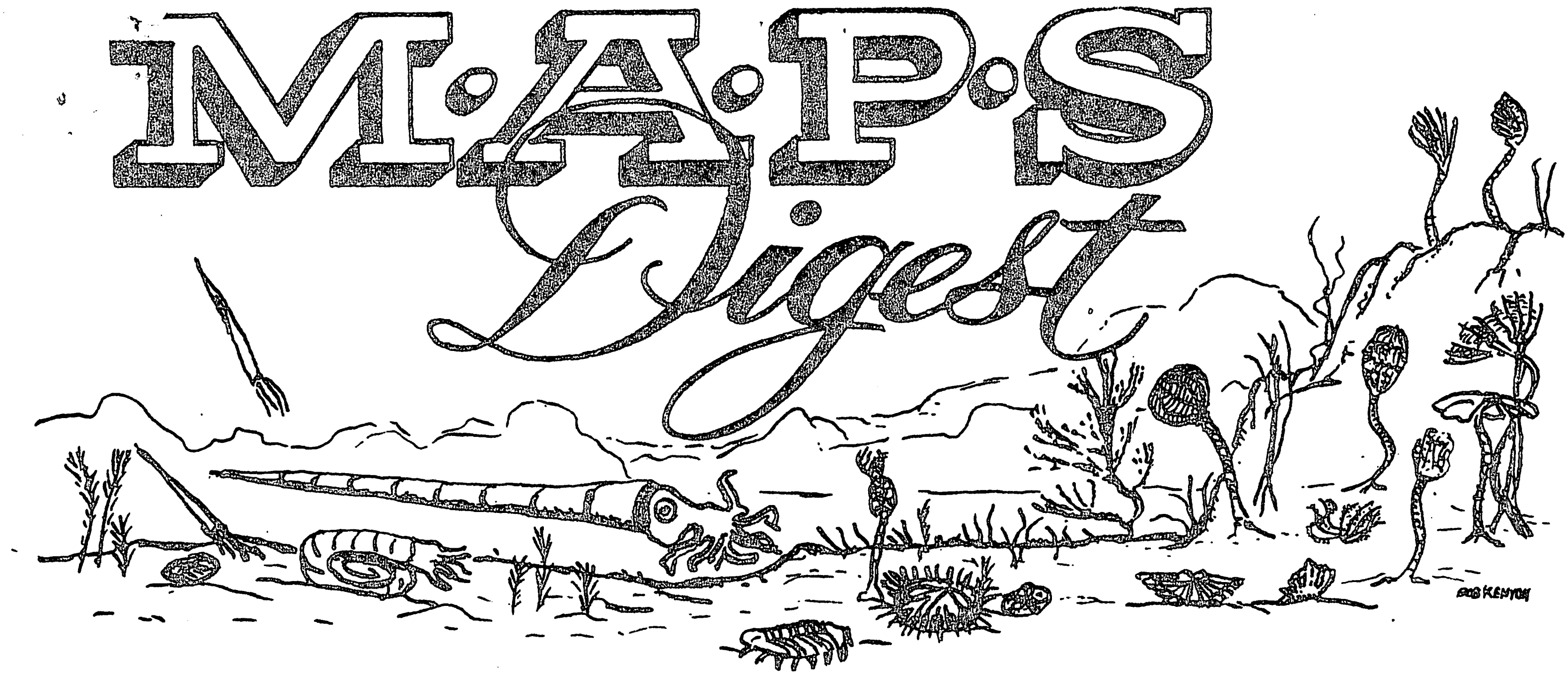

Volume 4 Number 1 November, 1980 Official Publication of the Mid-America Paleontology Society

FROM OUR PRESIDENT

Nearly 30 of us attended the field trip to south-central Iowa during the first Saturday in October. It was a beautiful day, weather wise; the hunting was good, and the fellowship was most enjoyable. To conclude the day, 21 of us went to a Dutch smorgasbord in Pella for a fine feast and additional visiting. As we prepared to leave, we learned that the good fairy, Dennis Kingery, had paid for everything. A big thanks to the Dougs of Donnellson for making the arrangements and to Dennis.

We do have one problem of which you should be made aware. Although we had a verbal agreement to hold the Expo at Western Illinois again next year, they backed out. This was due primarily because of an increase in enrollment. There are alternate sites in Macomb, but they are considerably more expensive and less desireable. We're investigating other locations in Galesburg, IL and the Quad City area. We will maintain the April 24-26 dates, changing it only as a last resort. We will have a location locked in in the very near future, possibly before this <u>Digest</u> goes to press. You will be informed as to the Expo's location and other pertinent information as soon as we can get the necessary informations.

I'm pleased to announce that Paul Caponera of the Chicago area will be my replacement as Paleo Chairman of the Midwest Federation. Although he is a neophyte to the hobby, he has mastered the science admirably. Thanks, Paul, from all of us.

Don

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MARK YOUR CALENDARS

1 Nov MAPS Meeting -- Augustana College
1:00 p.m. Board Meeting
2:00 p.m. Program

*****

MAPS MEETING -- NOVEMBER PROGRAM

"Anatomy and Taxonomy (to family) of the Brachiopods"

Program to be presented by Don Good. Bound to be -- good!

*****

Have you read--October, 1980, READER'S DIGEST, "Dinosaur Jim" Sherlock of Bones

*****

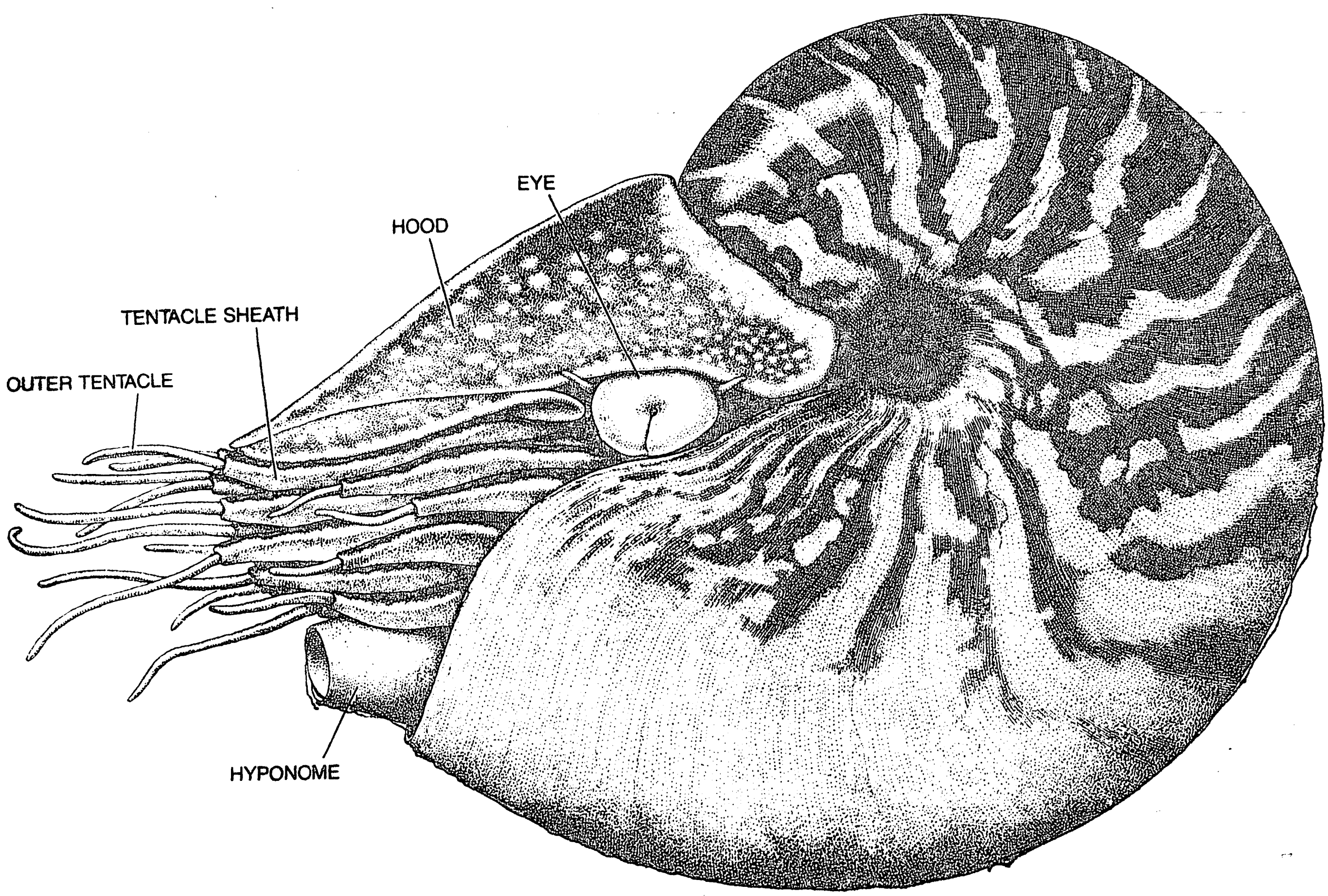
DUES ARE DUE

THE BUOYANCY OF THE CHAMBERED NAUTILUS -- SCIENTIFIC AMERICAN, October, 1980

by Peter Ward, Lewis Greenwald and Olive E. Greenwald

Before the end of the Cretaceous period some 65 million years ago life in the oceans was quite different from that of today. Among the most important large inhabitants of the seas were chambered cephalopods: mollusks that dwell in the outermost compartment of a shell they divide into compartments by secreting a sequence of septa, or walls, inside it...

The chambered cephalopods reached their greatest diversity during the Triassic, Jurassic and Cretaceous periods, from 225 to 65 million years ago. In the latter part of the Cretaceous their numbers began to diminish, perhaps in response to increasing numbers of a new type of mobile predator, the modern bony fishes, which maintain their neutral buoyancy in an entirely different way: they have an inflatable bladder and a gland that can fill it with gas. Whatever the reason, the extinction of the chambered cephalopods was almost complete by the end of the Cretaceous. Only the genus Nautilus now remains. The animals of the genus provide an opportunity to study the ancient buoyancy system. The precision of the system in the nautilus is remarkable: the difference between the weight of a mature nautilus (as much as 1,400 grams, or more than three pounds) and that of an equal volume of seawater can be as little as a gram.



Gross anatomy of Nautilus macromphalus, the species studied... The view shows the features that are visible externally. The head of the animal protrudes from the shell. It has more than 90 tentacles that are arrayed in two whorls on each side of the mouth. The eyes are prominent but the vision they provide is not acute. The head is protected by a tough fleshy hood.

The surviving species of Nautilus are found in the sea just outside the coral reefs that surround the islands of the tropical western Pacific. They are rarely seen near the surface, but they have been trapped at depths as great as 600 meters. Since they live below the typical range of human divers, little is known about their behavior and their ecology. Nevertheless, some observations have been made. For one thing, the stomach of a dissected nautilus usually contains pieces of bottom-dwelling crustaceans. Moreover, on the rare occasions when we ourselves have observed the nautilus in the sea the animal has been on the bottom or close to it. Finally, the nautilus is a slow swimmer; a diver can easily keep up with one. The impression is strong that the nautilus feeds by slowly foraging on the slopes of the fore reef.

The living soft parts of the nautilus consist of two principal sections, the head (more properly the head-foot) and the body. The head is covered by the hood, a tough, fleshy tissue that acts as a shield. The nautilus can retract into its shell, leaving only the hood exposed.

The most notable features of the head are its tentacles, which number more than 90, far more than there are in any other living cephalopod. Each tentacle is lodged in a sheath, into which it can be retracted and from which it can be protruded. The surface of the tentacle lacks the suckers found on the tentacles of other cephalopods. Instead it is covered with a sticky substance that aids it in holding prey.

The tentacles surround a massive pair of jaw parts that resemble the beak of a large parrot. The jaws are heavily calcified, allowing the nautilus to break up even the most heavily armored exoskeleton of a crustacean. Unlike the saliva of the octopus, a fellow cephalopod, the saliva of the nautilus contains no toxins to incapacitate a struggling prey animal. The jaws of the nautilus are its only offensive weapon. Below the tentacles and the jaws is a fold of tissue called the hyponome, which is used for locomotion: it expels a jet of water. The hyponome is actually a pair of muscular flaps that curl around each other to form a highly flexible funnel.

One other feature of the head deserves mention. Like other cephalopods the nautilus has prominent eyes, one on each side of the head, but unlike the eyes of the others, the eyes of the nautilus are poorly developed. For example, they have no lens. A tiny opening admits light, and presumably images form the way they do in a pinhole camera. Our own encounters with the nautilus suggest that its eyes may serve solely to detect changes in the intensity of light. On the other hand, the tentacles seem to bear cells that are sensitive to the presence of chemical substances. These cells may serve the animal in place of accurate vision.

The other main section of the living nautilus, the body, includes a large sac that contains the animal's organ systems. Much of the space is occupied by the systems for digestion and reproduction. The sac itself is enveloped by the mantle, a sheet of tissue that secretes the shell. The posterior mantle secretes the septa that divide the shell into compartments. The space between the mantle and the sac is open under the body, creating a large cavity that communicates with the hyponome. The cavity contains four large gills, in contrast to the single pair of gills found in all other cephalopods. The cavity also receives the exit pores for the digestive and reproductive systems.

The sexes are distinct in the nautilus. The male is slightly larger than the female because of the presence of a large organ, the spadix, which during copulation introduces a packet of sperm into the mantle cavity of the female. The female of many cephalopod species produce thousands of eggs in a year; an average female nautilus produces no more than 10 large eggs. (cont'd page 10)

EXPLORERS OF THE EARTH WITHIN, Cont'd from October Digest
Roger Bingham, SCIENCE 80, Sept/Oct

Wegener (the German scientist who first proposed the theory of continental drift early in this century) hypothesized a radically different interpretation that directly challenged the flaws in the ...wisdom. Mountains, he said, are found in narrow, curvilinear belts; if the shrinking apple analogy were accurate, they should be evenly distributed across the surface of the earth. Nor could he accept the notion of continents or land bridges sinking into the ocean floor. The principle of isostasy (which holds that the continents float in hydrodynamic equilibrium on a layer of denser material) would be violated. Continents were insufficiently dense to sink into the floors.

So why were fossils of small reptiles like Mesosaurus, for example, found only in Brazil and South Africa? Wegener dismissed land bridges. The prospect of crews of Mesosaurus putting to sea like primordial owls and pussy cats in a flotilla of pea-green boats seemed unrealistic. For Wegener, movement of the continents was the obvious answer. Quite simply, there must have been a time when Africa was just down the road from Brazil, an easy swim for the Mesosaurus. The geological evidence--the continuity of distinctive rock formations in continents now widely separated--forced the same conclusion.

Pulling together his strands of evidence from geological formations, the fossil record, and ancient climates, Wegener produced the well-known reconstruction of Pangaea, his massive protocontinent, surrounded by the universal ocean, Panthalassa. The map was crude, but it bears a clear resemblance to modern versions.

Although the hypothesis produced a mixed reaction initially, it soon fell into disfavor. Cambridge physicist Sir Harold Jeffreys demolished Wegener's proposed driving mechanism. The notion of continents of solid rock moving through ocean floors of solid rock in a rigid earth was, impossible. Jeffreys was not alone.

And then, in the 1950s and early 1960s, new investigative techniques led to a spate of discoveries that transformed the stagnating earth sciences and revived interest in continental drift. Essentially, the investigations focused on two areas: the nature of the ocean floors, and the magnetism of ancient rocks.

When rocks cool and harden, the iron particles they contain become magnetized in alignment with the earth's prevailing magnetic field. The direction is locked in, so that the rocks become a kind of fossilized compass. Scientists examining ancient rock from India, for example, discovered that its average magnetic inclination 150 million years ago was about 30 degrees south, by 25 million years ago, it had flipped to 15 degrees north.

One interpretation clearly jibes with continental drift: India moved north from below the equator. But there was another possibility. If the North Pole itself had wandered, the magnetic field would change, imprinting different magnetic values on stationary rocks. Teams in America and England examined the polar-wandering theory by looking at the paleo-magnetism of rocks in their respective countries and plotting the movement of the pole. The resulting curves began at the same point, had the same shape, but veered away from each other. The only way to superimpose them, the teams discovered was to close the Atlantic and reorientate Europe and North America--just as Wegener suggested.

Drift seemed to be back in business, a suggestion that was confirmed by the oceanographic studies. Virtually nothing was known of the ocean floor, except for the existence of a submarine mountain range running along the axis of the Atlantic (The mid-Atlantic ridge). But in the 1950s, a team of Lamont-Doherty Geological

Observatory, working with ocean floor echosoundings, produced a series of startling results. The mid-Atlantic ridge,...was not unique: It was part of a 40,000-mile long system of ridges that circle the globe like the stitching on a baseball. The simplest way to spot ridges was to look for earthquakes. They also found the crest of the mid-Atlantic ridge was notched by a valley, apparently a rift.

About the same time, the British geophysicist Sir Edward Bullard devised a method for measuring the rate of heat flow from the earth's interior. It was far greater at the ocean ridges than elsewhere on the continents or ocean floor.

The man who pulled all these observations into a coherent picture was the late Harry Hess of Princeton. In a seminal paper circulated in 1960 and titled "History of Ocean Basins" (but tentative enough for Hess to describe it as an "essay in geopoetry"), he proposed that the midocean ridges were outlets for molten rock upwelling from the mantle to form new ocean crust. According to Hess, convection cells in the mantle forced the material up, as if on a conveyor belt, to "patch" the growing rent in the crust. The new ocean floor spreads symmetrically on both sides of the ridges, creeping slowly toward the deep ocean trenches where it is destroyed. The process takes about 200 million years and explains why no ocean floor rock older than that has ever been found. It is constantly being swept to one side, into the trash can of the ocean trenches.

It is at this point that Tuzo Wilson entered the picture....Wilson attacked the problem of drift by looking at the distribution of ocean islands in the Atlantic. If the continents had drifted, he reasoned, there must be some evidence of passage in their wake--some kind of footprint. And if Hess' ideas were correct, volcanic islands, driven up through the crust near the mid-ocean ridges, would have been carried progressively further away from the ridges by the conveyer belt of drift. Wilson produced a compendious survey of the islands, which supported his thesis. The further an island was from the mid-Atlantic ridge, the greater its age.

By a similar kind of reasoning, Wilson suggested a mechanism for the formation of the Hawaiian Islands, the compelling but still controversial idea of hot spots within the earth. The conventional explanation of island chains was that they were formed by "leakage" from a large fault in the crust; all the islands in a chain were thought to be of the same vintage. Wilson disagreed. He argued that the Hawaiian Islands had been punched up in sequence, like rivets, through the Pacific plate as it moved over a hot spot.

Another crucial bit of evidence came from a paleomagnetic study published a year earlier by Cambridge research student Fred Vine and his supervisor Drummond Matthews. Looking through magnetic recordings made near ocean ridges by research ships, they tried to explain a curious pattern: linear ribbons of apparently different intensity, paralleling the ridges like the stripes of a zebra. In effect, Vine and Matthews discovered a magnetic tape recording of the history of sea floor spreading, equivalent to Tuzo Wilson's surface history based on ocean islands.

For an as yet unexplained reason, the earth's magnetic field periodically reverses itself. There have been 171 reversals in the past 76 million years. Each reversal showed up on the recording as a different stripe. As molten rock oozes up from the mantle at midocean ridges and cools, it becomes magnetized in the direction of the earth's field and spreads symmetrically to either side of the ridge to form a stripe of a given polarity. The variation in the stripes' polarity, as they moved away from the ridges confirmed Hess' theory and supplied a method for calibrating the rate of spread, rather like counting tree rings.

By a lucky coincidence, the University of Cambridge (the home base of Vine, Mathews, and Dan McKenzie, who was shortly to become a major theorist of plate tectonics) was host in 1965 to Tuzo Wilson and Harry Hess. Both men saw the importance

(cont'd. page 9)

THE CHAMBERED NAUTILUS (1858)

This is the ship of pearl, which, poets feign
Sails the unshadowed main,--
The venturous bark that flings
On the sweet summer wind its purpled wings
In gulfs enchanted, where the Siren sings,
And coral reefs lie bare,
Where the cold sea-maids rise to sun their streaming hair.

Its webs of living gauze no more unfurl;
Wrecked is the ship of pearl!
And every chambered cell,
Where its dim dreaming life was wont to dwell,
As the frail tenant shaped his growing shell,
Before thee lies revealed,--
Its irised ceiling rent, its sunless crypt un sealed!!

Year after year beheld the silent toil
That spread his lustrous coil;
Still, as the spiral grew,
He left the past year's dwelling for the new,
Stole with soft step its shining archway through,
Built up its idle door,
Stretched in his last-found home, and knew the old no more.

Thanks for the heavenly message brought by thee.
Child of the wandering sea,
Cast from her lap, forlorn!!
From thy dead lips a clearer note is born
Than even Triton blew from wreathed horn!!
While on mine ear it rings,
Through the deep caves of thought I hear a voice that sings:--

Build thee more stately mansions, O my soul,
As the swift seasons roll!
Leave thy low-vaulted past!
Let each new temple, nobler than the last,
Shut thee from heaven with a dome more vast,
Till thou at length art free,
Leaving thine outgrown shell by life's ar- resting sea!!

--Oliver Wendell Holmes

*****

LIBRARY ADDITIONS

This note is for the benefit of those who are serious about acquiring knowledge concerning echinoderms (crinoids, blastoids, etc.). A short course has been put together for presentation at the forthcoming annual meeting of the Geological Society of America in Atlanta, GA. All participants are active echinoderm specialists and are mainly professors. Much of the information is based on current research and ideas such as the newly proposed three sub-phyllum system for echinoderm classification, the new discovery of the oldest known (Blackriveran-Ordovician) blastoid is noted, etc. The information will be used in advanced courses in Zoology and Invertebrate Paleontology as well as by specialists in the phyllum

This has been published in soft-backed form (235 pages) as Echinoderms, Notes for a Short Course, edited by T. W. Broadhead and J. A. Waters, University of Tennessee, Department of Geological Sciences, Studies in Geology 3, Knoxville, Tennessee 37916. It can be obtained from the Department for $6.00 plus $1.00 for postage and handling.

also

Historical Biogeography, Plate Tectonics and the Changing Environment Proceedings of the Thirty-seventh Annual Biology Collioquium and Selected Papers. Ed. J. Gray and A. J. Boucot. Oregon State University Press, Coravillis, 1979, 500 pp. $59.75.

This reference appeared in a British journal. Harrell Strimple's comment about that is,"The British have been at these things longer than we have and they really do things up right."

also

Geological Highway Map Series

The AAPG Bookstore, P. O. Box 979, Tulsa, Oklahoma 74101

There are 11 of these geological maps. Information is the same as for Map 1, below, unless otherwise noted:

Map 1. Mid-Continent Region. Geologic map of Arkansas, Kansas, Missouri, and Oklahoma overlain by a standard highway map. Map sections include stratigraphic column, tectonic map, physiographic map, a source-

(continued page 10)

SEDIMENTARY NOTES

Ernest and Onsby Hammons, Petersburg, TN, Chairmen of the Board of Blastoid Mountain, were hosts to a club from Chattanooga for a trip for agatized coral. I can't decide which is better, their never ending TN Sil., Miss. fossils or their happy, exhilerating conversation. When you come to know them, you also come to know the meaning of southern hospitality. They gambled last year for a birthday gift for Onsby and got a table and came to Expo II. MAPS was the winner of that gamble. I hope you all meet them sometime.

There are two people who keep me on a course with the Digest. One of them is Roz Johnson, Napa, CA. Roz came to our Expo I and charmed everyone. She is a walking fund of information. Her second home is The Acadamy of Sciences in San Fransisco and her third home is Japan. She was very much a part in influencing decisions for a museum in Japan. She has also been responsible for beautiful displays of Kikkie Seki (Chrystanthumum Stone) at The Acadamy of Sciences. When I make an error with the Digest she very gently teaches me what to do better. Everyone should get to know her, also. Bert, the California crowd calls him "The Colonel", causes one to feel as though you've known him and been friends forever the first time you meet.

There is another person who helps keep me straight in the Digest. He is Philip Marcus, Wheaton, MD. He's been known to call me (that's long distance) to clear up muddy water. He's a retired attorney writing a book of law. The last conversation he had the galleys a bout ready. He's promised to get back to his hobby when he finishes his book. Although I've never met him, we've become friends over the phone and through pony express. He's a most precise man. He has hunted fossils overseas and is one of our many professional amateurs! He haunts Smithsonian. We'll all learn something when he shares his fossil lore with us. That book go to press yet, Philip?

Lee and LaVeta Hodges came from Kansas City to our recent MAPS field trip. They have/had gorgeous Pennsylvanian leaves in Kansas sandstone. They say the quarry has been dug so much since spring they cannot get to them anymore. Another tragedy for fossil lovers. This couple is quiet stability. They are both retired and ready for fossil hunting and good fun anytime. They had a fossil rock garden. Wish they'd waited until December to get rid of it, maybe MAPS could have held a November field trip in Mission, KS. Hope you meet them.

Guess I better tell you, Don Good is King of Blastoid Mountain (but don't forget the Hammons). I'll never tell you how many fat saucy blastoids he found. He will, though.

Dennis Kingery, Rock Springs, WY brought a box of fossils to Danny DeRossear. Danny is our youngest MAPS member, 18 months. Doug never opened the box, but Dennis made him promise with MAPS members as witnesses it was for Danny. Do you suppose it's another ancient bird like the one now resting in the Boston museum?

There has been a positive response to this column. It's for getting acquainted from afar. Please write what you are doing related to the hobby--no coffee clutch column, please. Some of you have been to Europe and met our members, some of you are contributors to universities, some of you have questions, lots of you have answers. Keep it brief, something to do with fossils, and let's get acquainted on a Digest Sedimentary Note field trip. You're terrific, I wish I knew you all!

*****

THE EXCHANGE

That's the swap column. Can't tell you if its successful. Jim Jenks has not reported he got a starfish as yet. The ginkgo leaf request was as much to test this column as anything--no ginkgo leaf. Dick Johannesen suggested this column as a means to get some special fossil to round out your collection way back in the beginning when he was editor. It just may be we're not ready for this column yet

*****

SPLITTING FRANCIS CREEK SHALE CONCRETIONS submitted by John J. Fagan

As anyone who has collected at Pit 11, Chowder Flats, Morris and other places where sideritic concretions are found knows, the attempt to split them with a hammer often results in disasterous results either to one's thumb or to the fossil. When I began collecting at Pit 11 about three years ago, Larry Osterberger encouraged me to take the unopen concretions home and freeze them.

Dr. Merrill Foster in his article entitled "Soft Bodied Coelenterates" in the book MAZON CREEK FOSSILS (p. 195), speaks about the freeze-thaw technique. He used this technique successfully to split concretions from Astoria. The concretions are frozen in a container filled with water. Hot water is used to melt the ice. He found that it took an average of twenty cycles to open the concretions, with the range being from two to fifty-one. From preliminary experiments with concretions from Pit 11, he states that it may take as many as ten times as long to open these concretions by this technique.

Since most of us do not have the patience or the time for such procedures, I would suggest another method, i.e., allow the extremes of our Illinois climate to do the cracking. I have used this technique with great success for the past two winters. Some of my best specimens including three insects, two chitons, an amphibian, a coelacanth and a phyllocarid were obtained by this method. The amphibian was frozen for two winters.

I place five gallon buckets and gallon plastic bleach bottles (plastic milk jugs are not strong enough) filled with concretions and water outdoors in October and let Mother Nature do the rest. I prefer the gallon jugs because they respond more easily to fluctuations in temperature, are easier to move around, make it easier to find the pieces of an individual concretion. The small jugs also allow me to begin going through them in January so that I get two winters a year.

Anyone who has collected at the plant area on the Northeast side of Morris and has tried to smash these concretions open knows the futility of attempting to split these concretions with a hammer. I have taken concretions which others have beaten into "ax-heads" and frozen them to successfully obtain choice specimens. I use this as an example to encourage others to use the freeze-thaw technique to split concretions.

I would also like to include a few other observations. First, I think that the concretions that you are saving from one winter to the next should not be left to bake in the sun over the summer, but they should be left in the shade or indoors. They seem to bake hard if you leave them in the sun.

Second, after observing the various orientations of the fossil within the concretion, I am less sure of where a concretion should be hit with a hammer.

Third, I tap the concretion two or three times lightly with a hammer before putting them into the buckets to determine if they are ready to split.

*****

TRILOBITES OF THE CHICAGO REGION by Charles Armstrongs

Last call! Anyone interested in a reprint of this out-of-print book contact
Alberta Cray
1125 J. Avenue NW
Cedar Rapids, IA 52405

<u>Hopefully</u> the price to be $5.00 or less, the book to be reprinted for holidays. No guarantees.

EXPLORERS OF THE EARTH WITHIN, Conc'd.

of the Vine-Matthews hypothesis, and it was during this period that Wilson had his greatest insight--the identification of an entirely new class of faults--transform faults, whose discovery presaged the modern plate tectonic theory.

Within two years of Wilson's idea, Mc Kenzie and Bob Parker at Cambridge and, independently, Jason Morgan at Princeton took Wilson's germinal concept of crustal blocks and developed it into a full-blown, theoretical formualtion involving the movement of rigid plates.

Now, 15 years on, it seems inconceivable that Wilson and the other proponents of drift could have met with opposition to their work...

In the meantime, his grand ideas are still bearing fruit, as a report in the March 7, 1980, issue of SCIENCE showed. The article reviewed progress in explaining some of the geologically peculiar features of North America rock formations that seemed not to fit with the rest of the continent.

In 1968, Wilson made yet another well-educated guess and concluded that part of Florida came from Africa, coastal New England and Newfoundland from Europe and sections of Nevada, British Columbia and Alaska from Asia. It now turns out that his insight was remarkably, if not entirely, accurate. Other workers had the same ideas, but typically, Wilson was...prepared to risk his name on a clear statement.

The western coastal blocks are now thot to be islands that were added to the N. American continent. On the East Coast, a block now named Avalon apparently did not become a part of North America until about 300 million years ago. And as for Florida, it seems that North America may have borrowed it from North Africa when Pangaea began to break up...

In March of this year, a range of mountains in the Antarctic was named for Wilson. Appropriately, the Wilson Mountains be just north of a range named for another great explorer, Alfred Wegener.

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LIBRARY ADDITIONS, Cont'd.

of-information listing, area cross section geologic history of the region, and a highway mileage chart.
Catalog: folded, 661 Price $4.00

Map 2. Southern Rocky Mountain Region. Geologic Map of Arizona, Colorado, New Mexico, and Utah.
Catalog: folded, 662. Price $4.00

Map 3. Pacific Southwest Region. Geologic map of California and Nevada.
Catalog: folded, 663. Price $4.00

Map 4. Mid-Atlantic Region. Geologic Map of Delaware, Kentucky, Maryland, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.
Catalog: folded, 664. Price $4.00

Map 5. Northern Rocky Mountain Region. Geologic map of Idaho, Montana, and Wyoming.
Catalog: folded, 665. Price $4.00

Map 6. Pacific Northwest Region. Geologic map of Washington and Oregon. Map sections include stratigraphic columns, tectonic map, physiographic map, area cross section, fossil locations, gemstone locations, places of geological interest, reference section, insets describing four national parks in the region geologic history, a highway mileage chart and a section on how to study geology while you drive.
Catalog: folded, 667. Price $4.00
(The number 667 appears incongruous, but it is as it appeared in the booklist. Ed.)

Map 7. Texas. This map also shows fossil locations, gemstone locations, places of geologic interest.
Catalog: folded, 666. Price $4.00
(Other half of the incongruity. Ed.)

Map 8. Alaska-Hawaii. Geologic map, includes stratigraphic sets describing national parks, geologic history, features on Alaskan glaciers and Hawaiian volcanics
Catalog: folded, 668. $4.00

(continu'd page 10)

LIBRARY ADDITIONS, CONT"D

Map 9. Southeastern Region. Geologic map of Alabama, Florida, Georgia, Louisiana, and Missippi. Includes above and satellite map, area cross sections, fossil locations, gemstone locations, places of geological interest, an inset on the Everglades Nat'l Park. Catalog: folded, 669. $4.00

Map 10. Northeastern Region. Geologic map of Connecticut, Maine, Massachusetts New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. Also included fossil locations, gemstone locations, places of geological interest, local geology to Rev. War strategy, insets on glaciation and nat'l parks. Catalog: folded, 670. Price $4.00

Map 11. Great Lakes Region. Geologic map of Illinois, Indiana, Michigan, Ohio and Wisconsin. Also includes fossil locations gemstone locations, places of geological interest, inset on Isle Royale National Park. Catalog: folded, 671. Price $4.00

Thanks are in order to Harrell Strimple University of Iowa for all these additons

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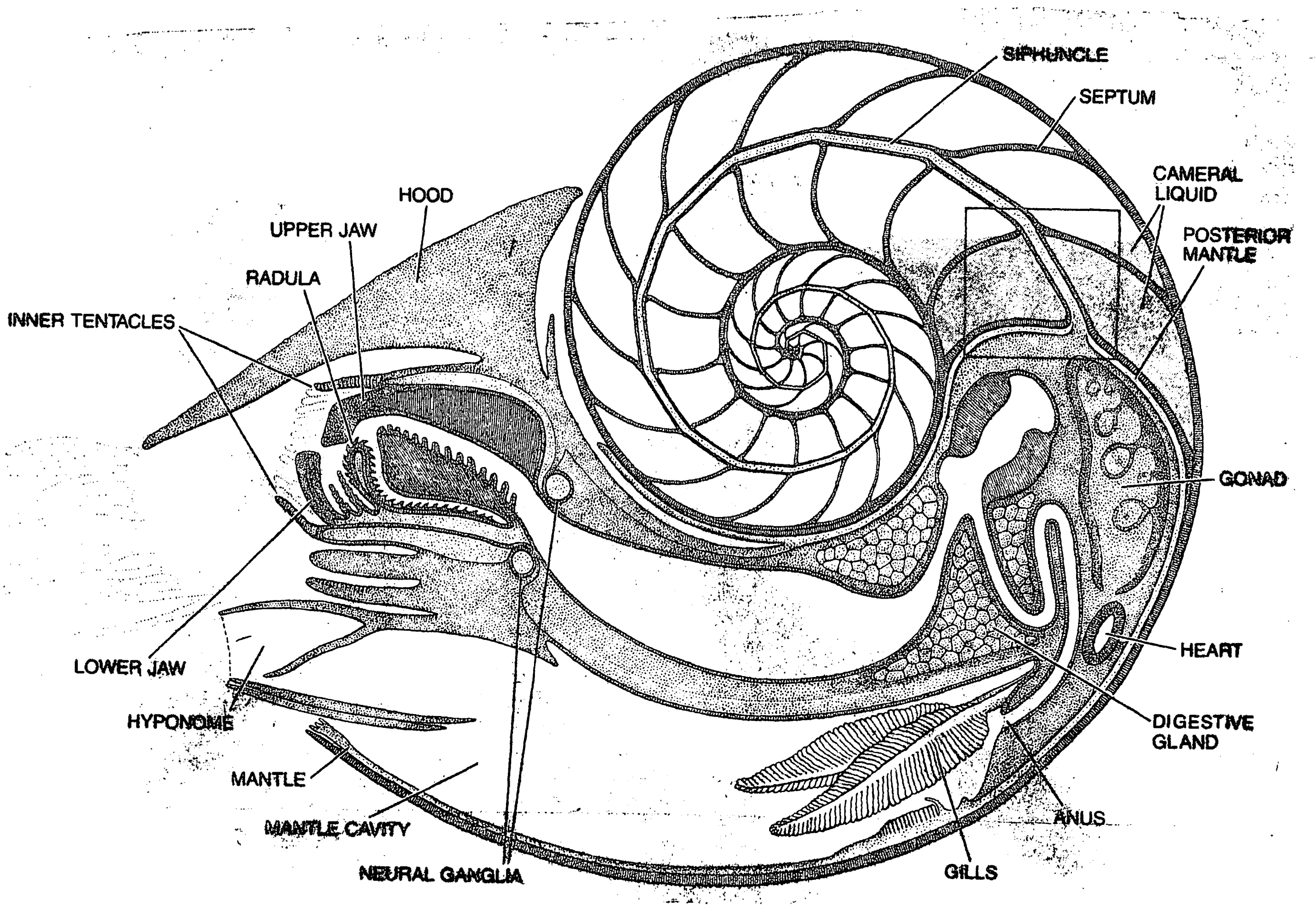
THE BUOYANCY OF THE CHAMBERED NAUTILUS, Cont'd.

The shell in which the nautilus lives is approximately a hollow cone wound lightly around itself. The shell is made of layers of aragonite, a crystalline form of calcium carbonate, in alternation with layers of a proteinaceous substance having a chemical composition resembling that of fingernail.

The internal division of the shell into chambers immediately suggests the possibility that the nautilus might change its buoyancy as a submarine does. As early as 1969 Robert Hooke proposed that "the animal has a power to fill or empty each of (the chambers) with water, as shall suffice to poise and trim the posture of



When a nautilus of the species N. macromphalus is fully grown, it is several inches across and weighs nearly a kilogram. At that stage the animal's shell has 30 or more chambers.

his vessel, or shell, fitteth for that navigation or voyage he is to make; or if he be to rise, then he can empty these cavities of water or fill them with air." We ourselves, however, have never found a nautilus in shallow water to refill a chamber with water; it can only empty the chambers. Moreover, it can empty them only slowly, the maintenance of buoyancy is in fact a lifelong effort. As the animal grows in its shell it builds a septum behind itself, thereby sealing off a new chamber. Each new chamber is filled at first with a watery fluid called the cameral liquid, but the liquid is slowly removed. This provides the buoyancy the animal needs to counteract the growing weight both of its living parts and of its shell.

The removal of the liquid from the chambers is accomplished by the siphuncle, a strand of living tissue enclosed in a calcareous tube that spirals from the posterior mantle of the animal through all the chambers of the shell, including the earliest chambers. At the center of the strand is a network of blood vessels. The surrounding seawater exerts a hydrostatic pressure on the body of a nutilus, and this pressure is transmitted to the blood that circulates in it. Hence the pressure of the blood in the siphuncle is equal to the blood pressure generated by the heart plus the pressure of the seawater, which increases by one atmosphere for every 10 meters of depth. At 400 meters, which is a typical depth for the nautilus, the inside of the siphuncle would have a pressure of more than 40 atmospheres, or nearly 600 pounds per square inch. In an emptied chamber, therefore, where the pressure is always less than one atmosphere, the calcareous tube surrounding the tissue of the siphuncle must keep the tissue from bursting.

One aspect of our research has been to examine the mechanism by which the siphuncle removes the cameral liquid that initially fills each chamber. The liquid closely resembles nautilus blood, and also seawater....It is therefore impossible to say with certainty whether the liquid is a filtrate of blood, a secretion of the siphuncle or of the mantle or perhaps seawater the animal has modified. Nevertheless, if siphuncular cells were to transport some of the ions from the liquid into the blood vessels at the center of the siphuncle, the concentration of ions in the liquid would fall below that in the blood. As a result the water in the liquid would flow by osmosis from the chamber into the blood. It could then be removed from the blood by the animal's kidneys.

The trouble with this hypothesis is that the hydrostatic pressure deep in the ocean favors the tendency for water to pass from the siphuncle back into the chamber. Indeed, even if the siphuncle could reduce the concentration of ions in the cameral liquid to zero and thereby maximize the osmosis of water out of the chamber, a calculation shows that at a depth of just over 240 meters the hydrostatic pressure becomes great enough to drive water in the opposite direction. Since nautiluses are found with completely empty chambers at depths as great as 600 meters, we were prepared to rule out the simple osmotic mechanism....

In our examination of siphuncular tissue we...noted that segments of siphuncle taken from chambers that were emptying or had already emptied have prominent intercellular spaces.... Tissue taken from the part of a siphuncle that traverses a chamber whose septum is still being built lacks both large and small intercellular spaces. On the other hand, the part of the siphuncle in chambers that have been emptied maintains its network of spaces. Hence the siphuncle appears to be capable of bailing out those chambers which might otherwise be filled by water forced inward by the substantial hydrostatic pressure of depths greater than 240 meters. (Concluded next month.)

The Mid-America Paleontology Society (MAPS) was formed to promote popular interest in the subject of paleontology, to encourage the proper collecting, study, preparation, and display of fossil material; and to assist other individuals, groups, and institutions interested in the various aspects of paleontology. It is a non-profit society incorporated under the laws of the State of Iowa.

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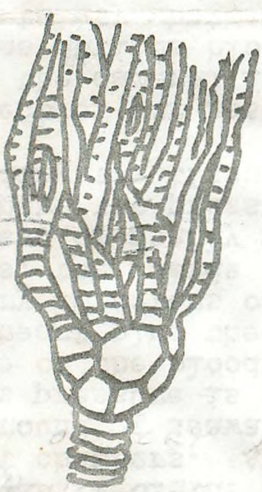

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