to the Vendian stage of the latest Precambrian (about 550 million years ago). They are regarded to be among the earliest known ancestral forms of the Foraminifera, and it is believed that more complex genera have evolved from them. They can be truly described as living fossils.

In their paper, which was richly illustrated with colour lithographs (reproduced here as Figs 1-2), Heron-Allen & Earland (1913) again noted a remarkable degree of grain

selection in some of these simple forms. Indeed, the material used in the construction of the test is the only way to distinguish the various species of these "sand balls". One form in particular attracted the attention of Heron-Allen & Earland. The species *Psammosphaera parva* reminds the observer of the Norwegian letter "ø" (Fig. 2.8). It has a habit of selecting one single long sponge-spicule around which it builds its spherical house of finely selected sand grains. The sand grains themselves are all just about the same shape and size. They were apparently enthralled by this species, and remarked:

"Two other species which we have described from 'Goldseeker' dredgings display marked selective powers. We cannot but arrive at the conclusions that the presence of the central spindle in var. *parva* is not fortuitous, but that the animal deliberately chooses the spindle as a main constituent of its 'house', and constructs its abode round the spicule in order to obtain the increased support afforded by its projections in supporting itself upon the surface layers of the bottom ooze."

- *Journal of the Royal Microscopical Society*, 1913, p. 18.

THE DEVELOPMENT OF IDEAS - THE PHENOMENON OF PURPOSE.

The mentioned earlier, descriptive work of examining samples, selecting specimens for illustration, and describing the foraminifera was always carried out jointly, with Arthur Earland as a co-author to the study. However, it is clear that even in these papers Edward Heron-Allen provided the motivation for the study, and wrote much of the final paper (sometimes even with acknowledgements obviously written by him in the first person). Of the two, only Heron-Allen elaborated upon the initial findings of the descriptive papers and carried the work further. He also publicised the results of the studies and communicated them to the learned societies.

By the early months of 1914, Heron-Allen's broader "synthesis" studies were well underway. He had occupied his time during the winter of 1913-1914 by compiling an

exhaustive study on the biology and reproductive processes of the foraminifera. He spent the first week of March in Edinburgh visiting his friend Sir John Murray, who placed at his disposal the original notes the latter had made during the H.M.S. *Challenger* Expedition. At the encouragement of Murray, Heron-Allen prepared the study for publication in the *Proceedings of the Royal Society*. Sadly, Sir John Murray died tragically in a motor car accident just a week after Heron-Allen's visit. The paper, which was printed the following year in the *Philosphical Transactions* of that learned society (Heron-Allen, 1915a), is an excellent review of the biology and life history of the foraminifera, and many of the observations he carried out are still valid. The final section of the paper (Section IX), though, contains some interesting speculation. Heron-Allen had apparently been contemplating the significance of grain selection amongst agglutinated foraminifera, and added a final section that carried the unassuming title "On Selection and Growth in some Arenaceous Foraminifera". In this section he concludes:

> "When we arrive at the consideration of the arenaceous forms it behoves us to proceed with the greatest possible caution, for the phenomena exhibited reveal an apparent development of purpose and what in the Metazoa would be termed 'intelligence', which is apt to lead the imagination far astray unless it is kept rigidly within the bounds imposed by the observed results…"

Heron-Allen's paper was communicated to the Royal Society on March 11th 1915, and shortly thereafter he was invited to give a lantern-slide presentation to the Royal Institution of Great Britain. He gave a presentation at their weekly evening meeting on May 21st entitled "On Beauty, Design and Purpose in the Foraminifera". His published paper (Heron-Allen, 1915b) stands as a literary masterpiece in the field of foraminifera. In it, he builds up the case for intelligence even further, stating:

> "An evolutionary cycle is ex hypothesi continuous, and I refuse to allow a consistent evolutionist to postulate a discontinuity in his evolutionary cycle - he cannot at some unknown point introduce into his bioplasm an outside and novel influence to which he gives the name 'intelligence'. I claim that every living organism living an independent existence of its own is endowed with the measure of intelligence requisite to its individual needs."

Notice that the quotation marks have now disappeared from the word "intelligence" in the last sentence. As Heron-Allen explained in the text of these two papers, the purported intelligence displayed by the foraminifera manifests itself in two ways. First, in the exclusive selection of certain materials. He provided the examples of *Ammobaculites agglutinans* and *Verneuilinoides polystrophus*, which select heavy gem minerals such as magnetite, garnet, and topaz, even though these minerals are very rare in the surrounding sediment. Secondly, in the manner in which these materials are used. Heron-Allen gives the example of *Halyphysema tumanowiczii*, which "protects its aperture with long sponge spicules that radiate in all directions …which must offer very efficient protection from parasitic worms". Another species mentioned is *Marsipella spiralis,* which builds its shell from sponge spicules arranged in a left-hand spiral. With reference to this last-named species he remarks that it "made the same discovery as did the prehistoric genius who invented string". Finally, he again cites *Psammosphaera parva,* speculating that the animal selects a long spicule to "buoy it up on the mud surface".

IS THERE INTELLIGENT BEHAVIOUR AMONG THE PROTOZOANS?

At this point, we can ask ourselves whether or not Heron-Allen's use of the terms "Purpose and Intelligence" was unique, or even original given the state of knowledge of protozoan behaviour, as it existed before the First World War.

Was he alone in attributing such properties to the lower organisms?

On the other side of the Atlantic, a young scientist at the University of Pennsylvania by the name of Herbert Spencer Jennings (Fig. 3) had been observing single-celled animals since the turn of the 20th Century. From a humble background, Jennings had even spent a year in Europe at the University of Jena and at the Naples Zoological Station, working with some of the most prominent protozoologists of the day. By 1906, he had made enough observations on the behaviour of *Amoeba* that he was able to put his ideas on paper. His popular textbook *"Behavior of the Lower Organisms"* published by the Columbia University Press went through several printings and was used as a college text well into the 1960's. Most of the book describes the behaviour of protozoans in the laboratory - their responses to various stimuli, hunger, pain, and various chemicals. However, in the final chapter, Jennings asks the question…"Do we find in the lower organisms objective phenomena of a similar character, so that psychic names would be applied if found in higher organisms?"

Jennings took the idea even further, and defined a set of criteria that he considered to constitute "psychic" or "intelligent" behaviour. These qualities included attention, perception, discrimination, choice, desire, pain, fear, and memory. Jennings defined "intelligence" as the modification of behaviour in accordance with experience. After years of observation of *Paramecium*, and other protozoans, Jennings states…."It is clear that we find the beginnings of such adaptive changes of behavior even in the Protozoa". He describes how *Amoeba* will avoid negative stimuli and react to positive stimuli, and concludes:

"The writer is thoroughly convinced that if an *Amoeba* were a large animal, so as to come within the every day experience of human beings, its behavior would at once call forth the attribution to it of states of

pleasure and pain, of hunger, desire, and the like, on precisely the same basis as we attribute these things to a dog".

On the question of intelligence, Jennings writes:

"I believe it beyond question that we should find similar attribution to it of certain states of consciousness a practical assistance in foreseeing and controlling its behaviour. An *Amoeba* is a beast of prey and gives the impression of being controlled by the same elemental impulses as higher beasts of prey".

- Jennings, (1906, p. 336).

Jennings leaves the reader to conclude that the behaviour of *Amoeba* fits well within his own definition of "intelligence".

We have no direct evidence that Heron-Allen was even aware of Jennings' textbook. There are no citations of Jennings' work in any of Heron-Allen's papers. Of course, it is quite possible that both authors had arrived at similar conclusions independently of one another. Such coincidences are commonplace in the natural sciences.

THE GREAT DEBATE

We return now to the autumn of 1915. After giving yet another lantern-slide presentation to the British Association (Section D, Zoology) on the 9th of September in Manchester in which Heron-Allen again maintained that the foraminifera possess "faculties akin to Purpose and Intelligence", a discussion ensued during which a number of Zoologists apparently "combated" while others supported his views. This discussion and the resultant correspondence he received inspired him to immediately put pen to paper in order to explain his position on the subject of foraminiferal intelligence. The result was entitled "A short Statement upon the Theory and the Phenomena of Purpose and Intelligence exhibited by the Protozoa, as illustrated by selection and behaviour in the

Figs 3-4. (3) Professor Herbert Spencer Jennings in his later years; (4) Professor Sir E. Ray Lankester at the British Museum (Natural History), *c.*1907. Sir Ray was Director of the museum from 1898 to 1907 and was a frequent guest at "Large Acres".

Foraminifera". It was presented at a meeting of the Royal Microscopical Society, attended by many prominent scientists, on October 20th, and was published in the same year (Heron-Allen, 1915c). In an effort to summarise his observations and clarify his position, Heron-Allen again reports various examples of grain selection, and concludes:

> "To sum up the matter in a few words, a study of the Rhizopoda extending over some thirty years has brought me to the conclusion that there appears to be no organism in the Animal Kingdom, however simple be its structure, *which lives a life of its own independently of any other organism*, which is not capable of developing functions and behaviour, which in the Metazoa might be called, and would properly be so called, Phenomena of Purpose and Intelligence".

On this occasion, Heron-Allen even quotes one of the basic principles of Marxism (italicised). We can only guess where this idea came from, but perhaps it is not a coincidence that Heron-Allen's life-long friend Professor Sir E. Ray Lankester (Fig. 4) knew Karl Marx personally, and was even one of the few people who attended the latter's funeral (Gould, 1999). This connection is quite likely, since Sir Ray was present at the meeting and took an interest in Heron-Allen's theories.

Heron-Allen again stimulated a lively discussion that was carefully recorded in the Society's *Proceedings*. Several prominent members expressed their opinions on the subject of his talk, and some of the comments were serious and others more provocative. The chairman of the society, Mr. D.J. Scourfield opened the discussion by expressing his thanks to Heron-Allen, and added "the subject had been laid before them in a very lucid and striking manner, and that the illustrative photographs were very beautiful and of exceptional value". On the question of intelligence, Scourfield remarked that he agreed with Heron-Allen regarding the importance of the definition of terms. In comparison with what other members said, Scourfield exercised remarkable restraint when he noted "it would be admitted that the problem was not completely solved by saying that we were confronted by purpose and intelligence".

Dr. Francis Shillington Scales remarked it seemed to him that Heron-Allen's interest in the subject led him to claim for the lower animals a portion at least of the intelligence which we were apt to give to a dog. Scales noted that Heron-Allen "did not claim intelligence for many of the physiological and developmental processes that exist in life. The selective processes of the Foraminifera were elementary compared with the developmental processes of the cells of plants and animals - many processes could be explained by chemotaxis. It was difficult to understand why Mr. H.A. should claim intelligence

to one and deny it to the other, or where he drew the line."

Heron-Allen replied that he was very glad to hear what Dr. Shillington Scales had to say, because he really voiced the views of the "old Guard" which he knew would "never surrender". Heron-Allen restated that "the measure of purpose and intelligence exhibited by the Protozoa, and reached in its highest development in Man, was shown by the use of extraneous materials which the creature selects from its surroundings, and which it adapts to a particular purpose." He wished to go no further than that. He further claimed what was wrong was "the introduction of anthropomorphic suggestions arising out of the words purpose and intelligence to define faculties which lead to these phenomena in the lower animals." It is already apparent that Heron-Allen is now beginning to retreat from the use of the words "purpose and intelligence".

The scientific critique of Heron-Allen's paper was prepared by his friend Sir E. Ray Lankester (Fig. 4), and also published in the *Journal of the Royal Microscopical Society,* the following year (Lankester, 1916). Sir Ray had a reputation for being a contrarian who relished professional debate and never shunned controversy. In his essay "The Supposed Exhibition of Purpose and Intelligence by the Foraminifera" Sir Ray raises a polite objection to Heron-Allen's choice of semantics. He writes:

"Mr. H.A. has been tempted, as a result of the facts observed, to ascribe what he had at first called 'Purpose and Intelligence', or by further modification 'Purposive Intelligence' and now calls 'faculties akin to Purpose and Intelligence' to the Foraminifera. I agree with Mr. H.A. that 'our human vocabulary is at present most inadequate for discussing problems of this kind'".

Sir Ray then adds a cautionary note, stating:

"To say that they are due to Purpose which is not Purpose as the word is ordinarily understood, and to Intelligence which is not Intelligence in

the usual acceptation of the term, seems to me to tend to misconception and a mistaken notion that we know more about the activities of the Protozoa than we do".

Finally, Sir Ray expresses his own light-hearted opinion on the question of intelligence in the Foraminifera:

"If we recognise the fact that mental faculties are, like human structure, immensely complex, and are dependent for their manifestation on the healthy activity of an almost inconceivably complex structure - the brain - we shall, it seems to me, be able to conceive of the reduced and less complex mental faculties of less elaborate brains. … Descending step by step we shall arrive at the conception of the microscopic mentality of a Foraminifer, and cannot fail to dismiss the notion of attributing to it purpose and intelligence, or anything that can seriously be called by those names."

- *Journal of the Royal Microscopical Society* (1916, p. 137).

Even more acute criticism of Heron-Allen's theory was interjected by Professor J. Arthur Thomson, professor of Natural History at the University of Aberdeen, who was a member of the Editorial Board of the Journal at the time. His discussion appears in the Society's *Transactions*. Adopting a sound pedagogical approach, Prof. Thompson introduces the problem with a bit of humour. He remarked that when he left Aberdeen there was much snow, some of the roads were blocked, and he saw the wind making some beautiful snow wreaths. He asked himself whether there was any purposefulness in the wind's finely finished work, and he answered emphatically "no" because he could interpret it without introducing any concept of purpose, purely by the laws of dynamics. Prof. Thompson then asked himself whether, in coming south, he had himself any purpose, whether his behaviour in making the journey was purposeful or purposive, and he felt compelled to answer in the affirmative. He proclaimed…"the difficulty in the present discussion seems to lie between these two extremes - between the work of the wind and the work of Man". Prof. Thompson

then cuts the Gordian knot of semantics by defining the terms himself through the clever use of common examples of animal behaviour:

"When rooks take up mussels in their claws and let them fall on the shingle, with the result that the shells were broken and the flesh made available, this is probably *intelligent purposefulness*. When the starfish does battle with the sea urchin with its tube feet, it wrenches off all the pedicellariae or snapping blades. This is prolonged behaviour directed towards an end which is not immediate - prolonged activity directed toward a future result. This is called *organized purposiveness*. It is believed that the same category applies to the activity of the President's Foraminifera."

- *Proceedings of the Royal Microcopical Society*, June, 1916, p. 251.

Heron-Allen prepared a carefully worded reply to the comments of the above gentlemen, and especially to the comments published by Sir Ray. In this reply, he concedes to Prof. Thompson, and retracts his use of the term "intelligence" as defined by the Oxford Dictionary. He explains what he meant by the use of this term:

"As Sir Ray points out, I first made use of the phrase 'Purpose and Intelligence', and later 'Purposive Intelligence'. Today I would rather use the term 'Definitive Purpose' or perhaps finally 'Purposiveness'. It appears to me that the theory which I have endeavoured to develop, without claiming to have originated it, derives support from the following lines, quoted by Sir Ray - 'The attributes which are restricted in the higher types of animal life to the nervous apparatus may be in the Rhizopoda diffused through every particle' - the whole protoplasmic substance being endowed in a low degree with the power of receiving, conducting, and acting upon external impressions. (…) I have always endeavoured to point out that it is, in my opinion, only to a degree appropriate to their organisation, not in its entirety, that the behaviour of the Rhizopoda is comparable with that of Man. (…) I am not arguing for the possession of 'high' mental activities in the Protozoa - it is obvious that these must be as rudimentary as they are in any egg - but in that rudimentary condition it seems to me that they must be there, awaiting the stimulus that calls them into action."

Heron-Allen concludes his reply by reaffirming:

"I cannot conclude in words more satisfactory to myself than in Sir Ray's own, when he says 'Descending step by step we shall arrive at the conception of the microscopic mentality of a Foraminifer'; and I wholly dismiss the notion of 'Purpose' and 'Intelligence' as these terms are defined in the Oxford Dictionary".

In the end Heron-Allen steps back a bit, accepts some of the criticism of the great natural historians, and appears to arrive at a consensus on the use of terminology to describe the behavioural processes he described in the Foraminifera.

As a footnote to the above discussion, it should be noted that in science, mimicry is perhaps the most genuine form of flattery. In the very next issue of the *Journal of the Royal Microscopical Society*, a minor article appeared written by Arnold T. Watson, entitled "A case of apparent intelligence exhibited by a marine tube-building worm, *Terebella conchilega*" (Watson, 1916). The author quite seriously describes what he regarded to be intelligent behaviour as a worm endeavoured to build its tube out of sand grains and gravel. One could speculate that had Sir Ray seen this paper, he would have conceded that at least this creature possesses a brain that controls its "microscopic mentality" - albeit a very rudimentary one.

Heron-Allen's work on grain selection in the Foraminifera and the scholarly debate that ensued did not go unrewarded. Shortly after the "great debate" Heron-Allen was offered the Presidency of the Royal Microscopical Society, an honour that he refers to as "a position which I regarded in my youth as being the highest honour which I could ever dimly aspire to" (Heron-Allen's War Journal - Harvey & Fitzgerald, 2002, p 62). However, during his first year as President, Heron-Allen seems to have busied himself instead with the task of writing a detailed biography of the great French natural historian and foraminiferologist, Alcide d'Orbigny, which he read as his first Presidential Address on January 18, 1917 (Heron-Allen,

1917). It seems that after the "great debate" of the previous year, no further notes on "Apparent Intelligence" were published in any of the subsequent issues of the *Journal of the Royal Microscopical Society*. Heron-Allen became more intensely involved with his wartime activities, and writes in his War Journal that his address given when his term as President of the Royal Microscopical Society expired in January 1918 "dealt entirely with the war-conditions under which the Society had worked since 1914". Certainly, during the latter years of the war, Heron-Allen had more urgent matters to attend to and the foraminiferal studies assumed a place on the "back burner". Heron-Allen continued his work on the Foraminifera in collaboration with Arthur Earland for another 15 years, though it seems he restricted himself to producing well-illustrated monographs of the modern foraminiferal faunas from various parts of the world ocean. As far as can be ascertained, he never again wrote anything about the subject of "Purpose and Intelligence" in the Foraminifera. The subject seems, as we say, to have "died a natural death".

A STUDY OF SUCCESS: EDWARD HERON-ALLEN VERSUS HERBERT SPENCER JENNINGS

While Edward Heron-Allen accepted the rebuttals from his colleagues, and seems to have dropped his studies of "Purpose and Intelligence", his contemporary in the States, H.S. Jennings went from strength to strength after the publication of his book *"Behavior of the Lower Organisms"*. Jennings accepted a professorship at John Hopkins University, and led a distinguished career giving guest lectures at various universities. He later became involved in experimental studies of genetics, and even spent a year at Oxford University as an Eastman Visiting Professor (1935-1936). The success enjoyed by Jennings after the publication of his treatise on intelligent behaviour among the protozoans could not have been in

starker contrast compared with Heron-Allen's later scientific career. Were Americans at the time more willing to concede that lower organisms display essential traits of "psychic behaviour"? However, it must also be said that Jennings took a slightly less controversial stance than did Heron-Allen, when he concluded in the final paragraph of his book:

> "The problem as to the actual existence of consciousness outside the self is an indeterminate one; no increase of objective knowledge can ever solve it. Opinions on this subject must then be largely dominated by general philosophical considerations drawn from other fields".

EPILOGUE

Fifteen years passed by after the great debate between Edward Heron-Allen and Sir Ray Lankester, until Heron-Allen's long-time friend passed away on August 15th, 1929 at the age of 83. The task of writing Sir Ray's obituary for the *Journal of the Royal Microscopical Society* fell to Heron-Allen. In his obituary he recalled some of the unknown details on their debate on "Purpose and Intelligence in the Foraminifera":

> "He accepted the Presidency of the RMS in the year 1909, but after attending the inaugural meeting he left the conduct of the meetings in the hands of the Vice-Presidents. I reproached him mildy for not attending meetings. He said to me on one occasion 'Wait till you are president - then I promise I will come and attack you in the Presidential Chair'. And he did: he half supported and half differed from me in the crusade I had embarked upon to prove the phenomena of Purpose and Intelligence in the Foraminifera. He objected to anything that savoured of Teleology."
>
> "He prepared a paper attacking the position I had taken up, and submitted it to the Council. This gave me the chance to study it and prepare a reply which I hoped might be crushing. This reply I sent to him, that he might be 'pre-cognised', as the Scottish Lawyers say. He then prepared a 'rejoinder' which he submitted to me, and we subsequently had a crowded meeting which was attended by many notable Zoologists who took part in the discussion. It was great fun, and I hope - and believe - that our "rapier-like exchange of wit and argument" seemed to the audience to be brilliantly impromptu."
>
> - Heron-Allen (1930).

Today we ascribe the apes and dolphins with a measure of intelligence, but nobody speaks of intelligence among the protozoans, only about genetically programmed behaviour. However, in the decades before the discovery of the double helix, natural scientists had no starting point, and were still groping around to define terms. Heron-Allen is remembered because he opened up such a debate in the United Kingdom. I am sure that he argued his case with the charismatic style that was typical of all his undertakings. I only wish I had been there to witness the great debate.

ACKNOWLEDGEMENTS

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SOME TREASURES OF THE HERON-ALLEN LIBRARY AT THE NATURAL HISTORY MUSEUM, LONDON

by CLIVE JONES

INTRODUCTION

Those of us present at the 3rd Annual Heron-Allen Symposium in the Allen Room, Soho, will remember a very interesting talk given by Claire Powell of the London Library (subsequently published by the Society as part of *Opusculum VI*). Claire described how, after joining the London Library in 1922, Edward Heron-Allen began donating to that body a large selection of his own works on music, antiquities, natural history and, in 1934, his work on asparagus. She informed us that a number of his volumes were populated by many letters, notes, cuttings and other ephemera, and that electronic databasing of all this was currently in progress.

Claire's description seemed very familiar to me, as at that time I too was undertaking a similar exercise in the Heron-Allen Library at The Natural History Museum. This library, now in the Department of Palaeontology, is named in his honour and in recognition of his relationship with the Museum between the years 1910-1939. Books and scientific papers in this library are from Heron-Allen's scientific collection. They are nearly all concerned with the study of microscopic organisms called foraminifera and constitute a major source of reference for that group in the Museum's Micropalaeontology Division (for an introduction to these fascinating creatures see Hodgkinson in this *Opusculum*). Here also, I was finding a wealth of letters, notes, critiques, clippings and a host of other ephemera such as bills and receipts, spread throughout the many volumes. It was also interesting to note the evolution of

Heron-Allen bookplates to be found, but little will be said about them here, they having been extensively described by Peter Alpress in his very interesting article, *Notes on Some Bookplates of Edward Heron-Allen*, which also appeared in *Opusculum VI*. Suffice to say that although four designs are present (see Fig. 1), the bookplate found by far in greatest abundance is the 1925 armorial plate (fig. 5 of Alpress). This is not surprising, as the bulk of Heron-Allen's scientific books were donated to, as it was then, the British Museum (Natural History) in that year. His decision to make this main donation then was, I believe, due in no small part to his increasing concern over a dampness problem, which was plaguing the room housing his library at the family home, "Large Acres", in Selsey. In evidence to this the majority of books bearing the 1925 plate also contain a pasted-in label stating:

> "Presented to the Library of the Department of Zoology, British Museum (Natural History) by Edward Heron-Allen, F.R.S."

I imagine he, or someone, spent many hours pasting bookplates and presentation labels into the numerous volumes that were about to inhabit the shelves of the Museum's Zoology Library. However, although it was 1925 that saw this major donation, he continued to add to it almost up to his death in 1943.

As well as his fine books, Edward Heron-Allen also initiated a separate collection of scientific literature - the reprints of scientific papers, alluded to above, which he amassed, just as scientists do today, through being part of an enthusiastic fellowship of researchers eager to exchange information about their science. These he had bound under the imprint *Variorum de Foraminiferis Opuscula.* The collection ran to 110 volumes, holding hundreds of individual papers, all neatly indexed and, of course, containing similar inclusions to his books in the main library. Recognising the value of such a

resource (and also realising the fact that bound volumes tend to go missing less easily than loose reprints), we have continued the practice to the present day and the '*Var Ops*', as they are affectionately called, now amount to nearly 400 volumes containing thousands of scientific papers. Edward Heron-Allen's collections now form the backbone to what has

Fig. 1 Heron-Allen bookplates at the NHM.

become a world-famous resource, which, just like our foraminiferal collections, attracts scientific visitors in its own right.

As far as can be ascertained, no detailed catalogue of Heron-Allen's original donation has ever been compiled, either by the man himself when the collection was first presented, or subsequently (Hodgkinson & Whittaker, 2004). However, using his bookplates and some clues presented by styles of binding, I have now completed a detailed database of both his scientific books and the '*Var Ops*'. The information is held electronically in the form of a Microsoft Excel spreadsheet - an easily transferable format, and a copy resides with Tim McCann at the West Sussex Records Office, Chichester. In addition to details of each publication the database also provides information on the style of bookplate and any notes and enclosures. The nature of these enclosures is varied, ranging from mundane bills and receipts for binding and artwork, through newspaper and magazine clippings of scientific reviews and obituaries, to letters from friends and critics alike.

THE TREASURES

I use the word treasure to describe, not only items of true rarity and value, but also, in a more abstract sense, the many items enclosed in the library's volumes which provide an invaluable insight into the scientific community of Heron-Allen's day.

Edward Heron-Allen's aim was to acquire for his library all the important early literature on the foraminifera, as listed exhaustively in Charles D. Sherborn's 1888 work *A Bibliography of the Foraminifera*. We are not entirely sure how far he got in his quest, but he certainly managed to gain possession of some very important early works, the rarest and most valuable of which now reside in the Museum's 'Rare Books Room' and can only be viewed by appointment. In the Heron-Allen Library, however, many remain and are in everyday use: of note are Hooke (1665), Soldani (1789-1795), Walker & Boys, (1784), and lastly, George Montagu's

Testacea Britannica of 1803-8, in which some of the forms we now recognise as foraminifera bear the name *Nautilus*, attesting to their early identification as small forms of mollusc. Heron-Allen in fact managed to acquire two copies of Walker & Boys, one of which contains his note:

"This edition, with the bookseller's name on the title page and the label of errata with the date [1st May, 1784] is extremely rare. I bought this copy for 15/- on 14th February 1914, the seller not knowing it was not the ordinary within".

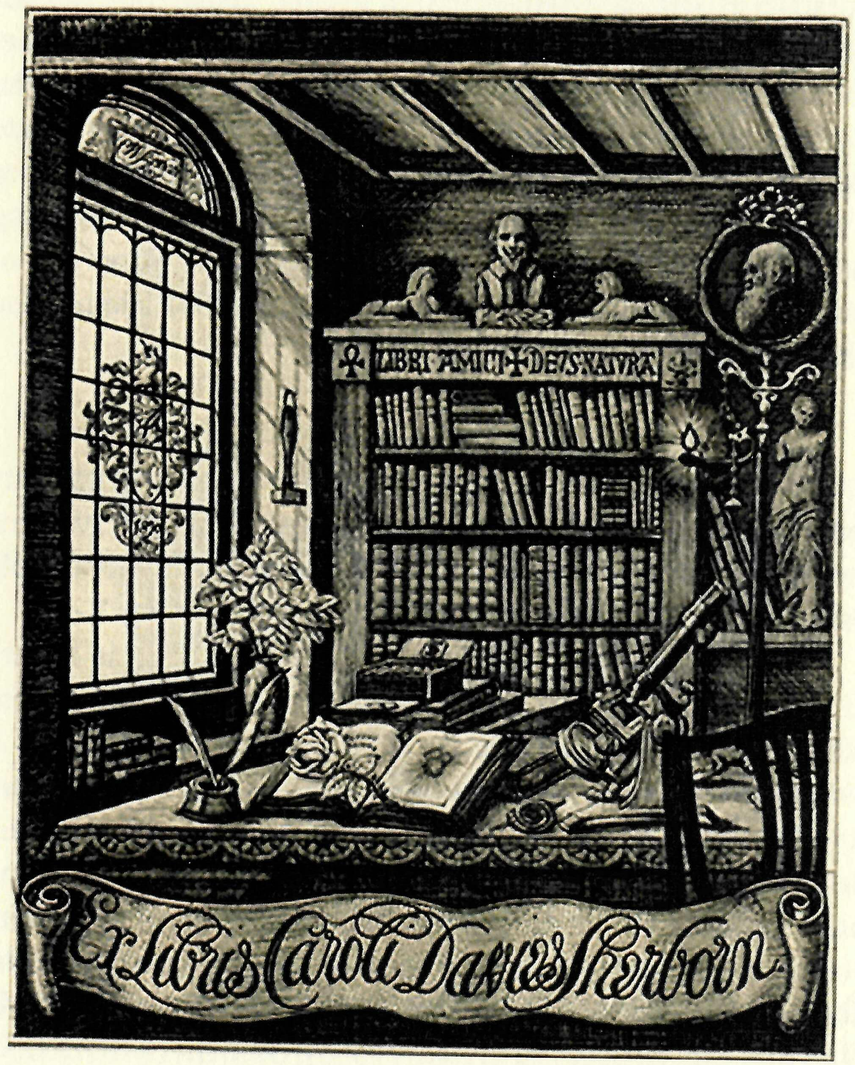


Fig. 2 The bookplate of C.D. Sherborn.

We see already that our benefactor knew his way around booksellers and had an eye for rare gems. He even acquired a copy of Sherborn's work bearing the *ex libris* plate of Sherborn's personal library (Fig. 2). This exceptionally fine bookplate deserves a mention in its own right. It was designed and engraved by Sherborn's father, C.W. Sherborn, considered by many to be one of the most notable bookplate engravers of the 19th century. We know all this because, as with all items of interest, Heron-Allen has left us an explanatory note. The plate contains a number of historical references, including those to Shakespeare and Darwin in the background. However, our main interest lies open on the desk, where we are presented with an extremely accurate reproduction of the finely spinose planktonic foraminifer, *Globigerina bulloides*. The illustration depicts Volume 9 of the *Reports of the Voyage of H.M.S.* Challenger by H.B. Brady (published 1884), opened at plate 77. Comparison with the actual plate in the library volume shows it to be remarkably true to the original and a testament to the engraver's skill.

Heron-Allen's quest also drew him to the original manuscripts, sketches and scientific notes of both bygone and fellow researchers of the foraminifera. These he acquired mainly through the estates of the deceased, often by purchase, and there is evidence to suggest that, in some cases at least, his purchase of what would most likely have been freely given, represented an expression of his benevolence towards the dependents. However, his greatest acquisitions were tracked down, often with the help of friends and agents, and purchased from specialised antiquarian booksellers. Perhaps the best example of these resides in the form of two volumes of original manuscripts in the hand of the renowned French researcher Alcide d'Orbigny (1802-1876), one of the great pioneers in the study of the foraminifera (Fig. 6). Heron-Allen has (of course) inserted his receipt of purchase in 1935 for just

under 312 francs from the Paris bookseller J-A Quereuil. He had long been interested in d'Orbigny, the man, and a number of letters attest to his having a cordial relationship with the d'Orbigny family. He visited the museums in Paris and La Rochelle, becoming probably the first Englishman to study d'Orbigny's collection of foraminifera in any scientific detail. The birthplace of d'Orbigny in the countryside near La Rochelle was also on his itinerary. This interest culminated in Heron-Allen's published Presidential Address, in 1917, to the Royal Microscopic Society of London, entitled "Alcide d'Orbigny: his life and his work".

The Heron-Allen Library contains many other major works worthy of note. However, it is not the intention here to present an exhaustive list of these treasures. Rather, I wish to convey a sense of the importance of the works that Edward Heron-Allen provided for us, comprising the core of what is now an internationally recognised repository of scientific literature. This, however, is to say nothing of the many valuable collections of specimens that he also gathered together to form the backbone of the National Collection. But, that is a diversion not to be taken here and I would advise the reader seeking further information to read Hodgkinson, 1989.

We can now turn our attention to treasures of the second and, I'm sure to many, more interesting kind - the enclosures contained in those many volumes. Here we find almost countless letters, comments, notes and other ephemera, all of which help to build an historical perspective, not only of the comings and goings within the science of the period, but also, mainly through correspondence connected with Heron-Allen's own researches, glimpses into the interaction of scientists of the day as people, as well as clues to their personal relationships. We do not see many letters written by Heron-Allen himself, although some have been returned with the addressee's reply on the same paper. Nevertheless, in many

cases it is possible to deduce the course of a two-way debate.

It has been extremely difficult to decide, not what to include here, but what, for the sake of brevity, must be left out. However, a logical place to start is with a reference to Edward Heron-Allen's introduction to the subject that would come to occupy his long and productive scientific career.

Heron-Allen's interest in the foraminifera began at Elstree Preparatory School where, at the age of thirteen, he delivered his first lecture on the foraminifera (*Globigerina* Ooze) before a small audience of fellow students. He had been drawn to the subject by text and figures on foraminifera found in Archibald Geikie's 1873 Science Primer, *Geology* (Fig. 3). The library has a later edition of this small book in which Heron-Allen has inserted a card between the relevant pages which reads:

"It was this page and page 80 which arrested my attention in 1873 and caused me to become a student of the foraminifera. H-A, 1937".

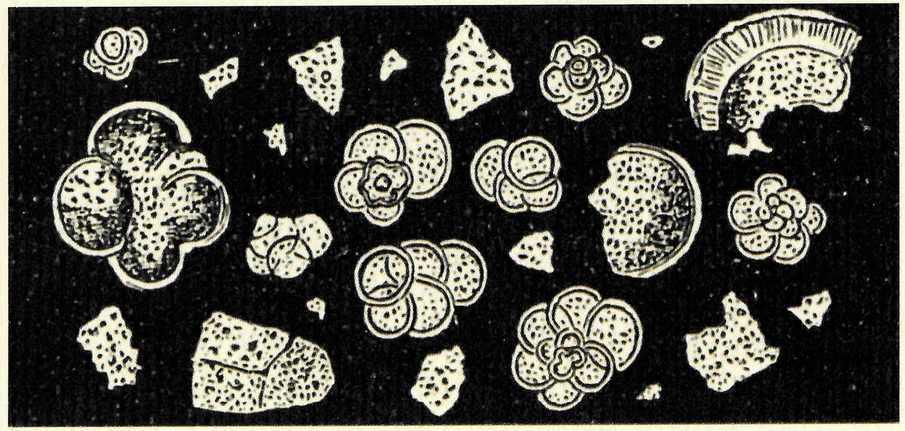
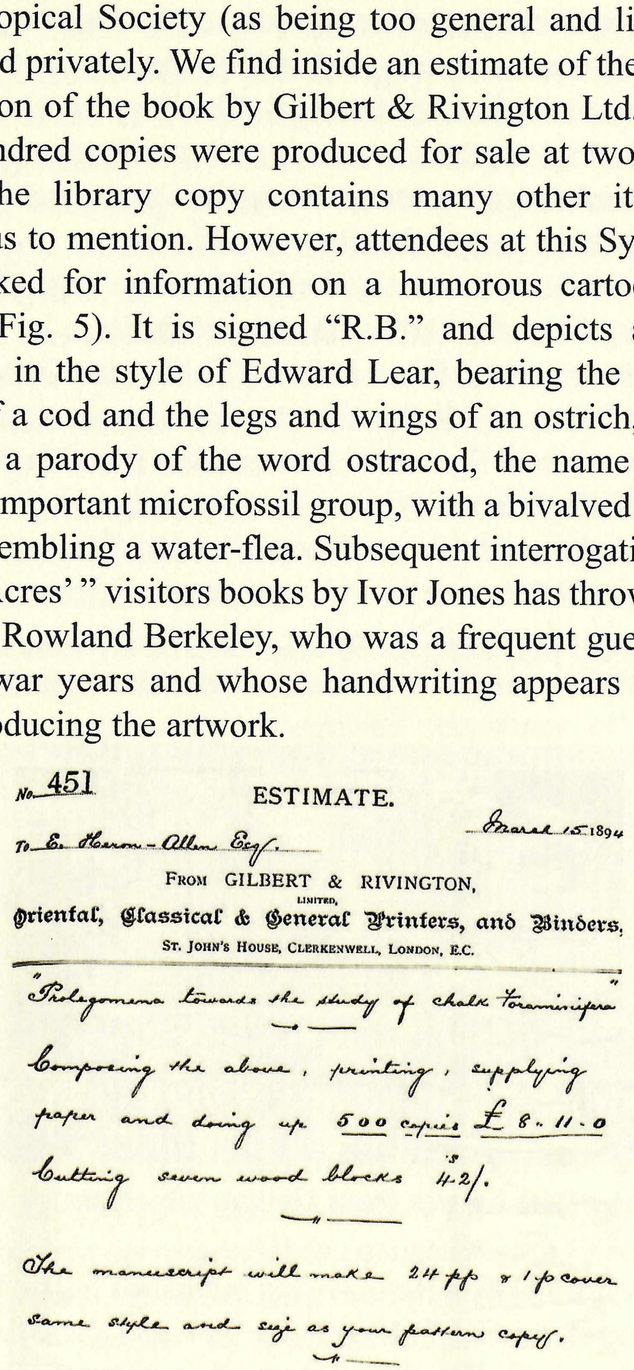


Fig. 3 One of the figures from Geikie, which struck the spark.

It was in 1894 that Heron-Allen published his first work on the foraminifera. His *Prolegomina Towards the Study of the Chalk Foraminifera* took the form of an elementary guide to the collection, preparation and identification of foraminifera from the Chalk and, having been rejected by the Royal

Microscopical Society (as being too general and light), was published privately. We find inside an estimate of the costs for production of the book by Gilbert & Rivington Ltd. (Fig. 4). Five hundred copies were produced for sale at two shillings each. The library copy contains many other items, too numerous to mention. However, attendees at this Symposium were asked for information on a humorous cartoon found within (Fig. 5). It is signed "R.B." and depicts a strange creature, in the style of Edward Lear, bearing the head and tailfin of a cod and the legs and wings of an ostrich, together forming a parody of the word ostracod, the name given to another important microfossil group, with a bivalved shell and body resembling a water-flea. Subsequent interrogation of the "Large Acres' " visitors books by Ivor Jones has thrown up the name of Rowland Berkeley, who was a frequent guest during the pre-war years and whose handwriting appears to match that introducing the artwork.



No. 451

ESTIMATE.

To E. Heron-Allen Esq. March 15 1894

FROM GILBERT & RIVINGTON, LIMITED,

Oriental, Classical & General Printers, and Binders,

ST. JOHN'S HOUSE, CLERKENWELL, LONDON, E.C.

"Prolegomena towards the study of chalk Foraminifera"

Composing the above, printing, supplying paper and doing up 500 copies £ 8.11.0

Cutting seven wood blocks 11.2/.

The manuscript will make 24 pp & 1 p cover same style and size as your pattern copy.

Fig. 4 Estimate costs for producing Heron-Allen's first publication on foraminifera.

It is not the intention here to chronicle all of Heron-Allen's scientific works, as that has already been comprehensively achieved by Hodgkinson & Whittaker (2004). However, it should come as no surprise to find that the

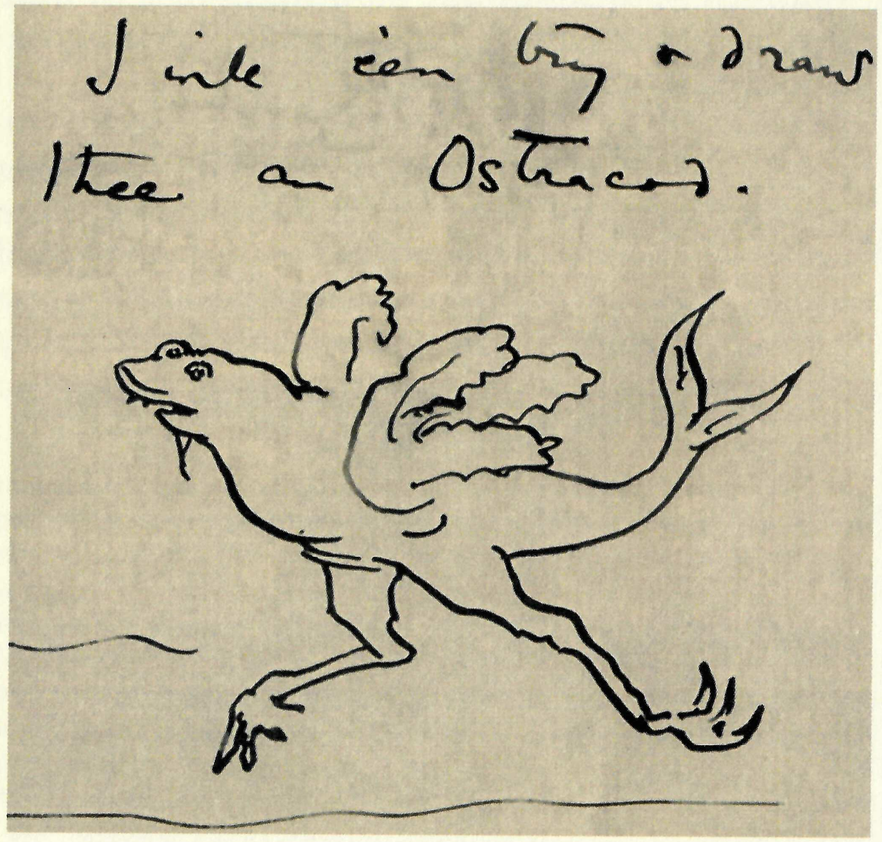


Fig. 5 Cartoon sketch of an 'ostracod' by Rowland Berkeley.

vast majority of inclusions relate to Heron-Allen's own work and reside within the corresponding volumes, which means the current offering now inevitably follows, at least in part, the course of this work.

Upon his move to Selsey in 1906-1907 Heron-Allen immediately began an extensive study of the foraminifera to be found along the local coastline. It was then that he met, at the suggestion of F.W. Millett (an early mentor of Heron-

Allen), a civil servant by the name of Arthur Earland (Fig. 7), who had already published a work on the neighbouring sands at Bognor. Thus began a scientific partnership that was to last until 1933.

We now turn our attention to works representing the fruits of this collaboration, but immediately find it not always to have been plain sailing.

In 1920 Heron-Allen & Earland wrote a paper entitled "An experimental study of the foraminiferal species *Verneuilina polystropha*, and some others, being a contribution to the discussion on origin, evolution, and transmission of biological characters". The work was eventually published in the *Proceedings of the Royal Irish Academy*, after its rejection by the Zoological Society of London following comments by two referees. Some of their lowlights are recorded here:

> "The authors have failed to contribute any facts throwing light on the problem stated in their title and show inability to appreciate even the necessary conditions for a successful conclusion." [and]…. "Paper thoroughly unscientific; with a confusion of ideas, lack of analysis, misunderstandings and meaningless jumbles of words. No respectful scientific society should be a party to publication. Their inclusion of dimorphism among variations shows their incompetence. Note 38 on page 46 - pure silliness advanced with pomposity." …."The only point worth publishing as a short note is the statement that the authors have shewn by x-rays that *Verneuilina* is dimorphic - like all the other foraminifera".

The volume also contains a letter of reply to Heron-Allen from the then Secretary of the Zoological Society, Chalmers-Mitchell, who, by all accounts was a friend (in other letters they discuss gardening and social meetings). It reads:

> …."and the authors of such reports are, by the rules of the committee, not made known".

I think we can guess what Heron-Allen requested in his side of that correspondence. Chalmers-Mitchell goes on to ask whether Heron-Allen and Earland would now consider

Figs. 6-9. (6) Alcide d'Orbigny; (7) Arthur Earland; (8) Joseph A. Cushman; (9) Heron-Allen by R.B. Ogle.

withdrawing their paper. This evoked a typical reply, for we find in the same volume, and somewhat rarely, a copy made by Heron-Allen of his own lengthy response, in which he mounts

a robust and detailed defence of the work, which includes the riposte:

….“would you, if you knew that you were right?”

Heron-Allen knew and, at least on one occasion, entertained the distinguished American foraminiferal researcher Joseph A. Cushman (Fig. 8), but, as we shall see, held a strongly opposing view to his thinking on taxonomic classification, which found expression mostly through Cushman’s published work. The library holds a copy of Cushman’s 1928 book “*Foraminifera. Their Classification and Economic Use*”. The book contains an inscription by Cushman, from Sharon, Massachusetts and dated June 1928, which reads:

“To Edward Heron-Allen, with delightful memories of an all too short afternoon at the Garrick Club”.

It also contains a letter to Heron-Allen from Earland, dated 23rd July 1929 (signed using his pet-name, Eugene). He is obviously replying to what Heron-Allen was proposing to say about Cushman’s work, for he writes:

“Dear Ned, I have already told you that I will not review Cushman’s book and I don’t intend to alter my mind. For that reason I refused an invitation from the Royal Microscopical Society. I have read your notes and strongly advise you to drop the business also. You won’t improve your reputation by this sort of stuff and some of it would make the ungodly very pleased.”….“Neither of us knows enough of geology and fossil foraminifera to criticise it in any proper way”.

I should note here that Heron-Allen and Earland worked primarily on Recent (= Holocene) material. That is, recent with a capital ‘R’, which in a geological sense signifies *c.*10,000 years ago right up to the present day. Earland is strongly suggesting that, as neither of them have the expertise to comment on ancient (i.e. fossil) material, they should steer clear of making remarks that could easily attract criticism to

themselves. Sound advice perhaps, but Heron-Allen had other ideas, for we also find, pasted into the same volume, Heron-Allen’s review of Cushman’s book, as published in the respected science magazine *Nature* for November, 1929. He manages a diplomatic start to the review, heralding the work as being of great value in the way it draws together a mass of information, gleaned from many years of study by Cushman and others. He then goes on to politely but firmly deplore the erection of a multitude of new names to, as he puts it, “further confuse students of the foraminifera” - an activity we call ‘splitting’.

A short diversion is necessary here in order to convey to the uninitiated a flavour of the argument that occupied, and continues to occupy, the minds of palaeontologists and life-scientists alike, and which polarized the views of Heron-Allen and his contemporaries. In the preceding years - the mid to late 1920s - a number of key workers began to put forward their own ideas on classification of the foraminifera. The situation eventually became quite confused, but there were essentially two basic schools of thought, the so-called ‘English School’ (ES) and ‘American School’ (AS), although, and just to confuse matters further, the latter also included some European workers. The essential difference was that the ES considered the foraminifera to be an essentially plastic group and thus tended to allow for much variation of form within it, whereas the AS were prone to split groups, often based on somewhat contentious differences in the shell which, some would argue, could easily be due to an organism’s response to environmental factors, or just to represent normal accepted variation. The debate was coincident with an emerging economic importance attaching itself to the foraminifera, summed up nicely in a quote from Cushman’s book in question. Here he likens geological strata to floors of an apartment house with their inhabitants:

"Each floor has its own fossils, so, if you see what are upon the surface, you know how many 'floors' you have to go down to reach the 'floor' whose fossils connote oil".

In fact, due to folding of strata, faulting, etc., it is rarely quite as simple as that. However, one can see how splitting might be encouraged in an attempt to further refine the divisions in the rocks - the apartment floors in Cushman's analogy.

As we have seen, Heron-Allen was firmly of the English School and railed at the huge increase in taxonomic names resulting from the work of Cushman and others. There is a second copy of this work of Cushman's in which can be found, again, pasted in, an article written some time later by Heron-Allen which appeared in *Nature*, November 1935, entitled "Dementia nomenclatorica Americana", in which he writes:

"Dr Hans Thalman's bibliography for 1933 contains 390 papers on foraminifera and therein are published 40 new genera and sub-genera, and no fewer than 390 new species and varieties, and his manuscript for 1934 so far accounted for 340 papers, 25 new genera and more than 300 new species."....."While saying that American protozoologists weren't the only 'offenders', they certainly contributed vastly to the proliferation of names". [He then goes on to say that he is] .... "sure that 80% of these so-called new species could easily be placed amongst already published forms, and that most or all of the new generic names since 1927 have only sub-generic value. This dementia nomenclatorica Americana is not only a serious problem today, but will burden the poor minds of future workers on foraminifera".

Having led the reader into the deepest regions of scientific argument, we can now make our way slowly to the surface again, but not before relating just one further Heron-Allen quote on the matter. This appears in another book review, again in the magazine *Nature*, but this time in 1934 for a rival classification by Galloway. He can't help having another go at the Americans:

"Since the founding by Dr Cushman in 1925 of his quarterly *'Contributions to the Cushman Laboratory of Foraminiferal Research'* the floodgates of nomenclature have been opened, and into these fathomless receptacles the rising spate of new genera and species has escaped ever since."

In the same review he refers to his old friend Frederick Chapman having named a genus after him, *Heronallenia*. He proffers no opinion as to whether it is an unnecessary new name, but does confirm that the two species comprising the new genus were originally described by Earland and himself under the existing generic names *Discorbis* and *Discorbina*!

As a consequence of delving amongst the contents of cabinets, cupboards and drawers at The Natural History Museum, a hitherto unknown portrait of Edward Heron-Allen has come to light (Fig. 9). It is a photograph of a portrait painted in 1920 by R.B. Ogle. Although an interesting find in itself, far more interesting is the lengthy comment Heron-Allen has written on the back:

"This reproduction of R.B. Ogle's picture is better than the original which was a most unpleasant portrait, which would seem to show that his drawing is better than his painting. He made an oil colour portrait of Itha in 1919, which was so appallingly bad that no-one can bear to look at it, and then he begged to be allowed to sit in my workroom when I was at work and made a portrait of me 'for himself'. Not liking to hurt his feelings, I allowed this, but when it was finished the consensus of opinion was that it was atrocious, making me look at least ten years older than I am. I explained delicately that my family were not pleased with it and that we had no intention of hanging it. Since then we have seen nothing of him, but in the Spring I heard to my amazement in Pau that, without asking my permission, he had sent it to the Royal Academy and it had been accepted and hung. He then had the reproductions made and sent me this copy. In October I was further annoyed to see that he had got it into *'The Bystander'*, and I came in for some disagreeable observations, as it looked as if I had acquiesced in this 'advertisement', to which I strongly object. I am not a botanist and never have been, nor am I a zoologist, my work having been confined to a highly specialized branch of Protozoology. He may become a famous painter in the future, but the whole incident is a severe lesson to persons of any position, not to allow pushing young beginners to paint their portraits out of sheer good nature."

R.B. Ogle did go on to become, perhaps not famous, but at least an artist of note, making his name primarily as an illustrator of books and magazines. His artwork was to be found in the *Boy's Own* and *Chums* magazines throughout the late 1920's and later in books such as *Claudius the Bee* (1936), for which he provided the frontispiece and internal illustrations. The latter is a story by J.F. Leeming about a dotty scientist who shrinks our young hero. He then sets off on his remarkable adventures, learning respect for insects and even participating in their wars.

Returning to letters found as enclosures, I beg to mention just two more, from so many, before closing. The first gives us an insight into Heron-Allen's scientific regimen. In a letter found in a book entitled *Eocene Beds of the Punjab* by Davies & Pinfold (1937), Lt. Col. L.M. Davies writes:

"I must thank you for your kindness in showing me your wonderfully organised and arranged room".

I assume this to be his room at The Natural History Museum.

Lastly is this letter, plucked from an enormous amount of correspondence and other ephemera to be found in Heron-Allen & Earland's (1913) "Foraminifera of the Clare Island District". It bears the address, St John's, 23 Putney Hill, and is dated 1st December 1913:

"Dearest Edward,

I had waited till I had thoroughly looked over your book before writing to thank you for it. I have examined every page and am amazed at the stupendous work of it, and not a little proud. But my dear boy - you must take care and not overwork your brain.

I do hope the book will have the success it deserves, but there cannot be many capable of appreciating such a work. Take a good rest now.

With love to you both and kisses to the dear little chicks.

Your loving old mother,
C. Allen"

ACKNOWLEDGEMENTS

I should like to thank Andy Henderson for relieving a poor technophobe of the task of imaging the items illustrating my talk and this subsequent article, and John Whittaker for his helpful suggestions on transcribing what was originally a verbal meander through these treasures. Finally, my thanks to Edward Heron-Allen, whose attention to detail and foresight in knowing that someday somebody would be interested in all this, went to so much trouble to ensure we missed nothing.

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THE CLARE ISLAND SURVEY OF 1911 - A SCIENTIFIC EXPEDITION WITH PRETTY GIRLS

by ANDREW S. HENDERSON
& JOHN E. WHITTAKER

Of the many volumes of Heron-Allen's Travel journals still preserved in Ivor Jones' family archive, the only one exclusively devoted to a scientific expedition is Volume XV, and relates to the Clare Island Survey of 1911.

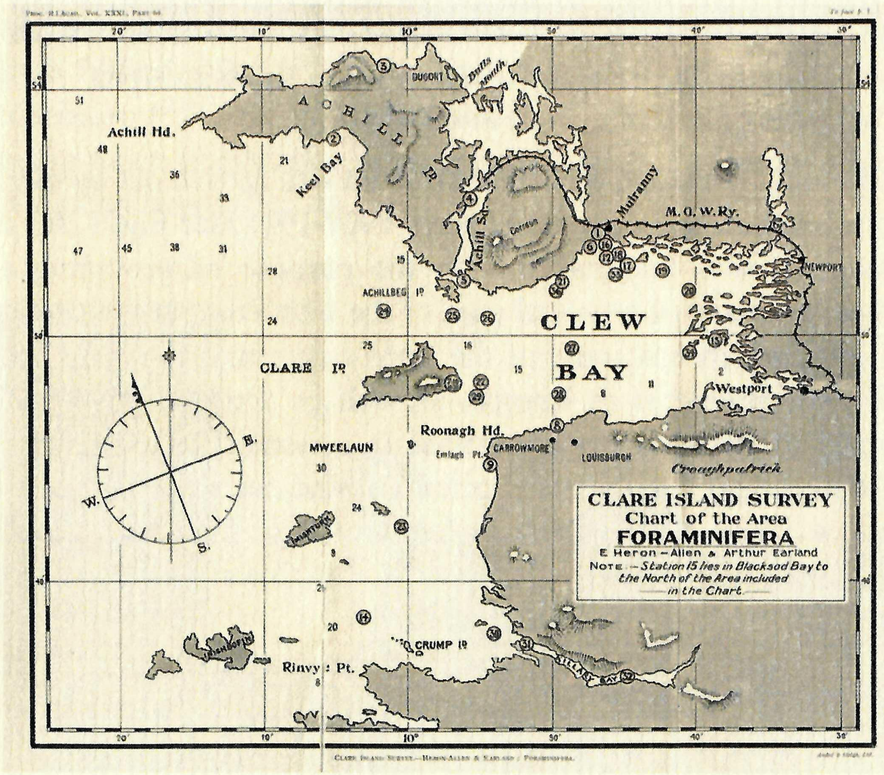


Fig. 1 Map of the Clare Island district showing foraminiferal sample stations.

This wide-ranging survey of the fauna, flora, archaeology, geology, meteorology, etc. of Clare Island, Co. Mayo, and the

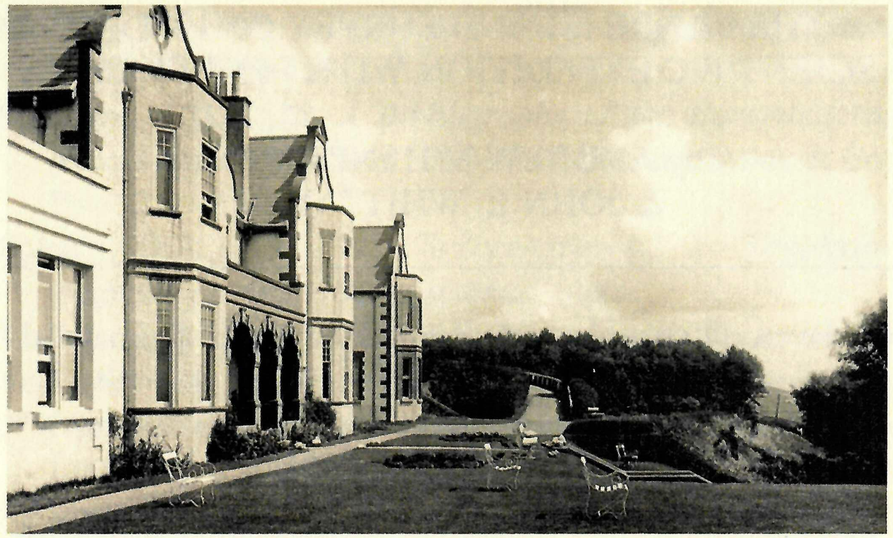


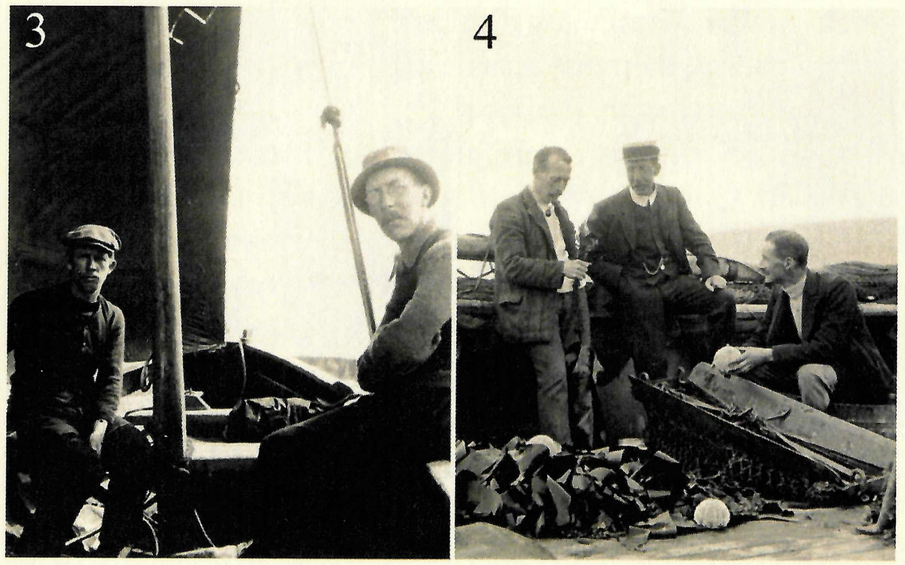
Fig. 2 The Midland Great Western Railway Hotel at Mulranny.

adjoining mainland of western Ireland was carried out by over one hundred scientists in the years 1909-1911 (see Fig. 1, for a map). It was undertaken with the purpose of providing a detailed study of a typical area of the west coast of Ireland, a region which has some of the most interesting faunistic and floristic problems in Europe, as well as contributing to the study of island floras and faunas in general. Edward Heron-Allen and his collaborator, Arthur Earland, were asked to carry out a study of the foraminifera by their friend R. Lloyd Praeger (Fig. 5), Secretary of the Survey Committee and of its sponsor, The Royal Irish Academy.

Heron-Allen wrote a personal account of the fieldwork in the form of a candid daily diary, sent as a series of letters to his wife Edith ('Nour'). These are bound within the Travel Journal, together with postcards sent to his daughters, some excellent photographs, and all manner of ephemera.

During the sampling of the landward stations, the scientists stayed at the luxurious Midland Great Western Railway Hotel at Mulranny (or Mallaranny, as it is sometimes spelt) (Fig. 2),

and a brochure, menus, wine-lists, and the hotel bills are all preserved. For the offshore samples they used either a local small boat owned by one "Johnny Bob" (Fig. 3), or had the assistance (through the good auspices of Praeger) of the Irish Fisheries' SY '*Helga II*' (Fig. 4), which was fitted with a trawl. Interestingly, this vessel was purchased a few years later by the Royal Navy and used against the Irish nationalists in the Easter Rising of 1916. Accompanying them on the *Helga* were other scientists engaged in the Clare Island Survey, notably a botanist called Arthur D. Cotton (subsequently the Director of Kew) who was working on marine algae, and George P. Farran and Rowland Southern, both prominent zoologists with the Irish Fisheries Board (for further information about them, see Robinson & Austin, 2001; Jackson *et al.*, 2002) - the latter two being much in evidence in photographs taken by Heron-Allen whilst on board (Fig. 4).



Figs 3-4. (3) "Johnny Bob" in his boat with Earland (right); (4) On board the *"Helga II"* with (l-r) G.P. Farran, A. Earland and R. Southern.

Subsequently, Heron-Allen and Earland moved onto Clare Island itself and into more mundane accommodation of the Granuaile Hotel ('McCabe's'), where the food in particular was not at all to their liking; they had, no doubt, been spoiled in Mulranny. The Travel Journal makes fascinating reading and provides a snapshot of rural Ireland, pre-Great War, a world long since gone. Today, some of Heron-Allen's comments about the locals and their customs would appear very rude and almost colonial in tone, but this was another age.

The photographs not only add the flavour to the science, but provide some quite atypical portraits of Heron-Allen in particular. Reproduced here (Fig. 6) is just such one - a young looking and relaxed picture of the man (then aged 50) in a flat-cap on a jaunting-car; far from the usual rather austere portraits of him dressed formally in black and white. The volume also contains some lovely photographs of two young ladies, named Inez and Muriel (Figs 7, 8). Who were they? He refers to them as 'flappers', a very early use of the word, which in his terminology means 'intelligent, independent young ladies in their late teens and of some breeding', and not to be confused with the local Irish girls, whom he always refers to as 'colleens'. Careful reading of the Travel Journal reveals all. [Entry for the 16th August 1911].... "We share the Island with a party of nine, a man named Murray and his wife, friends of the Messels from Balcombe who have been here for a month for the last four years. Their daughter and niece, [are] splendid wild flappers of 16…". The entry for the following day elucidates further..."I was looked out by the Flappers (the most enthusiastic and rowdy of them, by name Inez, turns out to be a serious young person of nineteen who lets her hair down, calls herself sixteen and behaves as such when she gets over here), to start an aquarium for them". Later in the Travel Journal there is a photo of the Mr and Mrs Murray and the two girls (Fig. 9). To our mind the younger of the two girls, Muriel,

Figs 5-8. (5) R. Lloyd Praeger with Edward Heron-Allen; (6) Heron-Allen in relaxed mood on a jaunting-car; (7) Inez; (8) Inez and Muriel.

looks most like Mr Murray (as daughters should) and I we therefore think Inez is the niece. Knowing the strict etiquette of the day, this explains why the girls were allowed to accompany our scientists (as they did everywhere). Heron-Allen seems to have also befriended Mr Murray who, amongst other things, was "Secretary of the Empire League and an intelligent genial soul"; he clearly gave permission. The oldest of the two, Inez (Fig. 7), is particularly striking with her large bonnet and doe-eyes. One cannot help thinking….whatever happened to her?

Scientifically, the fieldwork and the resulting foraminiferal study were a great success and Heron-Allen & Earland's paper of 1913 (*Clare Island Survey, Part 64. Foraminifera.* Published by the Royal Irish Academy, Dublin) has become a classic within the genre. They collected from 37 stations and described no less than 14 species new to science and 32 new

Fig. 9 The Murray party; left to right, Muriel, Inez and Mr and Mrs Murray.

to the British Isles. Fittingly, one of the new species was named *Discorbina praegeri*, after Praeger. Today, the foraminiferal faunal slides are housed in Heron-Allen & Earland's 'Type-slide Collection' at The Natural History Museum, and are beautiful works of art in themselves. Also preserved in his library in the Museum, is Heron-Allen's own copy of the Clare Island Survey, bound together with all manner of ephemera. Most of the latter is correspondence before and after the survey, but there are some invoices of great interest. Heron-Allen, typically, generously paid for the cost of all the illustrations. These comprise £21.11.0 from a Miss A.R. Hammond for making the foraminiferal drawings, and £59.0.0 from André and Sleigh Ltd., Photo Engravers of Bushey, Herts., for the cost of engraving and printing the map and plates, a huge sum in 1913. Perhaps not surprisingly, Heron-Allen was elected a member of the Royal Irish Academy on March 16th 1914.

Recently, The Royal Irish Academy has initiated a Clare Island re-Survey. As part of it, one of our members, Dr Robin Edwards of Trinity College, Dublin, has volunteered his services to look at the foraminiferal faunas again, almost 100 years since Heron-Allen and Earland made their collections. We wish him well. He will have a hard act to follow.

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John E. Whittaker

Opusculum I. Notes upon the Literary, Scientific, and Artistic Activities of Edward Heron-Allen FRS. Extracted from his diaries and other documents by Christopher Blayre (2000).

Opusculum II. Edward Heron-Allen. A talk delivered by his grandson Ivor E. Jones at the First Edward Heron-Allen Symposium, Chichester, July 2001 (2001).

Opusculum III. The Quest for the Heron-Allen Society. A talk delivered at the First Heron-Allen Symposium, Chichester, July 2001, by Timothy J. McCann (2001).

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Copies of these Opuscula cost either £5 (*Opuscula I-VI*) or £10 (*Opusculum VII*) each, plus postage, and may be obtained from Ivor E. Jones, Secretary of the Heron-Allen Society, Sweets Farmhouse, Stour Row, Shaftesbury, Dorset, SP7 0QH.

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