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B. H. Beane and the LeGrand Crinoid Hunters

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The author has closely followed and encouraged the work of Dr. Beane for many years. Prof. Gwynne is a longtime member of the faculty at Iowa State University, joining the Department of Geology upon completing his graduate studies at Cornell University in 1927. He has been active in the Iowa Academy of Science and contributed many articles and papers to professional journals and nature magazines.

The part of the North American continent now called Iowa has a history, a geological history that is, that goes back many hundred-millions of years. Part-way back, some 250,000,000 years ago, there lived in the vicinity of what is now LeGrand, Marshall County, Iowa, along with other forms of marine life, great numbers of marine invertebrates called crinoids. Note that they have been referred to as marine—and so they were, for at that time ocean water extended in the form of a shallow sea, perhaps not more than 600 feet deep, over much of the interior of the present North America.

These crinoids belonged to a group of animals called *echinoderms* (echinos—Greek for porcupine), their name having reference to the fact that some at least were spiney-skinned like the present sea urchins. Relatives of the group included starfish and sea urchins; these and the crinoids have representatives in the seas of today. These particular crinoids were small, the fleshy part rarely more than an inch across. Individuals lived in a thimble-shaped enclosure composed of a mosaic of many small polygonal, calcareous plates fitted edge to edge. This *calyx,* as it is generally called, was attached at the base to a flexible stalk composed of thin cylindrical, button-like

plates superimposed like buttons on a thread. In a few of the LeGrand species, the stalks were up to ½ inch in diameter. The stalk, known also as the stem, might be a foot or so long; it had root-like tendrils called *cirri* at the lower end, which served as a means of attachment to the muddy sea bottom. From the upper part of the calyx, thin shelly flexible arms extended a few inches, waving in the ocean currents, bringing in food to the crinoid. These shelly parts are often spoken of as the skeleton of the animal, though of course it should be understood that they are not skeletons in the sense they are thought of in mammals.

With death, the shelly calyx and stalk gradually fell apart. In places, the sea bottom sediment came to be comprised, in large part, of the remains of these crinoid skeletons, although of course the shells of other marine organisms were also present. But, most remarkably, in some places these delicate crinoid skeletons did not completely disintegrate. Instead, the stalk and calyx dropped over into the mud of the sea bottom, at least partially intact. This happened only in restricted areas, perhaps no more than a rod or so across, in what today are called nests or colonies. Then the crinoid remains were rapidly buried in limy mud deposited on the sea bottom.

Millions of years went by. The sediment composed of crinoid fragments, and the layers containing the crinoid nests, were covered up by more limy sediment. There may have been some hundreds of feet of it. It all gradually hardened to the rock we call limestone. The actual calyxes and stalks of the crinoids and their fragments were slowly replaced by other limy material. The sea gradually withdrew, but millions of years later another shallow sea came in over the continent and piled more sediment, this time mostly clay-like in character, upon the limestone containing the crinoid remains. There they were, deep down in the earth, covered by some hundreds of feet of limestone and shale, the hardened clay.

No more seas spread over the area, but for the past 200,000,000 years or so weathering and erosion by running water, wind, and glaciers have been continuously active. Well, yes, one more thing—there was some crustal movement, a sort of warping, with slow uplift of the continent. Also, the crinoid-bearing

beds with the rest of the rock column became tilted toward the southwest. The dip, for that is what it is called, is not very great. Perhaps no more than 8 or 10 feet to the mile. So the surface of the bedrock cuts across these gently dipping beds.

That long lapse of time gave the elements an opportunity to wear down the land. River systems developed, for the rain water had to run off. A predecessor somewhat along the course of the present Iowa River was at work, and was cutting a valley through Iowa, and more particularly for us, through northeastern Marshall County just to the north of LeGrand. Valley development was interrupted by the advent of glacial ice some 3 or 4 hundred thousand years ago. But in any case, the river and its tributaries have been at work for a long while, bringing the land into the condition in which we see it today. Also, and this is important, the shale beds and the limestone beds above the crinoidal limestone had been worn away, and the river had cut down into the limestone containing the crinoids. The beds composed of crinoid shell fragments, and now called crinoidal limestone, were right at the surface. So were some of the nests where the crinoid skeletons were more perfectly preserved. The beds were exposed as cliffs along the Iowa River, where the river had formed a narrows or gorge in cutting through them.

Of course the atmosphere and rain were still at work on the limestone. Pieces of the crinoidal limestone were etched by weathering so that their makeup of crinoid fragments was apparent to the examining eye. Here and there a nearly complete crinoid calyx may have weathered out, to lie on the slope and gradually disintegrate.

Who was the first human to notice these odd-looking objects? Did the Indians of the area ever wonder about them? Well, at least we know that in some areas they discovered sections of the stalks and used them as ornaments, the well-known "Indian beads." Certainly some of these could have been found along the Iowa River near LeGrand.

And then came the white man. The earliest record we have of recognition of these crinoidal remains by early scientists is in the work of James Hall, the first state geologist of Iowa,

in 1858. There may have been others among the pioneers who were curious about these strange markings in the rocks. Certainly they were early recognized as fossils, the remains of life now extinct. They so strongly resembled flowers that they have been called sea lilies or stone lilies. Then Charles Abiathar White referred to them in 1870, in his report on the geological survey of the state of Iowa. Quarrying of the limestone developed around 1860, on the south side of the river, and in June, 1874, the nest from which random specimens had come was discovered in the middle of the quarry section.

From that time on, crinoid hunters were busy. Quarry work was by hand, so the working out of the nest progressed slowly, along with the slow quarrying operations. It was not until 1890 that it was completely uncovered and removed. The owners and operators of the quarry, George F. Kirby and H. J. Howe, of Marshalltown, cooperated with the collectors so that many specimens were saved which would otherwise have been destroyed. Both of these men, as is to be mentioned later, were to have newly-discovered crinoid species named in their honor. In the meantime, many people with a scientific bent had become interested in these fossil crinoids and had acquired fine collections. Among them were Hon. Delos Arnold, Dr. W. B. Waters, and Dr. W. S. McBride of Marshalltown, Louis Hammond and John McCabe of LeGrand. Some of the LeGrand crinoids were first described in 1889 by two geologists, Samuel Miller and Wm. F. E. Gurley, in a report of the Indiana Department of Natural History.[1]

In July, 1890, Charles Wachsmuth and Frank Springer, also geologists, described species from LeGrand in Volume 8 of the *Illinois Geological Survey.*[2]

Then more species were described by Miller and Gurley in *Bulletin* 5 of the Illinois State Museum, in 1894.[3]

Descriptions of the crinoids of the area and finds to date

[1] S. A. Miller and Wm. F. E. Gurley, "New Species of Echinodermata," *16th Ann. Rept.*, Indiana Dept. Geol. and Nat. Hist., pp. 327-373 (1889).

[2] C. Wachsmuth and F. Springer, "New Species of Crinoids and Blastoids from the Kinderhook Group of the Lower Carboniferous Rocks at LeGrand, Iowa," *Illinois Geol. Survey,* Vol. 8, pp. 155-205 (1890).

[3] S. A. Miller and Wm. F. E. Gurley, "New Genera and Species of Echinodermata," *Illinois State Mus. Bull.*, No. 5, 53 pages (1894).

appeared with the publication in 1894 of a monumental work, a monograph by Wachsmuth and Springer.[4] These two men were from Burlington where crinoids had been found in other limestone formations, and were enthusiastic collectors and students of crinoids. They are said to have shipped away flatcar loads of crinoid-containing slabs. Springer later moved to New Mexico, where he was active as a geologist. Wachsmuth became curator of crinoids at the Harvard Museum of Comparative Zoology at Cambridge, Massachusetts. Their extensive collection is now in the Smithsonian Institution, in Washington, D. C. Tribute was paid to them and their work by Charles Rollin Keyes in an article in ANNALS OF IOWA, in 1896.[5]

All of this coming and going of scientists had aroused the interest of a young farm boy of the neighborhood. He was Burnice Hartley Beane, born November 17, 1879, on a farm north of LeGrand, Iowa. He received his secondary education at LeGrand High School and Friends Academy at LeGrand, but more than that, as a youngster, he learned what Wachsmuth, Springer, and the others were doing. He plied them with questions, became acquainted with the science of paleontology—the study of ancient life—and learned what crinoids were and what their fossilized forms looked like in the rocks. From that time forth, his keen eyes were on the lookout for the fossilized remains of all ancient sea life. Gradually, his interest centered more and more on crinoids, and over the years he has become a specialist on the crinoids of the LeGrand area. More than that, he has made some wonderful crinoid discoveries, and has developed great skill in clearing the fossils from the matrix in which they were embedded.

Rock taken from the quarry during the early days was used as building or dimension stone. The Historical Building on Grand Avenue, near the State House in Des Moines and the Marshall County courthouse were made of stone taken from the LeGrand quarry. Presently the quarry was taken over by the Chicago & Northwestern Railroad, and operated

[4] C. Wachsmuth and F. Springer, "Crinoidea Camerata," Mem. Mus. Comp. Zool. Harvard Univ., Vol. XXI, (1897).

[5] Charles R. Keyes, "An Epoch in the History of American Science," ANNALS OF IOWA, Vol. II, Third Series, pp. 345-363 (1896).

for many years in the production of crushed limestone, to be used as ballast. More recently, it has been owned and operated by the Concrete Materials and Construction Company of Cedar Rapids, Iowa, for the production of crushed rock to be used as coarse aggregate in concrete, as road-rock, and as agricultural limestone.

Following the completion of the working out of the original nest in 1890, Burnice Beane kept his eye on quarry operations. He went to Penn College at Oskaloosa, became a farmer, but all the while maintained his interest in the fossil life of the limestone beds near his boyhood home.

Only occasional crinoid specimens were found over a period of many years. But in the summer of 1931 came a further discovery. A blast uncovered a small colony, principally of *Rhodocrinus kirbyi,* from which some of the finest specimens recovered to date have come. Slabs not more than three feet in diameter have contained as many as 200 specimens in an excellent state of preservation. This crinoid had been named after George F. Kirby, one of the quarry owners who had cooperated so heartily in the work of the crinoid hunters.

The discovery of 1931 was largely the results of the efforts of Mr. Beane. He was constantly following the blasting operations and on the lookout for good crinoid specimens. He became friends with the quarrymen; they knew what he was looking for, and would call him to the quarry, as they did at this time, if anything they considered interesting showed up. Also, he had acquired skill in recognizing the presence of crinoids hidden in large pieces of blasted rock. A section through a crinoid stem, perhaps less than ¼ inch in diameter served as a guide.

In the course of his studies, he had developed great skill in cleaning the crinoids of their surrounding matrix, which is somewhat softer than the substance of the crinoid fossil. Working tediously with a needle held in a vise, dental tools and a small hammer, soft brushes, and perhaps some water, he has been able to bring the substance of the crinoids out in all their perfection. A slab of rock, not more than a few feet across, crowded with 100 or more fossil crinoids standing out in bas-relief is indeed a marvellous sight.

One thing led to another. Scientists became acquainted with the discoveries and the fine work of Mr. Beane. Soon he was receiving visits from paleontologists at the State University of Iowa—first Dr. Abram O. Thomas, and later Dr. Arthur K. Miller. They, of course, encouraged him. Then he travelled widely in this country visiting museums, collecting from other localities, and making friends with others having the same interest. One close associate and friend of long-standing was Dr. Lowell R. Laudon, a student at the University of Iowa between 1924 and 1930, later at the University of Tulsa, and at present Professor of Geology at the University of Wisconsin.

At first, Mr. Beane collected and cleaned, studied and stored these fine specimens just for his own interest. Then a visit to the Museum of the University of Nebraska at Lincoln established a friendship with Dr. Erwin Hickley Barbour, a well-known geologist. Dr. Barbour, and perhaps others, persuaded Mr. Beane that he should share his finds. The result has been that now specimens of LeGrand crinoids, cleaned and prepared by Mr. Beane, are to be found in most of the natural history museums of this country, and of many abroad. Some of these are: Iowa State Historical Building; Simpson College; Augustana College; Buffalo Museum of Science; Earlham College; State Universities of Iowa, Kansas, Nebraska, Oklahoma, Wisconsin, Arizona, Minnesota; and abroad in museums in Capetown, London, Paris, and Tokyo.

In 1934, Mr. Don Machin, a member of a student group with Prof. C. S. Gwynne on a field trip from Iowa State University, found a showing of crinoids on a large block of limestone at the quarry. This was apparently from the nest which had been uncovered in 1931. It had remained undiscovered by the quarry workers because it was covered with debris. Then, in the course of shifting of the pile, under the winter's snow and freezing and thawing, it saw daylight. The slab containing the crinoids was split from the block by the group, and later trucked to Ames. Arrangements were then made to have Mr. Beane come to Ames and prepare the slab for exhibition. This he did. He worked on the slab in the department of geology quarters, and the public was invited to see him operate. He

had many visitors, and the project aroused a great deal of interest. The specimen is now on display in the entrance lobby of the Science Building.

And of course, Mr. Beane's home is a treasure chest of fossil crinoids. Students of high schools, colleges, and universities have visited in great numbers over the years. Those from Iowa State University have been on his calling list for 35 years. Professional and amateur geologists from all over the country, even some from abroad, have stopped in LeGrand to become acquainted with Mr. Beane and his work. Respects have been paid to him and his work by rather recent articles in *Scientific American, The Iowan,* and *Earth Science.*[6]

At about the time of the 1931 discovery, another very unusual find was a further triumph for Mr. Beane's discriminating eye. This was a single slab about 3 feet by 5 feet, plastered with 183 starfish in a fine state of preservation, also a few trilobites and sea urchins. Mr. Beane delights in telling of Dr. Thomas' great astonishment at the sight of it. Dr. Charles Schuchert, eminent geologist and paleontologist at Yale University, had assured Mr. Beane in correspondence that fossil starfish were indeed rare and commanded a price of from 25 to 100 dollars, if available. Mr. Beane and Charles R. Keyes, a well-known geologist, made a detailed study of these fossil starfish, described in detail in an article in the *Pan American Geologist* in 1934.[7] The starfish were identified as a new species, *Iovaster grandis.* Mr. Beane has recently been negotiating with the U. S. National Museum with regard to the disposition of this fine starfish slab. A prize such as this should indeed be in a museum in the nation's capital.

Mr. Beane discovered another fine crinoid nest in the course of quarry operations in 1933, at the same level and only a short distance from the find of 1931. Fortunately, at the time of discovery, only the edge of the nest, twenty feet in length, had been opened. Many fine specimens were recovered from material blasted out into the quarry floor. Later,

[6] *Scientific American,* Vol. 195, pp. 165-166 (1956); Art Harnack, "Treasures from an Ancient Sea," *Iowan,* pp. 26-27 (November, 1959); Art Harnack, "Treasures from an Ancient Sea," *Earth Science,* Vol. 12, pp. 153-156 and 166 (1959).

[7] C. Keyes and B. H. Beane, "Modernity in Paleozoic Starfishes," *Pan American Geologist,* Vol. 62, pp. 197-212 (1934).

in 1934, the material above the nest was carefully blasted off and the crinoidal horizon removed, thus saving many thousand specimens. Finally, in 1937, the remainder of the colony was blasted out. Professor Laudon, then at the University of Tulsa, played a large part in this work, ably supported by the cooperation of the quarry workmen and their foreman, Ben K. Baumgardner. Many excellent crinoid specimens were also secured at this time.

Although the operations of the quarry were under the watchful eye of Mr. Beane until they ceased in 1958, no further colonies have been found. Present outlook is that operations in this quarry on the south side of the river will not be resumed because of the increasing overburden encountered as quarrying has advanced into the valley side. So the discovery of more of these wonderful crinoid fossils is unlikely. Of course, it is not known whether there are more nests or colonies in the rocks of the area. The circumstances leading to the preservation of these crinoids must have been very unusual. Here they were, living in great numbers attached to the limy mud of a shallow depression in the sea floor. The water must have been very quiet. With death, the stalks and calyxes settled into the soft ooze of the sea bottom. The seas of the time probably thronged with sharks which fed upon crinoids and other shellfish, but in these selected places, for some unknown reason, the crinoids lived on until their death and rapid burial. It should be noted that fossil sharks' teeth and spines are occasionally found in the LeGrand rocks.

Many of the crinoids found at LeGrand have been named after men who were associated with the search for fossil crinoids in the area. The finder of a new species of plant or mineral has the privilege of naming it, and *Rhodocrinus kirbyi,* as already mentioned, was named after George T. Kirby, one of the quarry owners, by Wachsmuth and Springer. This fossil belonged to the genus *Rhodocrinus,* established earlier by Samuel Miller. *R. kirbyi* was found to be different from any known specie, and so was given its name by the discoverers. Others named by Wachsmuth and Springer were *Rhodocrinus watersianus,* after Dr. W. B. Waters of Marshalltown: *Batocrinus macbridei,* after Dr. W. C. McBride of

Marshalltown; *Actinocrinus arnoldi* and *Cactocrinus arnoldi,* after Hon. Delos Arnold of Marshalltown; *Dichocrinus hammondi,* after Louis Hammond of LeGrand.

New species found at LeGrand by Mr. Beane, and named as such by Mr. Beane and Professor Laudon, include: *Taxocrinus hollandi,* named after Magnus Holland of LeGrand; *Pachylocrinus raymondi,* after Raymond Beane of LeGrand; *Decadocrinus baumgardneri,* after Mr. Ben K. Baumgardner, quarry foreman, of LeGrand; *Gilmocrinus o'neali,* in honor of Mr. Corwin O'Neal of LeGrand. Mr. O'Neal, editor of the *LeGrand Record* for many years, was a close friend of Mr. Beane, and did much to encourage him in his work. Other new species or varieties found at LeGrand by Mr. Beane or Professor Laudon, and identified and named by one or both of them include *Rhodocrinus octadactylus, Rhodocrinus douglassi haploformis, Zeacrinus infrequens, Abrotocrinus parviglyptus.*

Professor Laudon and Mr. Beane presented an excellent summary of the results of the study of the LeGrand crinoids in 1937, a study which had extended over 40 years.[8] Forty species of fossil crinoids, recognized in the fauna, were described. They included 11 new species, most of which Mr. Beane had the pleasure of finding and rescuing, one might say, from oblivion. In 1932, Penn College awarded him the degree Honorary Doctor of Science.

The skilled work of Burnice Hartley Beane and the crinoid hunters who preceded him, or who were associated with him, has given us a wonderful picture of some of the sea life of this part of the world of eons ago. Amazing also is the fact that the skeletal remains of these delicate creatures, the crinoids, have been so well preserved in the rocks by Mother Nature, to be finally brought to light by man's digging and blasting into the crust of the earth.

[8] L. R. Laudon and B. H. Beane, "The Crinoid Fauna of the Hampton Formation at LeGrand, Iowa," *Iowa University Studies in Natural History,* Vol. 17, No. 6, n.s. no. 345, pp. 227-272 (December 1, 1937).