Winifred Goldring (1888–1971): New York Paleontologist

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Winifred Goldring's family was of English descent. Her father had been trained at Kew Gardens in London as an orchid specialist. In 1879, he immigrated to Albany, New York to manage Erastus Corning's private collection of orchids. There he met the future Mrs. Goldring, and Winifred's mother, who was a local school teacher and the daughter of the head gardener at Corning's estate. Winifred's family consisted of eight girls and one boy; Winifred was the fourth daughter, born in 1888. In 1890, the family established a floral business that was quite successful. Winifred Goldring lived at the family home for most of her 81 years, although she traveled to Cuba and extensively throughout the United States including to Alaska.

FIGURE 1. Winifred Goldring ca. 1920. Source: New York State Archives (B0577).

Goldring was educated in local public schools and graduated from Milne High School, which was attached to the local college that later became the State University of New York at Albany. She was valedictorian of her class in 1905; she then enrolled at Wellesley College intending to study classical languages. At that time, Wellesley required taking at least two science courses (see Table 1), which changed the course of Winifred's life. She was hooked! Although her major was in zoology and botany, she took geology courses, taught by Elizabeth Fisher, as well. She also learned German, which gave her entrée to some of the most important and original scientific papers published during her career. Goldring received her bachelor's degree in 1909 with honors (Phi Beta Kappa and a Durant scholar), and a Master of Arts from Wellesley in 1912 (Fisher 1974; Kohlstedt 1980, 1990).

TABLE 1. Wellesley Curriculum, 1905–1909

Latin is required for admission
Major consists of three courses in two related departments, or 3 or 4 in one subject and 3 or 2 in 1 or 2 related subjects
Required courses
Bible (first and second years)
English Composition (1st and 2nd years)
Physical Training (1st and 2nd years, non-credit)
Hygiene (first year)
Philosophy (third year)
Mathematics
Foreign Language (at least 1 year, usually German)
Two science courses in different subjects (Botany, Chemistry, Physics, or Zoology)

Source: compiled from Ondedunk 1975

Winifred's master's thesis professor was William Morris Davis of Harvard, a physical geographer who stressed the role of water in shaping geological landscape. Davis adopted the findings of geologists in the American West — Dutton, Gilbert, King, Powell, and others —and applied them to the American East (Servos 1999). His cycles of erosion and uplift became an important explanatory system in Goldring's geologic thinking. In the summer of 1913, Goldring took a graduate course at Columbia from Amadeus Grabau, a

paleontologist and stratigrapher known for his volumes on North American index fossils (Langenheim 1999), which she was to find most useful in her later work on Devonian crinoids and in her handbook of paleontology. The same year that she took his course,Grabau published a benchmark textbook on stratigraphy of over 1,000 pages that codified the teaching on the subject in the United States for a generation (Grabau 1913).

Goldring's first scientific publication arose from work she had started shortly after Grabau's course. It appeared initially as an abstract of a paper given in 1920 *in absentia* at the Chicago meeting of the Paleontological Society (Goldring 1921a) and then in full as a *New York State Museum Bulletin* in 1922. She used variation in Pleistocene fauna to document salinity changes in the Lake Champlain area, a classic example of the facies concept that had been detailed in Grabau's textbook. Her study turned into a huge data collecting project for which she assembled thirty pages of tables to argue her case. And, although she collected fossils extensively in the Lake Champlain area, she also depended on collections made by others near the Lake and along the St. Lawrence River and the Ottawa River.

In 1921, with support from the New York State Museum, she took a course from Edward Berry of Johns Hopkins University, a paleobotanist specializing in Mesozoic and Cenozoic plants (Yochelson 1999). Goldring published her second paper in November 1921 in connection with work done in his graduate course. She studied the annual growth of rings in Carboniferous age petrified wood, arguing that her findings undercut a theory of climate variability put forward by E.C. Jeffreys (Goldring 1921b).

Devonian Crinoids

Goldring taught at Wellesley College and at a teacher's school in Boston from 1912 to 1914, when John Mason Clarke hired her at the New York State Museum as a scientific expert to develop exhibits in the hall of invertebrate paleontology. In 1916, he asked her to undertake a massive project, to complete a revisionary study of the State's Devonian crinoids that had been initiated earlier and was still in its infancy. In a historical introduction to the book, Clarke detailed the work of Goldring's predecessor, James Hall, who had in the 1860s published a major monograph on Devonian crinoids, as well as the subsequent collecting by Charles White, Clarke himself, Edwin Kirk and others. A large amount of notes, drawings, undescribed specimens, and other paraphernalia had already been assembled for the project but none of the scientists had been able to complete it. Winifred Goldring did so in seven years. This was another huge data collection and organization project; the resulting book was 670 pages long, and included no fewer than 60 spectacularly fine plates illustrating the crinoid diversity of the State (Goldring 1923). Of the plates, seven were photographs of crinoid colonies or a single specimen of a large crinoid whereas 53 were drawings by the artist George Barkentin of the state museum staff (Fig. 2).

At first glance Goldring's monograph seems like a straight forward taxonomic treatment inasmuch as 70% of the book focuses on taxonomic descriptions and 20% consisted of plates and their captions. However, 10% of the volume was devoted to an introduction, which is marked by a number of notable features because her intended readership was to be students of paleontology. Thus, this introductory section drew mainly on Frank Springer's section on crinoids in the English edition of Zittel's second edition of the *Treatise on Paleontology* (1913), which Goldring chose in order to acquaint her readers with crinoid basics. Springer himself was a research associate at the U.S. National Museum and a successful lawyer and businessman in New Mexico and one of Goldring's mentors. Following Springer's example, Goldring dealt with morphology, physiology, habitat, and the stratigraphic placement of crinoids. Furthermore, in the introduction, as well occasionally in the taxonomic section, she commented on evolutionary sequences of some of the

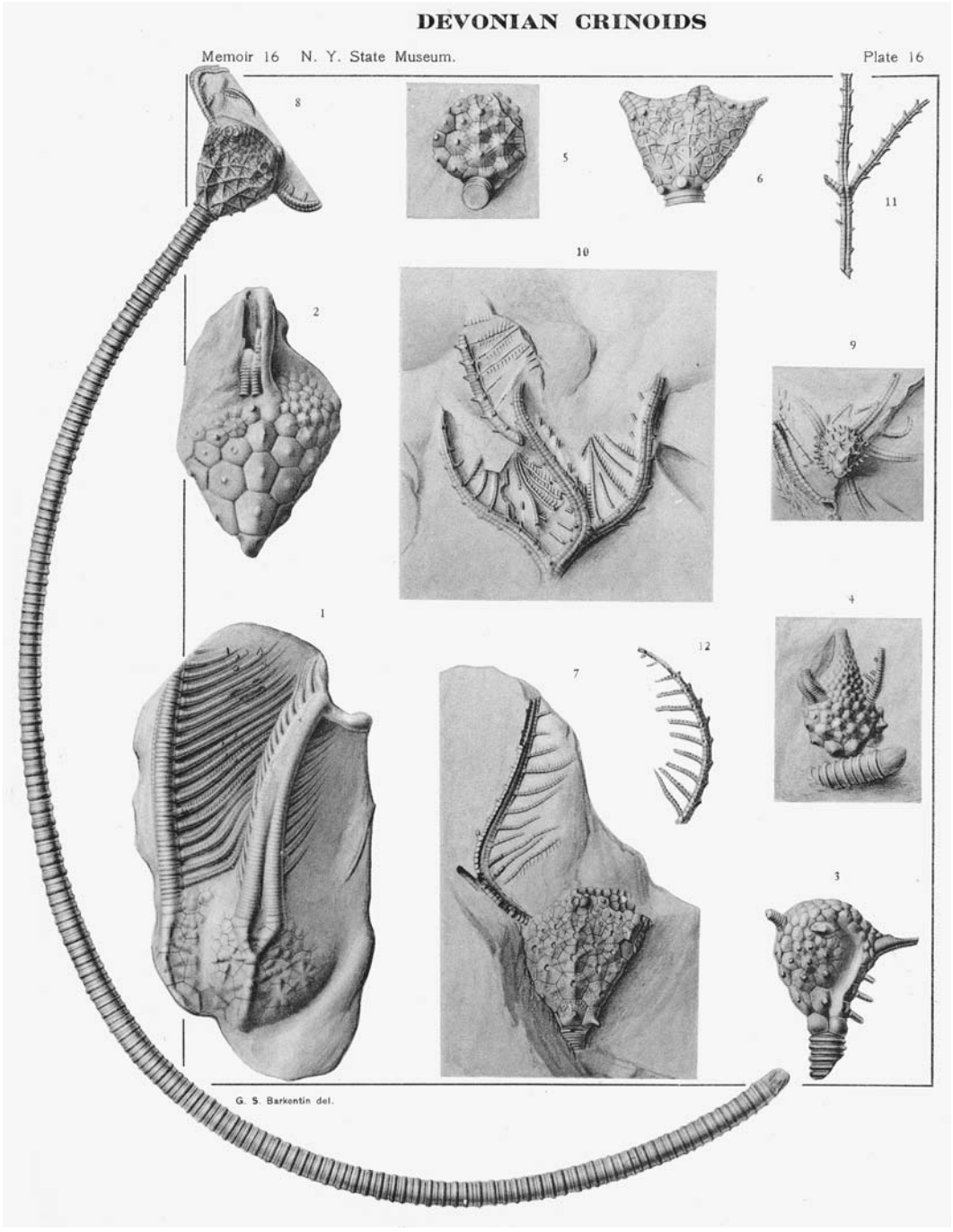

FIGURE 2. One of George Barkentin's plates published in Goldring's book on Devonian Crinoids (1923).

crinoids that she studied. Her bibliography placed her in the company of other crinoid experts in Europe and North America.

Of course, the heart of the book was its taxonomic descriptions. She reviewed no fewer than 25 families, 60 genera, and 155 species. Of these, two families, 18 genera, and 58 species were described as new. And, although she accepted nearly all of the new species described by Hall years earlier, she differed from Hall on many of his new genera (Tables 2 and 3). Between Hall's publication and hers, there had accumulated a substantial amount of new fossil material, plus a large body of published scholarship. Many of Hall's genera had to be merged with those of other workers for a better placement of the species. On issues of higher taxa, that is, families and orders, she and Hall were both quite conservative. They were well aware that they were working in a limited geographic region and only in the Devonian.

Table 2. New Taxonomic Names Credited to Goldring, Hall, Springer, and Others in Goldring, Devonian Crinoids (1923)

Authority	*New Families**	*New Genera*	*New Species*
Goldring	2 (8%**)	18 (30%)	58 (37%)
Hall	0 (0%)	6 (10%)	57 (36%)
Springer	3 (12%)	6 (10%)	7 (4%)
Wachsmuth & Springer	7 (28%)	4 (7%)	4 (3%)
Williams	0 (0%)	1 (2%)	9 (6%)
Others (Bather, Conrad, Roemer, Ulrich, Zittel, et al.)	13 (52%)	25 (42%)	20 (13%)
TOTALS	**25**	**60**	**155**

* Includes subfamilies (5). ** Percents do not necessarily total 100% because of rounding errors.

Table 3. New Combinations of Taxonomic Names Introduced by Goldring (1923)

Hall	11 of Hall's species referred to other genera
Grabau	1 of Grabau's species referred to another genus
Talbot	1 of Talbot's species referred to another genus
Williams	1 of Williams' species referred to another genus

At the time of its publication, Goldring's volume was extremely well received. Springer wrote a rave review of it in *Science*, saying it was a superb volume marking an epoch in American paleontology. But, we might ask, what has been the subsequent fate of her new taxa and how does this reflect on the quality of her work? In Moore's *Treatise on Invertebrate Paleontology* (1978) (see Table 4), all 18 of her genera are recognized and, as best we can tell, most of her newly described species. On the other hand, only three of the genera are still placed within the same family groups that she proposed, and only one of her two newly described family groups has survived, the other having been synonymized with an earlier described family (Table 4). This should come as no surprise inasmuch as it reflects the natural evolution of the science with additional collecting and with world-wide publishing on the Devonian.

Goldring's 1923 book initiated her career-long interest in Devonian crinoids. Because of her monograph, scientists and collectors sent her new material as it was uncovered in field work. As a result, she issued two kinds of analyses in follow-up publications (Table 5). Some of her papers

TABLE 4. Current Family Group Assignment of Goldring's 18 New Genera Described in 1923
(Family-groups assigned by Goldring [1923] and by Moore et al. [1978])

Goldring's new genera[1]	Family group assigned by Goldring[2]	Family group assigned by Moore et al.[2]
Anamesocrinus	Anamesocrinidae Goldring	Anamesocrinidae
Catactocrinus	Glossocrinidae Goldring (syn of)	Rhenocrinidae
Charientocrinus	Glossocrinidae Goldring (syn of)	Rhenocrinidae
Clarkeocrinus	Melanocrinidae	Dolatocrinidae
Corematocrinus	Poteriocrinidae	Scytalocrinidae
Corocrinus	Batocrinidae	Periechocrinidae
Cradeocrinus	Cyathocrinidae	Mastigocrinidae
Crateocrinus	Melanocrinidae	Dolatocrinidae
Cyttarocrinus	Platycrinidae	Hapalocrinidae
Glossocrinus	Glossocrinidae Goldring (syn of)	Rhenocrinidae
Hallocrinus	Glossocrinidae Goldring (syn of)	Rhenocrinidae
Iteacrinus	Cyathocrinidae	Mastigocrinidae
Liparocrinus	Glossocrinidae Goldring (syn of)	Rhenocrinidae
Logocrinus	Poteriocrinidae	Scytalocrinidae
Mictocrinus	Cyathocrinidae	Gasterocomidae
Pterinocrinus	Dimerocrinidae	Dimerocrinitidae
Sphaerotocrinus	Rhodocrinidae	Rhodocrinitidae
Thamnocrinus	Batocrinidae	Periechocrinidae

[1] In 1923, Goldring described 18 new genera of crinoids from the Devonian of New York. All are recognized by Moore et al. in the *Treatise on Invertebrate Paleontology* (1978), Part T, Echinodermata 2, Crinoidea, vol. 2.

[2] Goldring's family-group assignments are shown in column 2. Goldring's family-group classification follows that of Springer (1913) except for the two new family groups she proposed in 1923. Of the two new family groups described by her, the Anamesocrinidae is recognized by Moore et al. (see column 3); the Glossocrinidae had to be referred to the synonymy of Rhenocrinidae when its type genus, *Glossocrinus*, and other included genera were transferred to Rhenocrinidae.

consisted of fuller descriptions of existing species and genera from better specimens than had been available earlier. Also, she described a host of new taxa, both species and genera. Her associates in these projects were amateurs and museum professionals such as G. Arthur Cooper of the Smithsonian, Irving Reimann of the Buffalo Natural History Society, and E.R. Eller of the Carnegie Museum. She published her results in their journals, deposited type specimens in their collections, and named new species after her collectors.

The Gilboa Fossil Forest

In the 1850s, Samuel Lockwood sent petrified wood from the area near Gilboa, New York to J.W. Dawson in Canada, and in 1869 another Gilboa resident drew James Hall's attention to the material. Hall published on it in the *Albany Institute Transactions* and announced the discovery to the British Association for the Advancement of Science. J.W. Dawson described the new material as "tree ferns."

In 1920, New York City began construction of a new reservoir at Gilboa to bring water to the thirsty city. With the cooperation of the contractor for the site, New York State Museum personnel scrambled just ahead of the steam shovels to save as many fossils as possible, an early instance of salvage geology. In 1921, Clarke published on Gilboa in *Scientific Monthly,* but because of the press of other duties, he decided to place continuation of the study in the capable hands of Winifred Goldring and Rudolf Ruedemann, both in the paleontology section of the museum. By June 1922

TABLE 5. Articles on Crinoids, 1926-1954

Date	*Region*	*New sp. & gen.*	*Place of Publication*	*Collector*
1926	New York	2 sp.	NY State Museum Bulletin	Cooper
1933	Maine	1 sp.	Portland Soc. Nat. Hist. Proc.	Norton
1934	NY, Ontario	3 sp.	Buffalo Soc. Nat. Hist. Bull.	Reimann
1935	New York	3 sp.	Carnegie Museum Annals	Eller
1935	New York	6 sp.	Carnegie Museum Annals	Reimann
1936	New York	5 sp. & 1 gen.	Journal of Paleontology	Cooper
1938	Pennsylvania	1 sp.	Carnegie Museum Annals	Eller
1938	NW Territs.	7 sp. & 2 gen.	Bulls. American Paleontology	Kindle
1938	New York	0	NY State Museum Bulletin	Reimann
1939	NW Territs.	0	Journal of Paleontology	Kindle
1942	New York	0	Buffalo Soc. Nat. Hist. Bull.	Reimann
1945	New York	0	American Journal of Science	Kopf
1946	New York	1 sp.	Bulls. American Paleontology	Kopf
1948	New York	0	Wagner Free Inst. Sci. Bulletin	Kopf
1948	Pennsylvania	0	Wagner Free Inst. Sci. Bulletin	Howell
1950	New York	2 sp.	Wagner Free Inst. Sci. Bulletin	Reimann
1951	New York	1 sp.	NY State Museum Circular	Walker
1954	New York	12 sp. & 3 gen.	NY State Museum Circular	Myers et al.
18 papers	Mostly NY	42 sp. & 6 gen.	9 journals	9 collectors

Goldring had enough new material collected by Ruedemann and herself to identify the specimens as seed ferns. At the time, seed ferns were well accepted as a transitional form between ferns and flowering plants, although the concept fell out of favor within a few years of Goldring's work. She published her technical scientific results in the *New York State Museum Bulletin* in 1924 and 1926. George Wieland recognized her project in a favorable report in 1929 in *Science* magazine, but then Goldring stopped doing research on the Gilboa site mainly because once the area had been flooded there was no chance to acquire new material.

Her subsequent efforts relating to the fossil forest took a completely different direction from her approach to Devonian crinoids. This time she undertook to popularize the results, first in semi-popular articles for other scientists, educators, foresters, and even for over-seas consumption (Table 6). For example, she published an article on Gilboa in German in *Natur and Volk*, the journal of the Senckenberg Museum in Frankfurt.

TABLE 6. Articles by Goldring on Gilboa fossil forest

New York State Museum Bulletins 1924, 1926 (two items), 1929 (two items)
American Forests and Forest Life 1930
Natur und Volk (Senckenberg Museum) 1935
New York State Education 1930
Scientific Monthly 1927
Smithsonian Institution, *Annual Report for 1928*

Second, she and others at the Museum created displays, notably a full-scale diorama (Fig. 3) in 1925 that was more than just a recreation of the ancient forest. In the foreground were rocks of Gilboa age with the three horizons where the stumps were found clearly marked. In the middle ground were reconstructed trees based on her drawings, and in the back a painting of the forest by the French artist Henri Marchand and his sons. The state museum also cooperated with the engineers at the Gilboa dam site to put up a roadside display, the first highway exhibit of sci-

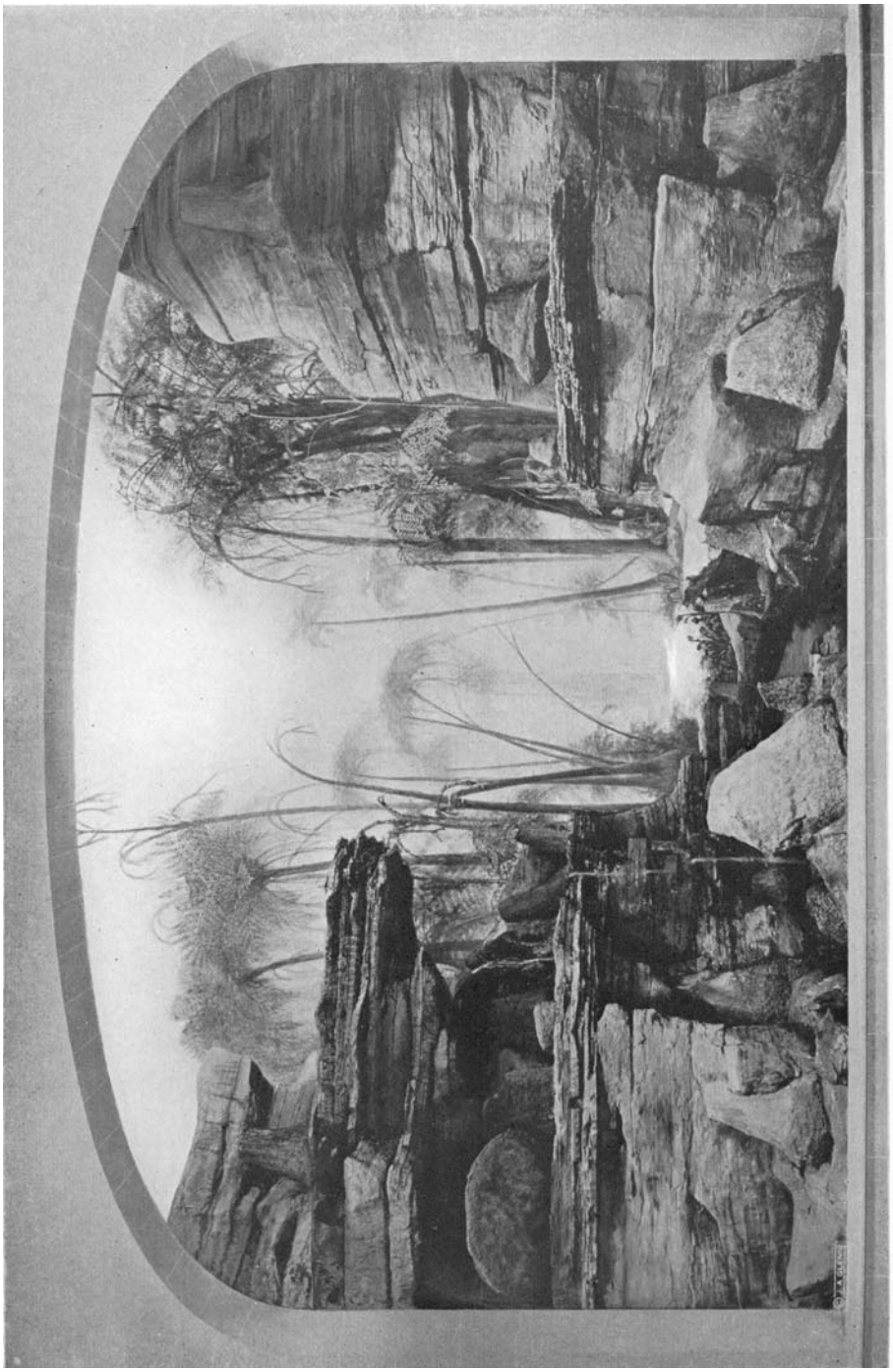

FIGURE 3. Goldring's diorama of the Gilboa fossil forest for the New York State Museum, 1925.

entific material in the state. A placard at the road's edge briefly described the site; a larger sign further back consisted of pages pasted up from Goldring's *Scientific Monthly* paper on Gilboa, and the stumps themselves were visible behind a low fence. This exhibit was renovated in 2000 by the local historical society.

Goldring's diorama on Gilboa was associated with other exhibits designed to popularize geology at the museum. Especially noteworthy were the cases on "What is a fossil?" and "What is a formation?" These in turn led her to publish handbooks for visitors and amateurs going into the field to study and collect. In 1929, the Museum published her handbook on fossils for beginners and amateurs in paleontology. This was an easily portable item for fieldwork, but it was also, to her surprise, adopted for classroom use. It went out of print in 1935, but demand was so great that she revised it in 1950, doing a considerable amount of rewriting (see Table 7). She kept the introduction the same but rewrote and expanded the descriptions and classifications and updated the bibliography. The 1950 edition went through two more printings by the State and one re-printing by the Paleontological Research Institution of Ithaca, New York.

TABLE 7. Handbook of Paleontology: The Fossils.
Pages devoted to sections in editions.

Topic in Section	1929	1950	Increase
Definition, preservation, collection	64	64	0%
Invertebrates: classification and description	155	167	8%
Vertebrates: classification and description	63	76	21%
Plants: classification and description	50	57	14%
Bibliography	6	8	33%
Index	13	17	30%
Total	351	389	11%

In 1935, Goldring published a companion handbook on formations for students and beginners of paleontology that included a geological map of the state of New York. Handbook owners were urged to use crayons or watercolors to color the formations, marked by patterns and shadings. It may have been that at the time, during the height of the Great Depression, that the museum could not afford to print a color map, but the coloring by the book user was also a useful educational exercise. Because this book moved into a more crowded market, and because at the time there were other many fine manuals of geology, it was not reprinted even though none of its competitors offered as much detail on New York State.

Algal Reefs

John Steele, in his study of the region's mineral waters, had called attention to the stromatolites in the Saratoga Springs area as early as 1825. Steele attributed them to inorganic origins. These stromatolites engaged the attention of several geologists, including James Hall, for a over century. In 1920, stone mason Robert Ritchie developed a suite of outcrops for popular viewing. This evolved into today's Petrified Sea Gardens, now a national historic site and national scientific site even though it is still privately owned and managed by a non-profit group. In the 1930s, Goldring studied the formations at the Garden and at nearby Lester State Park. She published a brief notice on the algal reefs in *Science* in 1937 and a 75-page *New York State Museum Bulletin* on them in 1938. She noted that these fossils were of Late Cambrian age. She also recognized the presence of three species of cryptozooans, all of which had been described and named by earlier scientists. Furthermore, she observed that the three species occurred at three different geological horizons and represented three different reef environments. But there was controversy over the nature of the cry-

tozooans themselves. Some, starting with John Steele, believed that they were not even organic. On the other hand, Ray Bassler of the Smithsonian Institution argued that they were blue-green algae, as did George Wieland of Yale University. Others argued that they were of animal origin—that is they were stromatolites—including Amadeus Grabau in his textbook in 1913 and in his *North American Index Fossils* (1909-10). August Rothpletz, who visited the area near Saratoga Springs in 1916, favored the animal theory. On the other hand, Goldring's evidence for a plant origin was based on field relations of the outcrops, microscopic evidence and thin sections, and isotope analysis.

Geological Mapping

After she finished her opus on Devonian crinoids, Goldring spent part of virtually every summer in the field. Geological mapping in New York had a long history. In her account (Goldring 1939a), in the 19th century 235 maps and sections had been produced for the State or units of the State. Early detail maps were mainly on the county level, but starting in 1900 quadrangle maps began to appear. John Clarke promoted that program during his directorship of the Museum from 1904 to 1925, and his successor, C.B. Adams, continued it. Two hundred and fifty-eight quadrangles are marked in New York State, counting the ones that are on the borders. By the end of the 1930s, about a third of them had been geologically mapped. One of the most prolific workers on quadrangle geology during Goldring's period was Goldring's predecessor and Clarke's successor as state paleontologist, Rudolf Ruedemann. Ruedemann did the Capital District quadrangles including the keystone Albany one, which he published in 1930. Goldring worked on two of the quadrangles that bracketed the Albany area, the Berne quadrangle to the north and the west, and the Coxsackie quadrangle to the south, but before she could see them through to publication, she had another mapping and publishing detour.

FIGURE 4. Winifred Goldring in the field, ca 1940. Source: New York State Archives (B0577).

John Boyd Thacher State Park is on the edge of the Berne quadrangle map and, in 1933, Goldring issued a guide to its geology. The guide included an uncolored geological map of the Park that the reader was urged to color in the formations. The Helderberg Mountains of upstate New York had by this time become an important tourist area due in large part to the advent of the automobile and to a road that had recently been completed to the Park. This area was a classic geologic section, and Goldring wrote about it in popular language for the many visitors of the new automobile age. Goldring drew heavily on her earlier training and experiences, and she used Davisian cycles of uplift and erosion to explain the topography. The Museum reprinted her guide in 1997; it included an introductory page adding information on plate tectonics to aid in the interpretation of the terrain (Landing 1997).

In 1935, Goldring published her monograph and map of the Berne quadrangle. This was the result of several summers' intensive fieldwork, during which she was accompanied at times by Ruldemann, Cooper, and others. Her monograph provided considerably more technical detail on formations and fossils than did the Thacher guide. This book as well as many of her other publications was illustrated by beautiful panoramic photographs by Edwin Stein, who served as the State Museum photographer.

Goldring was still mapping and writing on the Coxsackie quadrangle in her early 50s, finally producing the report and the map in 1943. The terrain was geologically more difficult than Berne

and, indeed, Goldring had to cross the Hudson River and enter into part of the Kinderhook quadrangle to understand what was going on. In addition to the quadrangle map, she provided a detailed map of the limestone area that showed some interesting geological structural features such as the Catskill Delta, which has been studied by generations of geologists. She again had Ruedemann and Cooper as assistants in the field, and Cooper contributed a chapter to the monograph. Goldring's Coxsackie book had more analysis of geomorphology than the one on the Berne quadrangle, and she paid considerable attention to the role of thrust faults in shaping the geology. She also incorporated new insights from Charles Schuchert and other university-based geologists.

Winifred Goldring rose gradually through the ranks at the State Museum, except for a brief period when she stepped out in 1918. In 1939, after Ruedemann retirement, she became the state paleontologist. Like Ruedemann and Clarke, she found herself very busy with administrative detail that cut into her own research. But she did manage to revise the fossil handbook, work on Devonian crinoids, and publish memorials of colleagues in the 1950s.

Generally, Goldring had supportive male colleagues at the New York State Museum and elsewhere. Nonetheless she did encounter problems as a woman geologist. She was advised more than once to stick to the museum and laboratory rather than to go into the field. In 1928 when she was considering a position with the U.S. Geological Survey she was tipped off not to apply because they wanted a "he-man" paleobotanist. In 1929, she wrote a blunt letter to Walter Bucher about the issue of whether women should go into geology and paleontology. She pointed out that her salary was half that of the clerks and stenographers at the museum. Generally, she preferred to encourage girls to go into botany and zoology rather than geology and geography. Nevertheless she was a recognized scientist leader in her own career. She received an honorary doctorate from Russell Sage College in 1937 and from Smith College in 1957. She was elected a Fellow of the Geological Society of America in 1921 and Vice President in 1950. She was elected president of the Paleontological Society in 1949 — the first woman to hold that post. But her greatest tribute was the esteem in which her scientist colleagues and later scientists held her work, and that is what she would have wanted.

Acknowledgements

Hallie Bignall (California Academy of Sciences) expertly transcribed a taped version of this paper. Gail Adametz (Smith College Science Library), Larry Currie (California Academy of Science Library), and Brad Seymour (New York State Museum) provided copies of Goldring's publications. Sally Gregory Kohlstedt (University of Minnesota) loaned copies of her research notes on Goldring, and she and Margaret Rossiter (Cornell University) encouraged and advised the authors.

Note on Sources

This paper is based mainly on Goldring's writings. A reasonably comprehensive bibliography can be assembled from GeoRef and from Fisher's list in his biography of her bur neither is complete. Kohlstedt's brief but thoughtful articles are easily accessible and Fisher's long memorial supplies more detail. Herrick's recent essay on Gilboa adds many more insights and is the latest word on Goldring. Manuscript sources include official records of the museum at the New York State Archives, and letters in the papers of colleagues with whom she corresponded, as cited by Kohlstedt and Herrick.

References

ANONYMOUS, 1922, Grants for research by the National Academy of Sciences, Science, new series: v. 55, p. 509.

FISHER, DONALD W., 1974, Memorial to Winifred Goldring 1888–1971, Memorials of the Geological Society of America: v. 3, p. 96–107.

GOLDRING, WINIFRED, 1921a, Decreasing salinity of the Pleistocene Champlain sea going southward, as shown by the character of the fauna, with a brief discussion of the Pleistocene fauna of the Hudson Valley and its significance, Bulletin of the Geological Society of America: v. 32, issue 1, p. 132–133.

GOLDRING, WINIFRED, 1921b, Annual rings of growth in Carboniferous wood, Botanical Gazette: v. 72, issue 5, p. 326–330.

GOLDRING, WINIFRED, 1922, The Champlain sea; evidence of its decreasing salinity southward as shown by the character of the fauna, Bulletin of the New York State Museum: v. 239–240, p. 153–194.

GOLDRING, WINIFRED, 1923, The Devonian crinoids of the State of New York, New York State Museum Memoir: v. 16, 670 p.

GOLDRING, WINIFRED, 1924, The Upper Devonian forest of seed ferns in eastern New York, Bulletin of the New York State Museum: v. 251, p. 50–92.

GOLDRING, WINIFRED, 1926a, New museum exhibits, Bulletin of the New York State Museum: v. 267, p. 81–84.

GOLDRING, WINIFRED, 1926b, New species of Hamilton crinoids, Bulletin of the New York State Museum: v. 267, p. 89–92.

GOLDRING, WINIFRED, 1926c, New Upper Devonian plant material, Bulletin of the New York State Museum: v. 267, p. 85–87.

GOLDRING, WINIFRED, 1927, The oldest known petrified forest, Scientific Monthly: v. 24, issue 6, p. 515–529.

GOLDRING, WINIFRED, 1929a, Handbook of paleontology for beginners and amateurs; Part 1, The Fossils. New York State Museum, Handbook: v. 9, 356 p.

GOLDRING, WINIFRED, 1929b, Honors to Doctor Ruedemann, Bulletin of the New York State Museum: v. 284, p. 20–21.

GOLDRING, WINIFRED, 1929c, The oldest known petrified forest, Scientific Monthly: v. 24, issue 6, pp. 515–529.

GOLDRING, WINIFRED, 1929d, An outdoor exhibit of the Gilboa fossil trees, Bulletin of the New York State Museum: v. 284, p. 33–35.

GOLDRING, WINIFRED, 1930a, The oldest known fossil forest, New York State Education: v. 17, issue 8, p. 704–707.

GOLDRING, WINIFRED, 1930b, The oldest known petrified forest, American Forests and Forest Life: v. 36, issue 8, p. 491–493 and 546.

GOLDRING, WINIFRED, 1933a, Handbook of paleontology for beginners and amateurs; Part 2, The Formations, New York State Museum Handbook: v. 10, 488 p.

GOLDRING, WINIFRED, 1933b, Guide to the geology of John Boyd Thacher Park (Indian Ladder region) and vicinity, New York State Museum Handbook: v. 14, 112 p.

GOLDRING, WINIFRED, 1933, A new species of crinoid from the Devonian (Oriskany) of Maine, Proceedings of the Portland Society of Natural History: v. 4, p. 153–155.

GOLDRING, WINIFRED, 1934, Some Hamilton crinoids of New York and Canada, Bulletin of the Buffalo Society of Natural Sciences: v. 15, issue 3, p. 182–200.

GOLDRING, WINIFRED, 1935a, Der aelteste versteinerte Wald aus der Devon-Zeit von New York, Natur und Volk: v. 65, p. 151–155.

GOLDRING, WINIFRED, 1935b, Geology of the Berne Quadrangle; with a chapter on glacial geology by John H. Cook, Bulletin of the New York State Museum: v. 303, 238 p.

GOLDRING, WINIFRED, 1935c, New and previously known Middle Devonian crinoids of New York, Annals of the Carnegie Museum: v. 24, p. 349–368.

GOLDRING, WINIFRED, 1935d, Some Upper Devonian crinoids from New York, Annals of Carnegie Museum: v. 24, p. 337–348.

GOLDRING, WINIFRED, 1936, Some Hamilton (Devonian) crinoids from New York, Journal of Paleontology: v. 10, issue 1, p. 14–22.

GOLDRING, WINIFRED, 1937, Cryptozoon, plant nature and distribution, Science: v. 86, issue 2241, p. 530–531. [Mistitled "On the origin of the Saratoga mineral waters," which is the correct title for the next paper in the journal.]

GOLDRING, WINIFRED, 1938a, An Upper Devonian species of *Aorocrinus*, Annals of Carnegie Museum: v. 27, p. 109–112.

GOLDRING, WINIFRED, 1938b, Devonian crinoids from the Mackenzie River Basin, Northwest Territories, Canada, Bulletins of American Paleontology: v. 24, issue 81, 23 p.

GOLDRING, WINIFRED, 1938c, Additional notes on previously described Devonian crinoids, Bulletin of the New York State Museum: v. 315, p. 77–83.

GOLDRING, WINIFRED, 1938d, Algal barrier reefs in the Lower Ozarkian of New York with a chapter on the importance of coralline algae as reef builders through the ages, Bulletin of the New York State Museum: v. 315, p. 5–75.

GOLDRING, WINIFRED, 1939a, Report on geological mapping of sedimentary rocks (exclusive of Grenville) and glacial areas in New York State, Bulletin of the New York State Museum: v. 317, p. 119–131.

GOLDRING, WINIFRED, 1939b, *Linobrachiocrinus*, new name for *Linocrinus* Goldring, 1938, not Kirk, 1938, Journal of Paleontology: v. 13, issue 3, p. 354.

GOLDRING, WINIFRED, 1942, Crown of *Ancyrocrinus* bulbosus Hall [from New York], Bulletin of the Buffalo Society of Natural Sciences: v.17, issue 3, p. 13–18.

GOLDRING, WINIFRED, 1943, Geology of the Coxsackie Quadrangle, New York, Bulletin of the New York State Museum: v. 332, 374 p.

GOLDRING, WINIFRED, 1945, Notes on *Thamnocrinus springeri* Goldring and other Hamilton crinoids, American Journal of Science: v. 243, issue 2, p. 57–65.

GOLDRING, WINIFRED, 1946, A new lower Chemung crinoid, Bulletins of American Paleontology: v. 31, issue 119, p. 1–8.

GOLDRING, WINIFRED, 1948a, Occurrence of *Gennaeocrinus kentuckiensis* (Shumard) in Pennsylvania, Bulletin of the Wagner Free Institute of Sciences of Philadelphia: v. 23, issue 1, p. 1–3.

GOLDRING, WINIFRED, 1948b, Status of '*Homocrinus*' *cylindricus* Hall, Bulletin of the Wagner Free Institute of Sciences of Philadelphia: v. 23, issue 4, p. 25–32.

GOLDRING, WINIFRED, 1950, Handbook of paleontology for beginners and amateurs, Part 1: The Fossils, second edition, New York State Museum Handbook: v. 9, 394 p.

GOLDRING, WINIFRED, 1950, Devonian crinoids; new and old, Bulletin of the Wagner Free Institute of Sciences of Philadelphia: v. 25, issue 4, p. 29–37.

GOLDRING, WINIFRED, 1951, A new species of the genus *Cratercrimus* Goldring, New York State Museum Circular: v. 27, 6 p.

GOLDRING, WINIFRED, 1954a, Devonian crinoids new and old: II, New York State Museum Circular: v. 37, 51 p.

GOLDRING, WINIFRED, 1954b, Memorial to George Halcott Chadwick [1876–1953], Proceedings of the Geological Society of America, p. 101–106.

GOLDRING, WINIFRED, 1958, Memorial to Rudolf Ruedemann (1864–1956), Proceedings of the Geological Society of America, p. 153–161.

GOLDRING, WINIFRED, 1960, Handbook of paleontology for beginners and amateurs, Part 1: The Fossils, second edition, third printing, Ithaca, New York, Paleontological Research Institution, 394 p.

GOLDRING, WINIFRED and FLOWERS, ROUSSEAU H., 1942, Restudy of the Schoharie and Esopus formations in New York State, American Journal of Science: v. 240, issue 10, p. 673–694.

GOLDRING, WINIFRED and FLOWERS, ROUSSEAU H., 1944, Carlisle Center Formation, a new name for the Sharon Springs Formation of Goldring and Flower, American Journal of Science: v. 242, issue 6, p. 340.

GRABAU, AMADEUS, 1913, Principles of Stratigraphy, A.G. Seiler & Co., New York, 1185 p.

GRABAU, AMADEUS W AND HARVEY W. SHIMER, 1909–1910, North American Index Fossils, Invertebrates, A.G. Seiler & Co., New York, 2 vols.

HERRICK, LINDA V., 2003, The Gilboa Fossils, New York State Museum Circular: v. 65, 100 p.

KOHLSTEDT, SALLY G., 1980, Winifred Goldring, Notable American Women: v. 4, p. 282–283.

KOHLSTEDT, SALLY G., 1990, Winifred Goldring, Dictionary of Scientific Biopgraphy: v. 17, p. 357–359.

LANDING, ED, 1997, Forward [*sic*], in reprint edition of GOLDRING, WINIFRED, Guide to the geology of John Boyd Thacher Park, New York State Museum Handbook: v. 14, p. ix.

LANGENHEIM, RALPH L., 1999, Amadeus Graabau, American National Biography: v. 9, p. 356–357.

MOORE, RAYMOND C. and TEICHERT, CURT, eds, 1978, Treatise on Invertebrate Paleontology, Part T, Echinodermata, 2, Crinoidea: v. 2, Geological Society of America and University of Kansas, pp. T403–T812.

ONDEDUNK, VIRGINIA, 1975, The curriculum: revision and growth, 1893–1943, in Jean Glasscock, ed., Wellesley College, 1875–1975: A Century of Women, 137–148.

RUEDEMANN, RUDOLF and GOLDRING, WINIFRED, 1929, Making fossils popular in the State Museum, Bulletin of the New York State Museum: v. 279, p. 47–51.

RUEDEMANN, RUDOLF and GOLDRING, WINIFRED, 1944, Memorial to David Hale Newland [1872–1943], Proceedings of the Geological Society of America, p. 209–216.

SERVOS, JOHN W., 1999 , William Morris Davis, American National Biography: v. 6 , p. 238–240.

SPRINGER, FRANK, 1913, Cyctoidea [p. 145–161], Blastoidea [p. 161–172], Crinoidea [p. 173–243] in K. A. von ZITTEL, Text-book of Paleontology, vol. 1, 2nd English ed., edited by Charles R. Eastman, Macmillan & Co., London.

SPRINGER, FRANK, 1924, [Review of] Devonian crinoids of New York, Science: new series, v. 60, p. 385–386.

SPRINGER, FRANK, 1926, American Silurian crinoids, Smithsonian Institution Publications: number 2871, iv+239 p., 33 pls.

WIELAND, GEORGE, 1929, View of higher seed plant descent since 1879, Science: new series, v. 70, 223–228.

YOCHELSON, ELLIS L., 1999 , Edward Berry, American National Biography: v. 2, 685–686.