A STUDY OF ENGLISH MICRASTER RESEARCH

From a Creationist's Point of View

RITA RHODES WARD, Biology Teacher
El Paso Public Schools, El Paso, Texas

INTRODUCTION

Because of the great importance attached by evolutionists to the English *Micraster* as an example of fossil evidence of change of species, it was decided to make a study of the major research papers dealing with this genus and relate the material to creationists' concepts. Such evolutionists as K. A. Kermack[1], D. M. S. Watson[2], and E. R. Truman[3], as well as other writers consider the English Micraster to represent perhaps the best example known of a gradual change from one species to the next. In this paper the basic research by A. W. Rowe[4] and that of K. A. Kermack[1] will be given special attention. The third study, that of D. Nichols, is not available to this writer at this time. References to this work, which is of secondary importance to this paper, will be brief.

The Micrasters

The *Micrasters* are sea urchins belonging to the phylum, *Echinodermata*. These spiny skinned animals fall into two subphyla, the *Pelmatozoa* (attached forms) and the *Eleutherozoa* (free-moving forms). The latter subphylum is comprised of five classes one of which is the *Echinoidae* or sea urchins. The *Echinoidae* are made up of two subclasses, the *Regularia* and the *Irregularia*. The *Micrasters* belong to the *Irregularia*.

The test of the sea urchins is very complex and forms fine fossils with the most minute details *clearly* revealed. This makes the *Echinoids* ideal material for study of presumed successional changes in structure. The size varies from some five or six mm. to as much as fourteen or more cm. in diameter. The shape may be flattened, globular, conical, or heart-shaped.

On the ventral side is found the *peristome*, a ring of plates surrounding the mouth. The peristome may be centrally placed or it may be nearer the anterior margin or *ambitus*. On the dorsal side is the ocu*logenital ring* comprised of a circle of ten plates. Five of the plates contain ocular sense organs and five alternate plates contain genital pores. In the *Micrasters* as well as some other species one of the genital pores does not develop. One of the genital plates is modified to form the *madreporite*, a sort of sieve which admits water. The *periproct* is a leathery structure surrounding the anus. In the *Regularia* the periproct is found within the oculogenital ring but in the *Irregularia* the structure is outside the ring. The oculogenital ring with the structures within it are referred to as the *apical system* or *apical disk*.

Radiating from the apical system are five structures called *ambulacra* which consist of double rows of pores. In the *Regularia these* rows extend to the peristome. In many *Irregularia*, including the *Micrasters*, the ambulacra are found on the aboral side only and resemble the petals of a flower. For this reason they are called *petals*.

This very brief and incomplete description of the morphology of the *Echinoids* will help to orient those not familiar with these structures.

The *Micrasters* are heart-shaped members of the *Irregularia*, belonging to the order *Spatangoida*. The periproct is found at the posterior end of the test while the peristome is placed anteriorly.

The Geological Formation

The *Micrasters* which formed the basis of the studies of Rowe and Kermack were found in the White Chalk of Southern England belonging to the Upper Cretaceus. These deposits of soft white limestone are several hundred feet thick. Similar deposits are found in Northern England and Northern Continental Europe, particularly France. Rowe confined his study to five zones comprising the Turonian and most of the Senonian. The zones were the following: *Terebratulina gracilis, Holaster planus, Micraster cor-testudinarium,* and the lower third of Micraster cor-anguinum which he termed low-zonal and the upper two-thirds of *Micraster cor-anguinum* which he called high-zonal. These formations cover about twenty million years in the evolutionary geological column. Kermack's study was based on one portion of Rowe's collection from the *Micraster cor-anguinum* zone.

The softness of the limestone makes removal of fossils quite easy. The tests of the *Micrasters* could be cleaned without damaging the complex ornamentation which served as the basis for much of the study.

THE MAJOR STUDIES OF MICRASTER

Rowe's Research

Rowe' collected two thousand specimens from six areas in Southern England. Each specimen was accurately zoned before being measured and studied. Published in 1899, this study is the only one to date which is based on a population rather than individuals. Rowe based his research on seventeen characters, only part of which will be discussed here. Various factors of size and shape of test were measured. Particular attention was directed to the ambulacra which Rowe considered the most dependable basis of zonal determination. The position of the peristome and the characteristics of the surrounding structures were studied. Rowe disregarded the structure of the spinal system because it was obscured by deposit in so many specimens, however he did consider its position a character of great importance.

The species used in this study and the zones in which they were found are as follows:[4] (p. 542)

High-zonal Series

Zone	Species
M. cor-anguinum (Upper two-thirds)	*M. cor-anguinum* (Two varieties)

Low-zonal Series

Zone	Species
M. cor-anguinum (Lower third)	*M. precursor* *M. cor-testudinarium*
M. cor-testudinarium	*M. cor-testudinarium* *M. precursor*
Holaster planus	*M. cor-testudinarium* *M. precursor* *M. Leskei* *M. cor-bovis*
Terebratulina gracilis	*M. Leskei* *M. cor-bovis*

Space permits only a brief discussion of the changes Rowe noted as his study proceeded from lower to higher zones. In general the test changed shape from narrow, cuneiform to broader and more oval. The dorso-ventral measurement increased proportionally. The apical disk moved from an anteriorly eccentric position to a more central position. The ambulacra or petals changed from deeply depressed rather short structures to shallow, longer forms. The structure of the interporiferous area of the ambulacra changed from smooth to ornamented. These structures are complex and it is not possible to describe the changes in detail in this paper. Of special interest is the sub-anal fasciole which always is poorly developed in the lower zone but is very highly developed in the higher zone. The wall of the test of *M. cor-bovis* is thin while higher forms possess thicker tests.

The different species graded smoothly from one to another. Note what Rowe says about the species:

"True species, and even prominent varietal types, are rare, and passage forms and trivial variants are the rule. Nothing but a Group will embrace them all, and give to each series its correlative value."[4] (p. 517)

Accordingly he proposed four groups of variants, namely: *M. cor-bovis, M. Leskei, M. precursor (M. cor-testudinarium* is considered a variety of *M. praecursor),* and *M. cor-anguinum*.

(It should be stated at this point that this writer has in her personal collection of fossil echinoids six Micrasters, four of which belong to the species studied by Rowe. Three of them, *M. cor-bovis, M. cor-testudinarium,* and *M. cor-anguinum* are superbly preserved. Since they form the basic phyletic line, it has been easy to follow the complex descriptions of Rowe. They exemplify not only the changes but some of the variants discussed.) (Figures 1-6)

Rowe gives a very complete description of *M. cor-bovis* as the ancestral species followed by comparisons between it and *M. Leskei.* He concludes the following:

"Every possible variation between the two species may be traced in their passage forms."[4] (p. 523)

Following further comparisons between the two species Rowe says:

"It will therefore not be unreasonable to look upon this primitive form *[M. cor-bovis]* as the progenitor of M. *Leskei,* and through it of *M. precursor* and *M. cor-testudinarium."*[4] *(p. 524)*

Although he emphasizes the lack of a sharp division between species and the predominance of intermediate types, Rowe divides the *Micrasters* into two zoological divisions, the low-zonal and the high-zonal, with the break occurring at the point between the lower third and upper two-thirds of the zone of *M. cor-anguinum.* A second break in the low-zonal fossils occurs between the *M. cor-bovis* with its thin test and *M. Leskei* with its thick test.

It was the purpose of Rowe to show that:

". . . we can trace an unbroken continuity in the evolution of *Micraster; so* that as we mount up, zone by zone, fresh features are added to the test, simply owing to the progressive elaboration of the epistroma; and that in each zone the special features of the test are so marked that one can tell by their aid from what zone a Micraster is derived."[4] (p. 540)

We see here a contradiction. If there is unbroken continuity, how can there be sharp distinctions between zones? Rowe does not make clear what he means by horizontal features. He states that changes in ambulacra are horizontal, not specific, that all the species in one horizon have one type of an ambulacrum while the species of the next horizon show other characteristics of the ambulacra. He does not explain the basis on which he determined species.

KERMACK'S RESEARCH

In 1954 K. A. Kermack completed a study of Micraster evolution from a different angle.[1] He limited his work to the specimens from one area using five hundred sixteen specimens collected by Rowe at Northfleet, Kent. It was Kermack's purpose to make a comparative study of *M. coranguinum* and *M. (Isomicraster) senonensis.* Rowe called the latter *Epiaster gibbus.* Kermack also studied allometric growth rates of certain characters in these two *Micrasters* and considered the relationships of certain characters in a supposedly single interbreeding population. A fourth purpose, that of studying methods of investigation, is not the chief concern of this paper.

After cleaning the tests and rejecting some specimens that for various reasons could not be used, Kermack made thirteen measurements on each specimen. These measurements were taken in millimeters except for one item which was measured in square millimeters and two items which consisted in counting plates. These measurements included dimensions which would reveal the shape of the test as well as its size. The measurement of the sub-anal fasciole proved challenging because of its irregularity. Details won't be included here except to say a camera was used. This measurement was particularly important as will be discussed later.

Kermack took into consideration three classes of possible errors in determining the validity of his evidence. First, errors in measurements would be considered as in any other research. A more important error would be found in bias in the sample. Rowe's personal interests, his attitudes toward the species, his attitudes toward faulty specimens — all these factors would affect the quality of the specimens and the relative numbers of each species. Study of the specimens suggested that Rowe was biased in favor of the passage forms and of *Epiaster gibbus (M. senonensis).* The third source of error was considered to be the age distribution of the sample. The uncertainties of preservation is believed to result in a biased representation of the living populations because some ages might be more likely to become fossilized than others.

Rowe had divided his collection into three sections: *M. coranguinum, Epiaster gibbus (M. senonesis),* and the forms he considered transitional between the two species. Kermack approached the problem of deciding whether there were two closely related species in the population or one variable species. After measuring all the specimens as described above Kermack came to this conclusion:

"... none of the characters under consideration enables us to distinguish between the two species with certainty." [1](p. 393)

Kermack further says:

"In all characters, except the area of the sub-anal fasciole, the two species completely intergrade. Such intergrading is due to hybridization and is not uncommon between species of recent echinoids: . . . *Micraster senonensis* and *M. coranguinum* may well have hybridized in the same way, thus producing transitional forms. By analogy with recent forms, however, there is no reason to deny to either the status of a good species, although they can certainly be distinguished on the character of the sub-anal fasciole." [1](p. 406)

He explains the variations as due to differences in growth rates of characters or to inherent shape. Also, Kermack *assumes* that the differences are due to natural selection and the changes are adaptive. Also, he postulates that the two species lived in different ecological niches.

NICHOL'S RESEARCH

In 1959 D. Nichols published the results of a research problem in which he studied the morphology and ecology of extant Spatangoids, giving special attention to *Echinocardium cordatum,* and relating the material to the extinct *Micrasters.* [3](pp. 70-72) He formulated the hypothesis that the low-zonal forms such as *M. cor-bovis* were surface dwellers or did not burrow deeply while the high-zonal species such as *M. coranguinum* burrowed deeply. He based this hypothesis on a comparison of the fossils with living forms. The extant forms which burrow deeply have a strong sub-anal fasciole. This circular groove containing cilia provides a sanitary tube for the removal of wastes. Surface dwelling forms do not need such a tube. Also, the smooth ambulacra of the low zonal forms did not have as well developed cilia as the ornamented ambulacra of the high-zonal types. The cilia facilitate the circulation of water necessary for respiration and the removal of detritis which falls on the animal. Nichols counted the number of pore pairs in the petals and by comparison with extant forms concluded that the increasing number of pairs suggested increased number of respiratory tube feet. He postulated *this* enabled the animal to burrow more deeply. [5](P. 47, 48) Since the lithology of the zones is similar, Nichols concluded the animals lived in different niches in a similar habitat.

SUMMARY OF THE THREE STUDIES

Rowe collected some two thousand specimens from several areas giving particular attention to two factors, namely: the changes from zone to zone and the many transitional forms between species. He postulated that *M. cor-bovis* was the primitive type (thin tested) from which *M. Leskei* (thick tested) evolved. Other species then followed *M. Leskei.* Rowe emphasized the difficulty of determining species because each species smoothly merges into the next with no definite place to draw a line between species. He attached particular importance to changes in the ambulacra, but he used the trait to determine zonal level, not species.

Kermack used Rowe's specimens from one locality assuming the animals comprised one interbreeding population. Using two species, *M. coranguinum* and *M. senonensis,* he made a study of thirteen traits which could be measured. Kermack concluded that twelve of the characters were so overlapping that they could not be used to determine the species. The thirteenth trait, the sub-anal fasciole, is a sure way, according to Kermack, to distinguish the two species with *M. coranguinum* having sub-anal fasciole and the other species lacking the structure. He postulated that the prevalence of transitional forms indicate hybridization while the sub-anal fasciole suggests the animals occupied different niches with the differences being due to adaptation to environmental pressure.

Nichol's study consisted in extensive work with living Spatangoids and use of the data to interpret the significance of the characters exhibited by the *Micrasters.* On the basis of his study he concluded that some forms were burrowers while others lived on the surface. The structure of the ambulacra, the shape of the test, and the presence or absence of the sub-anal fasciole were the characters considered.

It is significant that the three men approached their studies from a completely evolutionary oriented viewpoint. All data were interpreted from that bias. It was not a matter of determining whether or not evolution is a fact but of finding evidence to support an idea which was taken for granted as true.

GENERAL PROBLEMS OF FOSSIL SPECIES

In considering the significance of the proposed interpretation of the *Micrasters* some general problems of determining fossil species should be noted. Imbrie [7](p. 125) makes some interesting statements:

"In spite of the extended attention this problem has received, the nature of fossil species remains one of the most controversial topics in paleontology. . . . But two key questions are still being asked: What is a fossil species? How can fossil species be recognized? . . . The concept of fossil species held by most paleontologists is largely an inference, an inference based both on observed structure of living species and on a theoretical model of the evolutionary mechanism."

It might be noted here that neontologists are not in agreement as to what a biological species is. It is not intended to discuss that problem in this paper. Paleontologists necessarily are more restricted in the traits they can use as a basis for specimen determination.

The concept of a *typological species* is widely used both in paleontology and in neontology. According to this plan a specimen is selected as a type specimen and the status of other specimens is determined by comparison.

Inferences as to species also are based on biogeography and ecology. The exploration of these two fields in paleontology is in its infancy, and as is the case in other phases of paleontology, is approached from a completely evolutionary point of view.

Most fossil species are termed by Imbrie [7](p. 131) *transient species*. By this term is meant each species represents a brief point in the evolutionary history of the organism with gaps both preceding and succeeding the species. This is a purely evolutionary concept. *Successional species* are those, such as the Micraster of this study, in which there is a gradual gradation between assumed species. Examples of this are extremely rare in the fossil record.

A CONSIDERATION OF MICRASTER SPECIATION

Regarding the determination of fossil species Imbrie has this to say:

"By the nature of the evolutionary process we cannot eliminate arbitrary taxonomic judgments. Species-making will remain a Practical art as well as a scientific discipline." [7](p. 127)

It can be seen from this quotation as well as from the discussions of Rowe and Kermack that the *Micraster* species are determined entirely within an assumed evolutionary framework. Also, that the determination of a species is arbitrary and depends on the opinion of the worker. Rowe discusses the difficulty of species determination of *Micraster* in detail and admits his judgment as to lineage is entirely a personal decision. [4](p. 543)

Furthermore, those who have studied the *Micrasters* disagree. All agree on the *M. Leskei-M. cortestudinarium-M. coranguinum sequence.* But Rowe believed *M. Leskei* evolved from *M. corbovis* while Kermack postulates that *M. corbovis* branched from *M. Leskei* which he considers only a small form of *M. cortestidunarium*. Kermack also believes that *M. senonensis* branches from *M. cortestudinarium* and followed a parallel evolution to the main line just as *M. corbovis* evolved along with the main line. Rowe considered *M. senonensis* as belonging to the genus *Epiaster* and divided *M. coranguinum* into two varieties which Kermack ignored as well as the species *precursor* which Rowe postulated. Kermack believed the two species he studied had evolved from stock at lower levels and both belonged to the stratum in which they were found. His basis for rejecting migration is based on comparisons with *Micraster* sequences in other deposits both in North England and on the continent. However, Nichols believes that *M. senonensis* migrated from some other locality.

These investigators believe that the genus evolved from a burrowing type to a surface dweller but none of the scientists attempt to explain what caused the change. James R. Beerbower [6](p. 133) simply states the question can't be answered at present.

Kermack states that hybridization prevented full adaptation to environment and would result in "poorly adapted transitional forms" [1](p. 422) He further states that the formation of a barrier between the two species would permit more perfect adaptation. He does not explain in what way the hybrids might be faulty. If numbers in the population are indication of their success, they were more successful than the true species.

Rowe based his postulates on the assumption that the vertical stratification of the fossil beds represent a succession of evolutionary forms. R. G. Johnson [9](p. 123) states that the vertical stratification of modern benthic communities suggests fossil strata will not be pure or that there will be mixing of successive populations, and life spans will overlap. That will have a bearing on the validity of Rowe's assumptions. Johnson further states [9](p. 115) that the vanishing of a species such as *M. corbovis* does not necessarily imply a change of immediate environment but that the change may be elsewhere and indirectly affect the local fauna. This puts a question on the assumption of Kermack [1](p. 422) that the niche of *M. corbovis* suddenly vanished.

As this writer studies her specimens she finds the differences described by Rowe, but the variations do not exceed in magnitude those observed in the human species or in domesticated animals. Some of the changes in the ambulacra were so small a magnifier is required to see them well. When one considers that these changes, according to uniformitarian estimates of time, took place over a period of perhaps some twenty million years, it can be seen the presumed evolution was indeed slight. Then here is another problem. The Echinoids supposedly arose during the Ordovician about four hundred million years ago. If twenty million years were required to produce the slight differences observed in ***Micraster,*** how can one account for the many kinds of ***Echinoids*** even over the three hundred million years postulated for their evolution? There is a discrepancy in the proposed evolutionary rates with Micraster evolving much more slowly than the class ***Echinoidae*** as a whole.

In this brief discussion can be seen the purely subjective nature of the evidence for change of species in the ***Micrasters.*** Also, it is quite evident that all the investigators are interpreting the evidence from an evolutionary bias. Are the ***Micrasters*** one highly variable species? Do they exemplify a true change of species? If so, where are the breaks between species? Or did the forms grade so that ***M. Leskei*** was fertile with ***M. cortestudinarium,*** and ***M. cortestudinarium*** could cross with ***M. coranguinum,*** but ***M. Leskei*** and ***M. coranguinum*** were not interfertile? No one can answer these questions.

SOME UNEXPLORED PROBLEMS

This entire study does not touch on the geology of the problem. Uniformitarianism is implied by the investigators. The relation of the chalk formations and their paleobiota to flood geology or catastrophism is a subject too involved for exploration in this paper. Other species of the ***Micrasters,*** the relation of the ***Micrasters*** to other ***Spatangoids,*** and the presumed evolution of the ***Echinoidae*** as a class could form the basis of extended study.

FROM THE CREATIONIST'S POINT OF VIEW

The point of view of a creationist on this problem is simply stated: It doesn't make any difference whether changes of species did or did not take place. If there were no changes, then there is no reason for concern. If there was an actual genetic as well as morphological change, then it was no different from some changes which have been observed in other organisms today. The organisms still were ***Micrasters*** and easily could be one of the "kinds" of Genesis. In no sense does changes of species in the ***Micrasters,*** if such changes did occur, prove the overall hypothesis of evolution. Such changes would not close any of the gaps in the phylogenetic tree of life. But the variations demonstrate the capacity for change the Creator placed in the original "kinds."

"Dr. R. A. Stirton, in his book ***Time, Life and Man,*** says that the greatest value in the study of paleontology is the satisfaction it affords the individual who enjoys it." [10] (p. 11)

This writer has derived much pleasure from her study of the ***Micrasters.*** The marvelous beauty and the intricate detail of the fossils produces feelings of awe and wonder — awe toward the Creator who put them here and wonder as to how they were formed. Faith is strengthened rather than weakened by studies such as this — a source of deep satisfaction.

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Figures 1 to 7 show dorsal and ventral sides of Micraster forms given species names as they are found in the various chalk formations. The figures are in the order in which they are found in the series, from M. ***leskei*** in the low zonal to M. ***coranguinum*** from the upper horizon. The total time period according to evolutionary geological assumption is about twenty million years. The relatively slight changes, particularly from M. ***corbovis*** to M. ***coranguinum*** should be noted. These are scarcely comparable to the known variability shown by races of mankind. Yet this is one of the classic examples of evolution always referred to in courses in invertebrate paleontology.

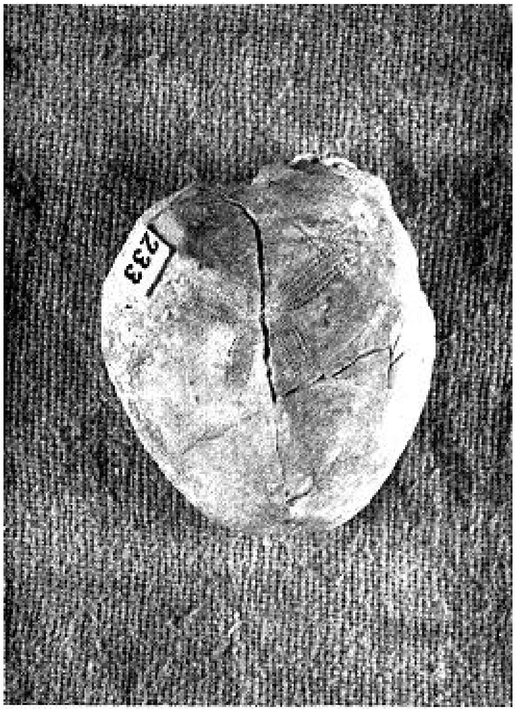

Figure 1. Micraster *leskei* Desm. Upper Cretaceus chalk Turonian, Rouen, France. Dorsal side.

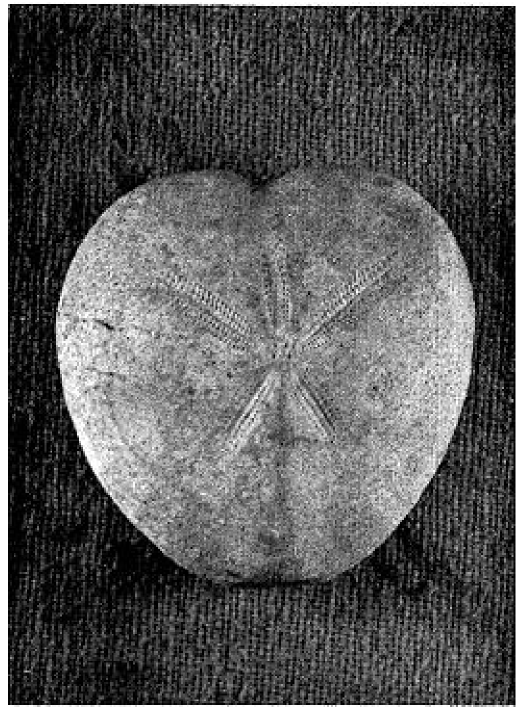

Figure 2. M. ***corbovis.*** Upper Cretaceus: Danien chalk cliffs, Sussex, England. Dorsal side.

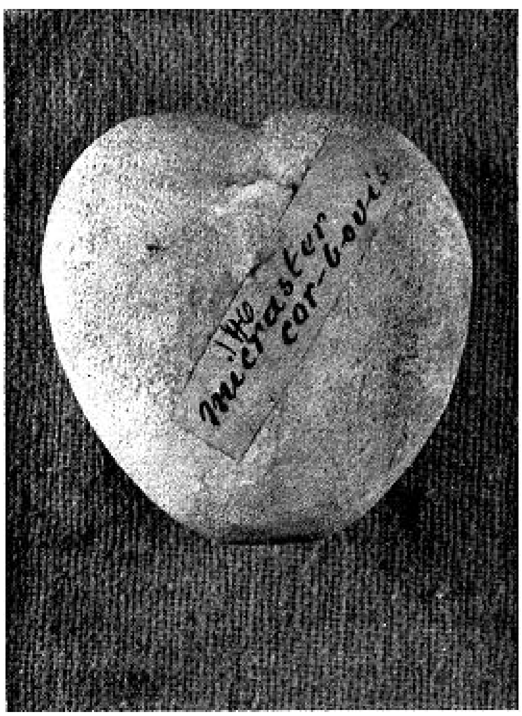

Figure 3. M. corbovis. Ventral side of Figure 2.

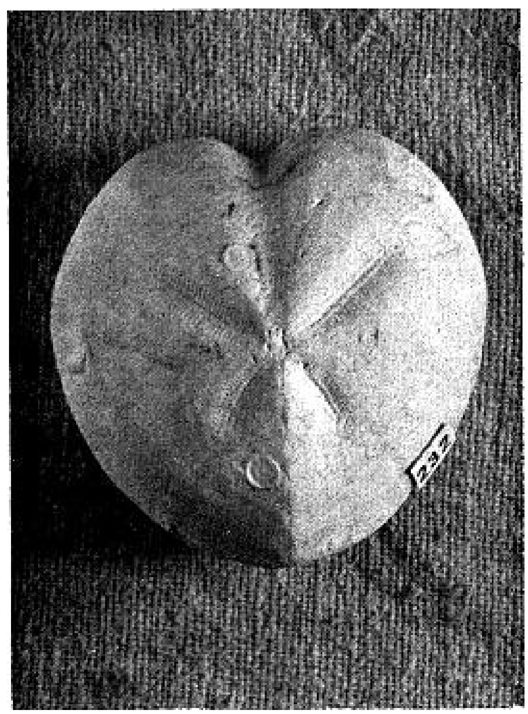

Figure 4. M. *cortestudinarium* Agassiz. Upper Cretaceous chalk cliffs, Norwich, England. Dorsal.

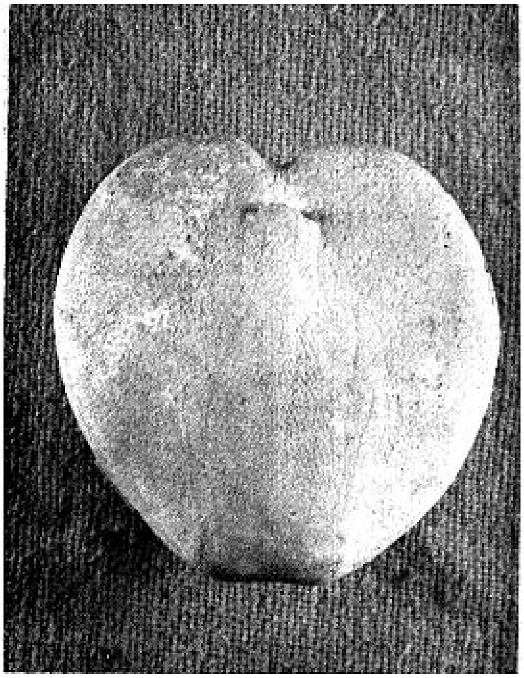

Figure 5. M. ***cortestudinarium*** Agassiz. Ventral side of Figure 4.

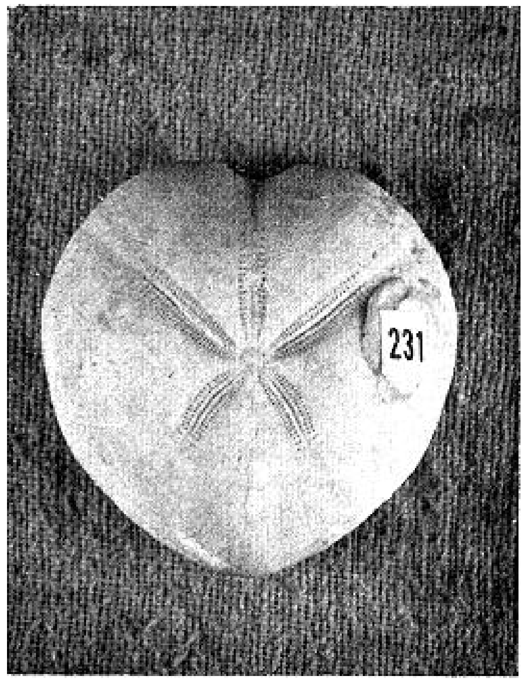

Figure 6. M. ***coranguinum.*** Upper chalk Cretaceus, Dorchester, Dorset, England. Dorsal side.

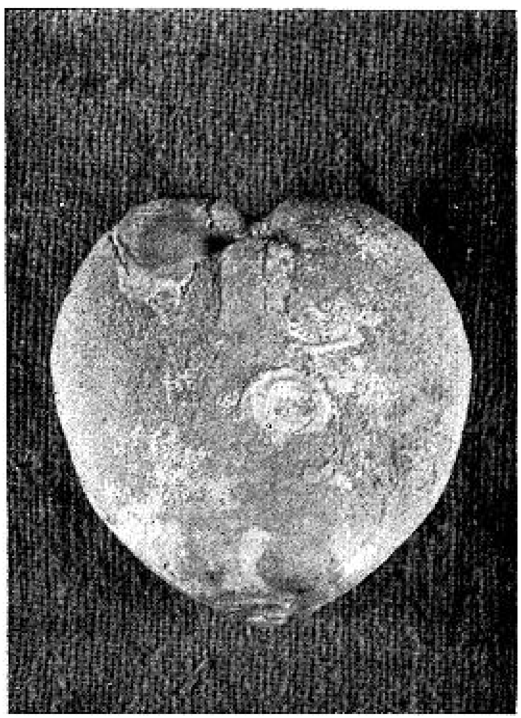

Figure 7. M. ***coranguinum.*** Ventral side of Figure 6.