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THE FOSSILS CALLED "BUGS"

by

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In the parlance of the trade, microfossils are frequently referred to as "bugs", micropaleontology as "bug work", micropaleontologists as "bug men", and micropaleontological reports and publications as "bug reports" and "bug papers".

Perhaps microfossils came by the nickname, "bugs", as a result of their abundance, small size, and myriad variety of form, but one is led to suspect that the name was originally applied by someone seeking to avoid the use of long words which, in addition to involving a lot of verbiage, are inclined to fall into the category of "tongue twisters".

Paleontology, the study of fossils, is commonly divided into three specialized fields: (1) vertebrate paleontology, which deals with the fossil record of animals that had backbones, or spinal columns; (2) invertebrate paleontology, which deals with the record of animals that had no backbones, or spinal columns; and (3) paleobotany, the study of the fossil record of plants.

Micropaleontology is the study of fossils of microscopic size or structure from all three of these groups, vertebrates, invertebrates, and plants.

Among the vertebrate microfossils are:

- Fish scales
- Teeth from fishes and other small animals
- Otoliths and other microscopic bones or bone-like parts

Among the invertebrate microfossils are:

- Silicoflagellata
- Coccoliths and Rhabdoliths
- Foraminifera
- Radiolaria
- Sponge spicules
- Echinoid spines and skeletal parts
- Holothurian elements
- Annelid worm jaws (scolecodonts), plates, and tubes
- Conodonts
- Bryozoa
- Microbrachiopoda
- Micromollusca: pelecypoda, gastropoda, scaphopoda
- Microarthropoda: trilobita, archaeostraca, branchiopoda, ostracoda

Among the plant microfossils are:

- Diatoms
- Algae
- Seeds
- Spores
- Pollen

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After reading all of these names, it is not difficult to imagine someone with an aversion to profound vocabulary lumping them all together under the term "bugs" for short.

Vertebrate Microfossils

The vertebrate forms occur frequently in association with other microfossils, but to date most of them have received very little attention or study. Recent work on fish scales[1] has proved their value in correlation, and it seems probable that like attention to microscopic teeth and bones will likewise make them dependable indicators of geologic time and environment.

Scales, teeth, and various types of fish bones are no novelty to the average person, although few realize that they occur as microscopic fossils. For many people, however, "ear-stones" of fishes (otoliths) are something new under the sun. The following interesting historical sketch is quoted from a paper by R. B. Campbell.[2]

> "The micro-examination of Upper Cretaceous and Tertiary deposits frequently reveals small concretions of carbonate of lime not unlike seeds and which show definite sculpturing. These are easily recognized as 'fish otoliths' or 'ear-stones'. ...
>
> "As is the case with many fossilized forms we find that Aristotle, Pliny, and other Greek and Roman scholars were familiar with the otoliths of fishes. They contented themselves with noting their occurrence. Characteristically during the Middle Ages these fossils were regarded with superstition and they were frequently borne as amulets. Some, called St. Peter's Stones because they bore the imprint of St. Peter's keys, were comparatively recently to be found in apothecary shops. In this connection they were used as a preventative and cure for colic and headache.
>
> "Even after these otoliths began to be studied by men of science strange ideas concerning them were entertained. It was even the opinion of some that these stones in the heads of fishes frequently brought about their death by attracting the cold in winter thereby causing their brains to freeze. Gradually more tenable explanations were offered and it was recognized that there was some connection with the hearing of fishes, the existence of which sense had hitherto been denied.
>
> "Klein (1740) showed the existence of otoliths in thirty fish and was of the opinion that these otoliths correspond to the little bones found in the ears of higher vertebrates (Hammer, Anvil and Stirrup). This view ... was adhered to down to Cuvier's time. Though Cuvier occupied himself but little with fish otoliths he ascertained that they have nothing to do with bones but consist of carbonate of lime ... . He also regarded them as having excellent characteristics for the differentiation of species ... ."

Otoliths were not "made use of in the science of paleontology or stratigraphy until in 1884 Professor Ernst Koken of Berlin published"[2] on otoliths from the Oligocene of north Germany and the Oligocene and Eocene of Mississippi and Alabama.

Since Koken the otoliths have not been given much attention by workers in the field of stratigraphy and "the literature has grown mainly with the work of Bassoli in Italy, Priem in France, and Schubert in Austria."[2]

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[1] David, Lore Rose, Use of Fossil Fish Scales in Micropaleontology, Carnegie Institution of Washington Publication 551, pp. 25-43, pls. 1-6, figs. 1-9, July 18, 1944. Reprinted as Contribution No. 353, Balch Graduate School of the Geological Sciences, California Institute of Technology (Pasadena).

[2] Campbell, R.B., Fish Otoliths, Their Occurrence and Value as Stratigraphic Markers, Jour. Pal., Vol. 3, No. 3, pp. 254-257, Sept. 1929.

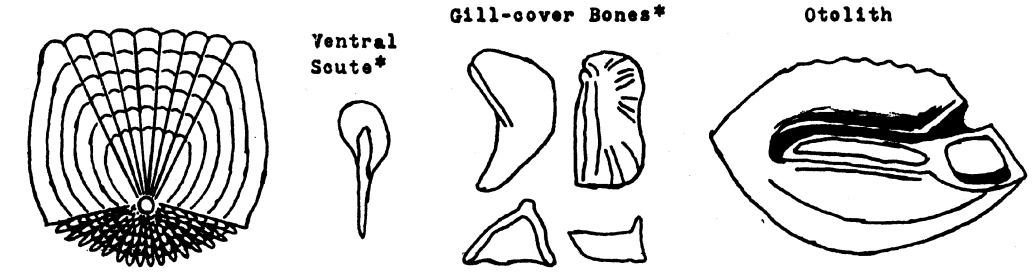

Fig. 1. Diagrams of Fish Microfossils

Single-celled Invertebrate Microfossils

The first five invertebrates listed belong to a major group or phylum of the animal kingdom called Protozoa. The Protozoa are unique among animals, in that all of them have one-celled bodies. All other animals are composed of many cells which are variously grouped to form specialized organs, such as those of sight, hearing, respiration, and digestion, and these cells differ one from another in accordance with the places they are to occupy and the purposes they are to serve in the functioning of the animal body. The living human body has been likened[3] to "an organization of 27 million million cells which live and work, die and disappear individually." 27,000,000,000,000 cells, that is! The protozoan is but 1.

The simple structure of the protozoan animal body stands in marked contrast to the myriad varieties of the tests or shell-like parts that are formed by most of these tiny creatures. In nearly all cases it is these hard parts that are found as fossils, and thousands of different forms (species) have been recorded - each having developed with the growth of a tiny single-celled protozoan.

Silicoflagellata

The following is quoted from a paper by Dr. G. D. Hanna.[4]

> "The Silicoflagellata form a small but exceedingly interesting order or class of protozoan animals. They have siliceous skeletons of unique structure and are known with certainty only from the upper Cretaceous to the present time. A few species are found living, widely distributed, near the surface of the sea, where they form a minor portion of the plankton.
>
> " ... the silicoflagellata as a group furnish most trustworthy horizon-markers ...
>
> "The features which make the silicoflagellates valuable as markers are: (1) they are usually common when they occur at all; (2) species are exceedingly limited as to number in any formation; (3) the species have a very short geological life; (4) being pelagic (free floating) in habitat they have a very wide geographic distribution; ....; (6) species are so distinct that they can be readily identified, and integration does not appear to have been noticed. In short these organisms are almost the paleontologist's ideal of marker-fossils."

Hanna points out, however, that these forms have not received the attention and study that they deserve.

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[3]Harvey, B.C.H., Simple Lessons in Human Anatomy, American Medical Association (1931), p.270.
[4]Hanna, G. Dallas, Silicoflagellata from the Cretaceous of California, Jour. Pal., Vol. 1, No. 4, pp. 259-260, Jan. 1928.
*David, L.R., op. cit., p. 28.

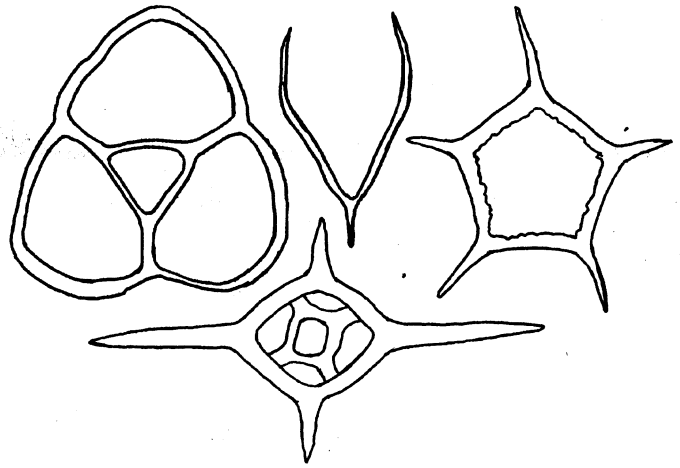

Fig. 2. Outline drawings of Silicoflagellata. Magnifications range from x375 to x650.

Coccoliths and rhabdoliths

There is a difference of opinion among investigators as to the true nature of small calcareous discs (coccoliths) and spicular bodies (rhabdoliths) which occur abundantly in modern marine-bottom deposits. Similar bodies have been recorded as fossils from rocks as old as the Cretaceous. Coccoliths and rhabdoliths are not visible under magnifications of much less than 700 diameters.

Coccoliths Rhabdoliths

Fig. 3. Coccoliths and Rhabdoliths. Magnifications about x1200.

Foraminifera

Foraminifera are typically aquatic (water living) protozoans of microscopic size, although a few species are known to have attained sizes up to several inches in diameter. All except a few of the simplest forms secrete perforated protective and supporting skeletons called tests, and it is from this perforate or foraminate characteristic that the foraminifera get their name. Most tests are calcareous; a few completely siliceous. In many species the tests are composed of such foreign materials as sand grains, mica flakes, sponge spicules, or even other foraminiferal tests, more or less firmly cemented together by a secretion which may be calcareous, siliceous, ferruginous, or chitinous. One of the most primitive tests of all is composed solely of chitin.

Architecturally the tests may vary through a multitude of forms from a single simple chamber to a complicated, variously coiled multi-chambered structure. The following five plans or some modification of them are the characteristic arrangements for chambers in nearly all foraminiferal tests: single chambered, linear series, biserial series, plano-spiral coil, trochoid coil.

On the basis of ornamentation, also, there are thousands of easily recognized forms. Raised costae (ridges), knobs, spines, striations, and coarsely perforate areas form the most common types of ornamentation.

Numerous other variable details of the test structure such as details of the apertures, sutures, and general shape are used in distinguishing between genera and species of the foraminifera.

A few species live in fresh or brackish water, but the great majority are marine. About twenty-five species are pelagic and float at or near the surface of the ocean. Most species, however, are bottom dwellers, some being attached to plants, rocks, and other objects while others are free to crawl slowly about on the muds and oozes of the ocean bottom. In shallow waters today foraminifera are so abundant that the tests sometimes form obstructing shoals. The Globigerina oozes of the ocean depths are composed largely of foraminiferal tests. Thick limestones in Paleozoic and younger formations are composed largely of fossil foraminifera. The great pyramids of Egypt are constructed of such nummulitic limestones.

Fossil foraminifera occur from the Cambrian to the Recent and are abundant in rocks younger than the Devonian. Species have definite geologic and geographic ranges, and when these are known in detail it becomes possible to determine the age of sediments and the conditions under which they were deposited.

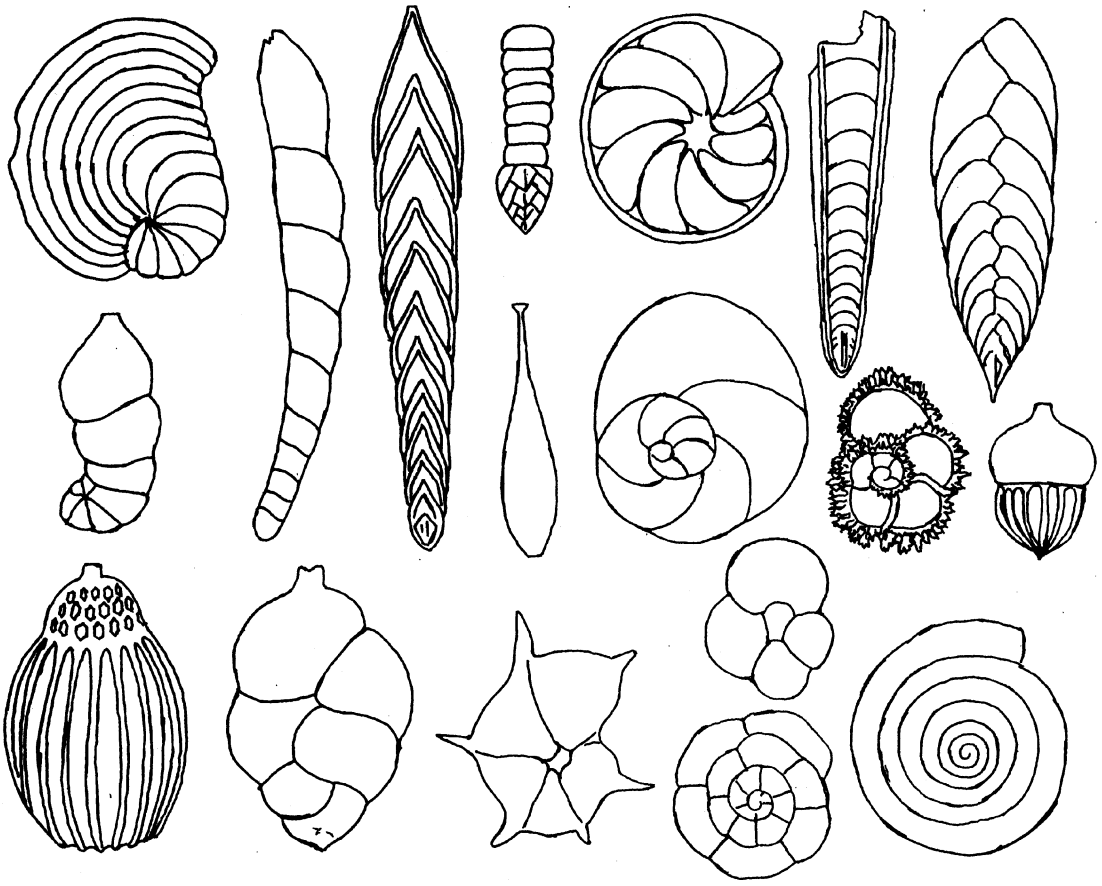

Fig. 4. Foraminifera. Magnifications range from x18 to x120.

The first discovery of foraminiferal tests was made by Janus Plancus[5 & 6], in 1730, on the beach of Rimini, Italy, and in the following year Beccari[6] made the first discovery of fossil foraminifera in the Pliocene of Bologna. Since then many workers have studied this group, and a voluminous literature has been built up. Previous to about thirty years ago, however, these studies were pursued primarily on an academic or pure science basis, with little thought for any practical economic application which they might have.

During the past thirty years the petroleum industry has spent millions of dollars on research in micropaleontology and its application to the discovery and production of oil and gas, and as a result of this work the foraminifera have come to take first place among fossils used in stratigraphic and structural geology. In 1940[7] it was estimated that more than one million dollars was being spent each year on the operation of oil-company paleontological laboratories. The value of micropaleontology as a tool in geologic mapping and other requirements of academic and economic work has been so conclusively demonstrated by the results of this application to petroleum geology that many progressive colleges and universities, government geological surveys, and purely research organizations have incorporated it as one of their major projects, and others are reported planning to do so.

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Radiolaria

Last on our list of Protozoa are the radiolaria. These are minute single-celled animals which usually form exceedingly delicate siliceous skeletons that are typically spherical, discoidal, helmet-, cap-, or flask-shaped and variously ornamented with spines, bars, and lattice-work patterns.

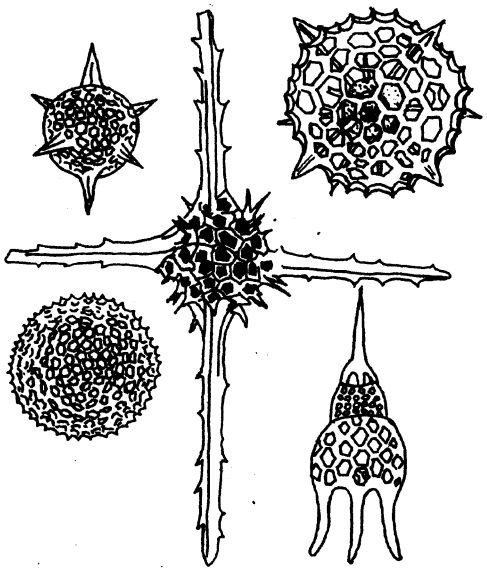

Fig. 5. Radiolaria. Magnifications about x6 (center fig.) to x250.

Radiolaria are exclusively marine organisms and are found in vast numbers at all oceanic depths. As fossils they date back to the pre-Cambrian, and, according to Barrios[8], they are the oldest of all known animal organisms, since they occur plentifully in the bituminous quartzites of Brittany, interbedded with pre-Cambrian gneiss. Although less frequently encountered in the fossil state than foraminifera, radiolaria have rather common occurrence and in some cases appear to have considerable value as guide fossils.

(To be concluded in November issue.)

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[5] Plancus, Janus (Giovanni Bianchi), Ariminensis de conchis minus notis Liber, cui accessit specimen Aestus reciproci Maris Superi ad littus portunque Arimini, pp. 1-88, pls. I-V, Venetiis, 1739.

[6] Zittel, Karl A. von, Text-Book of Paleontology, Second Edition Revised, edited by Eastman, Charles R., Vol. 1, p. 24, McMillan and Co., Ltd., London, 1927.

[7] Schenck, H.G., Applied Paleontology, Bull. Amer. Assoc. Petrol. Geol., Vol. 24, No. 10 (October 1940) p. 1759.

[8] Zittel, Karl A. von, op. cit., p. 43.

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SENATOR W. H. STRAYER

An Appreciation
by
E. B. MacNaughton

W. H. Strayer's life was a long and fruitful one. He was of that type of forthright citizen of which we need more and more and seem to see less and less. He sponsored many important undertakings in this state. Standing high on the list of his achievements is the State Department of Geology and Mineral Industries.

His mind conceived the plan of the Department and it was his effort which won legislative approval for that plan. He was appointed a member of the first Commission and was elected its first Chairman, a post he filled up to the time of his death.

It was my privilege to be with him on the Commission in the beginning years of its work and, as was the case with everyone who worked closely with the Senator, he won my confidence and my admiration as a farseeing, honest, and capable administrator and counselor.

Senator Strayer loved Oregon and he never overlooked an opportunity to develop the resources of the state. That deep interest explains his great contribution to the Commission's record.

It can be said of him and his work on the Commission, as it was of Christopher Wren, who designed and built St. Paul's cathedral in London, if you want to see his memorial, look around you.

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NEW TEXAS COMPANY TEST

Texas Company geologist, Dr. F. D. Bode, announced on October 23 that his company would drill a test at a location near Mist in Columbia County. The legal description of the location is 3042 feet north and 1030 west of the southeast corner of sec. 19, T. 6 N., R. 4 W. The name of the test will be Clark and Wilson No. 6-1. A road was built to the location last spring. The drilling will be done by contract and it is expected that the hole will be spudded in about the first of the year.

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OREGON BAUXITE EXPLORATION

Exploration of Oregon ferruginous bauxite by Alcoa Mining Company is being conducted at about the same tempo as that of the past year. Four drills are working in Columbia County in areas that will require several months to drill out. Oregon headquarters of the company are at Hillsboro.

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COAL BRIQUETS WITHOUT BINDER

A method of briquetting coal without outside binder has been developed by the Illinois Geological Survey. Studies have been made using a commercial scale unit of special design. Among a number of procedures, one has been recently developed whereby minus 10-mesh coal is first briquetted under high pressure at room temperature, then partially devolatilized. According to an announcement by the Survey, the resulting briquets are firm and meet commercial standards of smokelessness as shown by combustion tests in a conventional heating stove.

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PUMICE PRODUCED

The pumice operation of H. W. Christy, located on the Great Northern railroad about 1½ miles north of Chemult in Klamath County, has been stepped up recently. Loading facilities have been greatly improved. A bulldozer delivers the pumice from a pit to a 3/8-inch grizzly mounted at the top of a short incline. Oversize passes through rolls. Finished product is loaded on gondolas with a Scoopmobile. Some of the pink volcanic ash from a deposit located between the highway and the Southern Pacific railroad due west of the plant is added to each car shipped. The ash is said to serve as a natural cementing agent which materially reduces the amount of cement required. The deposit of ash is said to be at least 70 feet deep.

Christy holds numerous claims in the area surrounding his plant. He plans to enlarge his operation in the near future by increasing his siding to hold 15 cars and by installing a suction-hose loading device which would deliver pumice from pit to cars or crusher.

Present freight rates from Chemult for a minimum car of 70,000 lbs., based on a 1000 lbs. per yard agreement, are 34¢ per 100 lbs. to San Francisco, 32¢ per 100 lbs. to Medford, and 13¢ per 100 lbs. to Portland.

Shipments are being made to California points principally, with some cars going to Seattle, Klamath Falls, and Portland.

Although pumice blocks and brick were formerly manufactured at this plant, only bulk pumice is being shipped now.

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OREGON QUICKSILVER MAP

All known quicksilver deposits in Oregon are shown in red on a black and white map of the State which has just been issued by the State Department of Geology and Mineral Industries. The map on a scale of four miles to the inch was prepared by Mr. Francis Frederick, consulting mining geologist of San Francisco, who studied Oregon quicksilver deposits in 1943 and 1944. In addition to showing location of these deposits, the map has a table in the margin which lists all mines according to counties and the amount of their total production.

This map may be obtained at the Portland office of the Department at 702 Woodlark Building, or at the field offices located at Baker and Grants Pass. The price is 25 cents postpaid.

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BUFFALO MINE SOLD

The well-known Buffalo Mine, located north of Granite in eastern Grant County, has been sold by Bruce Dennis, operator of the property for the past eight years, to E. R. Ramsey and Alan Kissock of New York according to the Record-Courier, Baker, under date of October 24.

The Buffalo Mine, under Mr. Dennis and Frank Allen, superintendent, has been producing steadily for a number of years except during some of the wartime years when gold mines were closed by Government order. An extensive development program is planned by the new owners. High grade encountered in development work will be stored during the winter for shipment in the spring. Mill ore will be stockpiled against operating the mill when the roads are opened. Mr. R. G. Amidon is superintendent for the new owners.

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MORMON BASIN PLACER OPERATION

The Placeritas Mining Company - a partnership among A. N. Crawford, Huntington; Arman Schrieber, Placerville, California; and Ernest Schrieber, Los Angeles - has tested the Colt estate placers in Mormon Basin, located about 22 miles west of Huntington, and is installing equipment. Mormon Basin placers were worked in the early 1860's by hydraulicking operations but were handicapped by lack of gradient and a limited water supply. Operations planned by the Placeritas Company will have the advantage of dragline equipment and a floating washing plant. All heavy equipment has been delivered to the property. The plant is in process of being installed.

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