VERTEBRATE PALEONTOLOGY AT THE FLORIDA MUSEUM OF NATURAL HISTORY, UNIVERSITY OF FLORIDA: THE PAST 60 YEARS OF RESEARCH AND EDUCATION

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ABSTRACT

This paper presents the history and development of the vertebrate paleontology (VP) program since its inception at the Florida State Museum (name changed to Florida Museum of Natural History in 1988) over the past 60 years. Given the rich and ubiquitous 40-million-year fossil record exposed in Florida and general public interest in extinct life, it is not surprising that paleontology has continued to be a cornerstone of the museum. The impact of two aspects of this program is highlighted; i.e., (1) the "formative decade" from 1956 to 1965; and (2) the development of the VP collection and related activities over the past 60 years. VP has benefitted greatly from dedicated and passionate people involved in this program, including curators, staff, undergraduates, volunteers, and 80 graduate students. Other topics covered in this history include leadership, infrastructure, research, education, and outreach. Outcomes have included a collection that has grown to almost a half million digitized specimens, more than 15 million dollars of grant-supported projects, active, year-round field work, about 400 peer-reviewed papers published, and innovative exhibitions and public programs. The unique identity of the VP program and its recognition among peers both nationally and internationally results from the positive influences of these foundational core and related activities over the past 60 years.

Key words: Cenozoic, collections, education, Florida, fossils, history, museum, paleontology, research, university, vertebrate.

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INTRODUCTION AND CONTEXT

On the occasion of the Centennial celebration of our museum, it seems fitting to reflect upon and describe the impact that the Vertebrate Paleontology (VP) program has had not just on the development of our museum, but also on the science of vertebrate paleontology, both nationally and internationally. By virtue of the richness of its fossil deposits spanning the past 40 million years, strategic position in the southeastern U.S., and the activities of our program, Florida and our museum have a rich history that needs to be told. Ray (2005) presented additional context and relevant details, whereas the current paper expands upon, focuses, and extends our knowledge of this history of the VP program over the past 60 years.

The discovery and scientific study of fossil vertebrates in Florida dates back more than a century to the period between 1881 to 1896 (Ray, 2005), and was largely influenced by Joseph Leidy. The collections of Pleistocene vertebrates from the Peace River (Leidy, 1889) and late Miocene mammals from the "Alachua Clays" near Williston (Leidy and Lucas, 1896) thus represent important milestones for this history. Primarily because of the rarity of pre-Pleistocene fossil localities east of the Mississippi River, during the first half of the 20th century, sporadic studies of fossil vertebrates, e.g., early Miocene mammals (e.g., Simpson, 1932) established Florida as a place to be considered in terms of its fossil record of Tertiary life in the eastern United States.

Also in the early part of the 20th century, Florida State geologist E. H. Sellards and his field crews spent four years (1913 to 1916) collecting late Pleistocene mammals from Vero Beach. In a surprising discovery, Sellards (1916, 1917) reported human skeletal remains in association with the extinct vertebrates. These reports were soon rejected by prominent scientists, including the venerable Hrdlička, an archaeologist from the Smithsonian (Hrdlička, 1917). Regardless of its veracity, this discovery brought Florida to prominence on the national scene in terms of understanding the peopling of the Americas.

During the middle of the 20th century, crews from Harvard's Museum of Comparative Zoology (MCZ) under the direction of Thomas Barbour made extensive excavations at the early Miocene Thomas Farm site in rural Gilchrist County. In 1939 Barbour purchased a 40-acre tract of land encompassing the Thomas Farm fossil site that was ultimately deeded to the University of Florida (UF; Patton, 1964). The Thomas Farm site has not just produced a wealth of fossils and research ideas, but through the years it also has served us well in terms as a meaningful venue for education and outreach (Fig. 1).

In the classic Wood Committee Report (Wood et al., 1941) that codified the North American continental Tertiary ages, (now called the North American Land Mammal Ages, i.e., NALMAs; Woodburne, 2004), the Hawthorn [sic.] (Formation) was considered a correlative of the Hemingfordian age as it was typified from Nebraska. With regard to the Hemphillian, reference is also made to the Alachua Formation of Alachua (location of UF), Levy, and Marion counties in northcentral Florida. These stratigraphic tie-ins galvanized the importance of Florida in a continent-wide understanding of Tertiary land mammal evolution and set the stage for the future importance of our program in vertebrate paleontology (VP).

Successful academic programs develop their own character, and such has been the case with VP at our museum. In this history, after a discussion of what I am calling the formative decade between 1956 and 1965, I will then reflect on, and describe, the following essential components of our program: (1) leadership and administrative vision; (2) budgets, external funding, and endowments; (3) people; (4) VP collections growth and infrastructure; (5) research accomplishments and identity; (6) university instruction; (7) museum exhibits and educational outreach; (8) national professional leadership; (9) interactions with amateurs and clubs; and a summary and concluding comments. Taken together I hope that a picture will emerge of an active program in all of these facets and that these embody the academic culture and unique brand of VP that has developed over the past 60 years.

I have tried to make this a balanced view of this period, and it has been rewarding to review

Figure 1. Collecting at Thomas Farm, probably from the late 1940s. From left to right are Archie Carr, Frank Young, Francis Norman, Buddy Young, Theodore White, and Marjorie Carr (head at center bottom; Simons, 2000). Archie Carr was influenced by the MCZ Director Thomas Barbour who in turn was an advocate for local involvement of the University of Florida at this important fossil site (J. C. Dickinson photo).

publications, reports, and other archival materials. However, there is likely a personal bias over the past five decades since 1977 when I have been a curator at the FLMNH. In addition, in consulting archival and other resources I found many possible photos that could be included in this history. I have decided to include mostly those of historical importance that have not been previously published, rather than featuring photos of more current activities of our program. Depending upon the context, I refer to the museum as the Florida State Museum (FSM) starting in 1914-1917, but then refer to it as the Florida Museum of Natural History (FLMNH) for events that occurred after the name was changed in 1988.

THE FORMATIVE DECADE--1956 TO 1965

I have chosen to start this history in 1956, about sixty years ago. As will be further explained below, this decade is bookended by two formative events, i.e., completion of Walter Auffenberg's PhD on Florida fossil snakes in 1956 and the submission of a National Science Foundation proposal in 1965 by J. C. Dickinson for a new building that decades later (in 1983) would be named Dickinson Hall in recognition of his enormous impact on the museum.

Before we discuss the VP program during that time, it is instructive to provide some context and framework about Gainesville, the University of Florida, and museum during that time. Gainesville was, like it is today, primarily a college town. Public schools and universities in the South were segregated; UF was peacefully integrated in 1958. The population of the city was about 30,000; 60 years later Gainesville proper has a resident population of about 130,000 (www.census.gov), not including the inhabitants of surrounding Alachua County that now comprises the Metropolitan Statistical Area. There were no commercial airline flights to/from Gainesville; travelers had to use Jacksonville, some

80 miles away, or the more distant Orlando or Tampa airports, or travel by rail or car. I-75, which bisects Gainesville today, had not yet been built. Alachua County, where UF is located, was "dry" (no alcohol sold or dispensed in public establishments), and it remained that way throughout this period. J. Wayne Reitz was the newly inaugurated UF President who occupied this office through this decade. It likely is no coincidence that the rapid expansion of the FSM and its programs including VP during this decade occurred during Reitz's administration that also saw major growth campus-wide, including the construction of 300 buildings. In 1956 UF had a student population of 10,997; by 1964 it had grown to 16,874 (http://www.ir.ufl.edu/factbook/enroll.htm); in 2016 it was about 50,000.

The FSM was a unit of the university housed in campus buildings and about a half mile NE of the main campus in the "high-rise" Seagle building (http://www.seaglebuilding.com/). The 1955-56 FSM Annual report (Grobman, 1957) indicates that there were 15 full-time staff and faculty employees of the FSM and a total state budget of ~$70,000. By 1965 this had grown to two dozen full-time staff and faculty employees and a total state budget of $222,000 (Dickinson, 1965).

Vertebrate Paleontology (VP)—Several important events occurred during this decade that resulted in VP emerging on the national scene as a young, active program with much potential. Although at the beginning of the decade there was no formal division or program of VP in the FSM, in 1956 Walter Auffenberg completed his PhD on fossil snakes of Florida. This was the first graduate dissertation at UF to advance understanding of ancient vertebrate life in our state. In that same year, Robert Bader, a UF biology professor published an important paper on Miocene horses from Thomas Farm (Bader, 1956). Bader also entered hundreds of specimens into our catalog from that locality, thus reviving a dormant collection (Grobman, 1955). At that time, the VP collection consisted of about 1,000 catalogued specimens almost entirely from Florida. Arnold Grobman, (Auffenberg's major professor for the PhD) was the Director of the FSM. It was a time of generalists, and, although primarily a herpetologist, even the Director Grobman reports that he had been in the field collecting Pleistocene fossils. By the end of the 1950's the annual reports began to describe VP as a program with its own set of activities, implying the beginning of this discipline as a division within the FSM. Upon Bader's departure, newly minted PhD Auffenberg assumed duties as curator of vertebrate paleontology (Fig. 2). Auffenberg left in 1959 to work with Grobman at the BSCS (Biological Sciences Curriculum Study) in Colorado, although he later returned to the FSM in 1963 as Chair of the Department of Natural Sciences and Curator of Herpetology. By the early 1960s Dickinson was director and it is likely that based on their previous association working together in the 1950s, he recruited Auffenberg back to the FSM. More will be said below about J.C.'s vision and leadership. He was highly influential in guiding the academic and public programs in a direction that would result in increased prominence over the years.

In 1959 Clayton Ray was hired into the museum (and shared half-time with the biology department) as a faculty curator of VP. Ray left for the U.S. National Museum in 1963, and then two VP faculty were hired, i.e., S. David Webb as an Assistant Curator in 1964 and Thomas Patton, initially as a biology instructor, but then in a split appointment he also became an Assistant Curator at the FSM in 1965; more will also be said about them below. This started a tradition of two VP faculty that brought the FSM up to the level of PhD curators of similar programs at peer institutions, e.g., Kansas, Michigan, Nebraska, and Texas (Langston et al., 1972). Field work at important fossil sites in Florida continued throughout this period. In addition to Thomas Farm, these included McGehee Farm from north of Newberry (Alachua County) that provided important evidence of early dispersals from South America (Hirschfeld and Webb, 1968), as well as numerous Pleistocene localities.

Fittingly for this fledgling program seeking national recognition, in 1964 the FSM and Florida Geological Survey co-hosted the Annual SVP (Society of Vertebrate Paleontology) Meeting at UF on November 16-18. A pre-meeting field trip

Figure 2. Walter Auffenberg working on a *Bison latifrons* horn core from the late Pleistocene near Bradenton, Florida (Grobman, 1958).

in central Florida (Auffenberg et al., 1964; Fig. 3) was followed by three days of talks, a business meeting and social events (Fig. 4). This meeting was presided over by Tilly Edinger and attended by about 64 people (Nichols, 1965).

LEADERSHIP AND ADMINISTRATIVE VISION

The leadership of the FSM/FLMNH has been of fundamental importance to the development and success of VP. Another important circumstance has been the museum's position and governance within the university. According to Dickinson (1965), the museum was funded as a separate "department" within the university since its establishment as a unit at UF in 1914 (Van Hyning, 1915; Anonymous, 1920). In 1917 the FSM acquired a dual purpose not just as a university museum, as the Florida Legislature also designated it the official state museum of natural history. The Director currently has Dean-level status at UF and therefore reports directly to the President (via the Provost). In

Figure 3. The 1964 field trip to Thomas Farm during the Society of Vertebrate Paleontology meeting. Pierce Brodkorb (white shirt and khaki pants) of the UF Biology (Zoology) department is standing in the right center and to the left (Brodkorb's right) is Claude Hibbard (hat and gray shirt and pants) from the University of Michigan (FLMNH photo archives).

many regards, this has resulted in an optimal level of autonomy and served as a model for the governance of other museums within universities. During the past 60 years we have had five directors, Arnold Grobman (1952–1959), J. C. Dickinson, Jr. (1961–1979), F. Wayne King (1979–1985), T. Peter Bennett (1986–1996), and Douglas Jones (1996–present). Because of his long-term impact on our museum's development and initial rise to prominence, in this section I will highlight and reflect upon the accomplishments of J. C. Dickinson (Fig. 5) and, in particular, as they pertain to VP. J. C. hired me in 1977 and therefore what I say below is from first-hand experience working with him and my continued association with him until he died in 2009.

As a graduate student, Dickinson was trained at UF by Pierce Brodkorb, a paleo-ornithologist in the Biology department, and was greatly influenced in his thinking by his time as a visiting researcher and postdoctoral fellow at the MCZ, Harvard. Dickinson was a strong advocate for the FSM to remain its own academic unit; i.e., of college-level status and not subsumed as a department within a college (e.g., Arts and Sciences). He had concerns that with the different mission of the FSM, i.e., because it does not have students per se, its own official curriculum, and does not generate SCHs (student credit hours), it potentially would be vulnerable during economic hard times or by bean-counters wanting to trim fat from the university enterprise. This seems to be the optimal governance, but also requires an excellent rapport and continual advocacy with the upper administration; in this regard Dickinson was politically astute. Dickinson also realized that the FSM curators should, so far as possible, have their salaried lines in the FSM, and not be shared with the "teaching" departments, e.g., Anthropology, Geology (now Geological Sciences), and Biology (previously Biology, then changed to Botany and Zoology, and more recently returned to Biology). Museum faculty curators

SOCIETY OF VERTEBRATE PALEONTOLOGY

NEWS BULLETIN

ANNUAL MEETING

The annual meeting will be held at the University of Florida, Gainesville, Florida, November 16-18, in McCarty Auditorium, Radio Road (SW 8th Ave.) and Newell Drive (SW 16th St.). Members may enter the campus from US 441 (SW 13th St.) at SW 8th Ave. Parking permits may be obtained at the Campus Police Station, Radio Road and Newell Drive. McCarty Hall is one-half block north, on the left (west).

FIELD TRIP

A pre-meeting field trip will visit Miocene, Pliocene, and Pleistocene vertebrate localities, Sunday, Nov. 15, 8 a.m. to 3 p.m., followed by cocktails and buffet at the Coleman J. Goin residence, 626 NW 36th Avenue. Those planning to participate are requested to send advance reservations to Pierce Brodkorb, Dept. of Biology.

TRANSPORTATION

The connecting point for Gainesville is Jacksonville, Florida. EAL flight 689 leaves Jacksonville at 8:10 p.m., arrives Gainesville 8:56 p.m. We will meet this plane on Saturday and Sunday.

Atlantic Coast Line Railroad leaves Jacksonville at 10:25 a.m., arrives Gainesville 12:14 p.m. Another train, leaving Jacksonville at 10:25 p.m., should be avoided as it is often several hours late.

There are 10 buses daily (Greyhound and Trailways) from Jacksonville to Gainesville, a run of 1 hour, 40 minutes.

Car rental from the Jacksonville airport to Gainesville (80 miles) costs about $13.50, or a 3-passenger plane may be chartered for $34.

GSA MEETINGS, Nov. 19-21, MIAMI BEACH

Miami is 346 miles south of Gainesville, a 6-7 hour drive via I-75 and the Turnpike. EAL flight 689 leaves Gainesville at 9:06 p.m., arrives in Miami at 11:31 p.m. The SVP has reserved a meeting room for Saturday morning, November 21.

PROGRAM

Monday, November 16: McCarty Auditorium

9 a.m. Registration
10 a.m. Fishes (Bobb Schaeffer, chairman)
2 p.m. Amphibians and Reptiles (John H. Ostrom, chairman)
8 p.m. Smoker (place to be announced)

Tuesday, November 17: McCarty Auditorium

9 a.m. Amphibians and Reptiles (Everett C. Olson, chairman)
2 p.m. Business Meeting
Amphibians and Reptiles (Peter P. Vaughn, chairman)
6 p.m. Cocktails (place to be announced)
8 p.m. Annual Dinner (place to be announced)

Wednesday, November 18: McCarty Auditorium

9 a.m. Birds and Mammals (Don Savage, chairman)
2 p.m. Mammals and Tertiary Stratigraphy (John A. Wilson, chairman)

HOTELS

Gainesville has many motels, but reservations should be made in advance. Most are located on US 441 (13th St.), the closest being University Inn and Holiday Inn, 1 mile south of McCarty Hall, Manor Motel, 2.2 miles north, and Travelodge, 1.5 miles northeast.

University Inn	1900 SW 13th St.	$7.50-8.00;	$9.50-12.50 double
Holiday Inn	1901 SW 13th St.	7.50-8.00;	9.50-14.50
Bambi Motel	2119 SW 13th St.	6.00-7.00;	8.00-9.00
Casa Loma Lodge	2120 SW 13th St.	6.00-8.00;	7.50-9.00
Francisco Motel	2307 SW 13th St.	6.00;	7.00-8.00
Tom Sawyer Inn	3335 SW 13th St.	6.00;	7.00-8.00
Motel Tabor	4041 SW 13th St.	6.00-7.00;	7.00-8.00
Gator Court	4170 SW 13th St.	6.00;	7.00-8.00
Manor Motel	2325 NW 13th St.	$6.00-8.00;	$8.00-10.00 double
Howard Johnson's	2820 NW 13th St.	8.00-10.00;	10.00-13.00
Hil-Top Court	3103 NW 13th St.	5.00-6.00;	6.00-8.00
Richland Heights Court	4155 NW 13th St.	6.00;	7.00-8.00
Travelodge Motel*	413 W. Univ. Ave.	$7.00-9.00;	$9.00-12.00 double
Thomas Hotel	615 NE 2nd Ave.	$5.50;	9.00

*Across street from Florida State Museum

Figure 4. Announcement of the 1964 SVP annual meeting in Society of Vertebrate Paleontology News Bulletin (Anonymous, 1964).

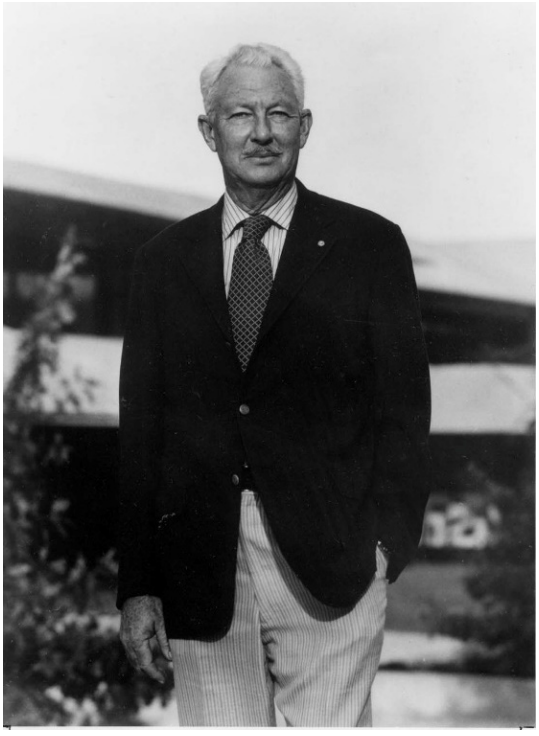

Figure 5. Dr. J. C. Dickinson, Jr. in the courtyard of the new FSM building in the 1970s that was renamed Dickinson Hall in 1983. He was director of the museum from 1961 to 1979 (FLMNH photo archives).

would have their own Graduate School faculty status, which allows them to supervise graduate students, and have non-salaried affiliate or joint appointments in the teaching departments. To this day, tenure and promotion are considered within the museum.

Dickinson was a formal and imposing leader. He had strong opinions and ran the museum with a top-down style perhaps stemming from his time as an officer in the U.S. Coast Guard (Anonymous, 2009). He did, however, in his own way have a benevolent and encouraging style if he thought you were a hard worker and doing good things that advanced the museum. On the other hand, he did not suffer fools at all. Because of the museum faculty's relatively light teaching load, he had much higher expectations for scholarly performance relative to faculty in teaching departments. He also expected in place of teaching that the museum faculty would develop their respective collections. Dickinson was from a family of means and had a philanthropic inclination towards several programs at the FLMNH. In honor of his first wife, "Miss Lucy," J. C. endowed the Lucy Dickinson Fellowship in Vertebrate Paleontology intended to be used as a recruiting tool to attract the best and brightest graduate students. In the long-term view, J.C.'s combined vision and leadership served the museum in general and has also greatly benefitted VP in particular. As will also be discussed below, he was instrumental in the move from the Seagle Building to the new FSM building in the early 1970s.

BUDGETS, EXTERNAL FUNDING, AND ENDOWMENTS

Over the past 60 years the Museum has been very supportive of the VP program, even during challenging financial times. During this interval UF support has grown initially from about 0.5 FTE (full-time equivalent) to 5 FTEs (2 curators, 3 staff). We also are fortunate to have had good quality space, although with the continuous expansion of the program, most notably the research collections, space continues to be the major challenge as is also the case for the other actively growing collections initially planned within a building a half century ago. However, the operating support provided by our department has been relatively flat, and there is an expectation that curators will generate external funding for their projects. We have therefore relied heavily on external support, primarily from the National Science Foundation. So far as our records indicate in the early years, Auffenberg was the first to receive National Science Foundation (NSF) support for work in Jamaica (Grobman, 1959), followed by Ray who along with then-graduate student Elizabeth Wing received funds for zooarchaeological investigations, which likely was the beginning of that discipline as it is now known. Over the past 60 years the VP program has received about 100 grants from NSF totaling more than $15 million in research, collections, and education support. Several large NSF grants during this period have had a major and lasting impact not just on VP, but on the museum in general. These include the new building proposal that was funded in 1966, about a dozen collections improvement grants for VP starting in the 1970s, and the recently completed Panama PIRE (Partnerships in International Research and Education, https://www.flmnh.ufl.edu/index.php/panama-pire/home/). Although not directly funding VP, recent large projects such as iDigBio (Page et al., 2015) are transforming collections through digitization.

We also have been fortunate to generate funds from other sources in support of our activities and programs. In the 1990s Webb had several Special Category grants from the Florida Department of State to support his field and research activities on the Aucilla River Prehistory Project (ARPP; Webb, 2006). Over the years we have also had numerous projects funded by the National Geographic Society, including field work in Florida and Bolivia. The VP program has several endowments, including the Dickinson Fellowship for graduate students and collections support provided by the Toomey family.

PEOPLE

VP Curatorial Faculty

As mentioned above, the first faculty curator of VP at the FSM was Walter Auffenberg (Fig. 2) during the late 1950s, who then left in 1959. Auffenberg was followed Clayton Ray, who arrived

Figure 6. Dave Webb holding a mastodon tusk collected from the Aucilla River, Taylor County, Florida (Eugene Rowe photo).

in 1959 and departed for the Smithsonian in 1963, where he spent the remainder of his career in the National Museum of Natural History (Smithsonian) on the curatorial staff of what was to become the Department of Paleobiology. After Ray's departure two faculty curators were hired in VP, i.e., S. David Webb from the University of California, Berkeley, in 1964, and Thomas H. Patton from University of Texas who arrived as a biology instructor and then was added to the FSM in 1965 (Dickinson, 1965). Patton had done his research on early Miocene artiodactyls from the Gulf Coastal Plain of Texas (Patton, 1969a) and Webb on the "Pliocene" (now considered to be middle and late Miocene) faunas from northern Nebraska (Webb, 1969). Perhaps not surprisingly given their PhD projects, after their arrival at the FSM, Patton tended to specialize on the earlier part of the record, i.e., Miocene and the

lone late Oligocene I-75 fossil mammal site known from Florida (Patton, 1969b), whereas Webb (Fig. 6) concentrated on the Pliocene and Pleistocene. Patton left the museum in 1977 and Webb retired in 2003. Webb's lasting legacy on many fronts spanning five decades had a profound impact on the VP program, as is ably chronicled in Ray (2005) and also discussed elsewhere in this article.

Upon the departure of Patton for UF's law school, I was hired in 1977, having received my PhD in vertebrate paleontology (Geological Sciences) at Columbia University and then serving as an instructor in Yale's geology department. In 2004 Jonathan Bloch, with his geology PhD from the University of Michigan (Geological Sciences), joined us as a faculty curator in vertebrate paleontology.

Affiliated Faculty

Although they were hired into other faculty curator positions at the museum, two other museum faculty curators have had a major impact on the VP Program, as were three other faculty in the UF biology department.

Robert S. Bader.—Bader was on the UF faculty as a biology professor in the mid 1950s. Grobman (1955) credits Bader for reviving the dormant VP collection program at the FSM and indeed our catalogs indicate that the early entry of specimens was done either by Bader, or under his supervision. Bader published a few relevant papers on Thomas Farm horses (Bader, 1956) and Pleistocene mammals from Alachua County (Bader, 1957). His contributions to Florida VP were regretfully short; he left for the University of Illinois in 1956.

Walter Auffenberg.—As mentioned above, Auffenberg (Fig. 2) had a major impact on the VP program, particularly with his early association during the formative decade and as our first curator in charge of VP (Grobman, 1958). Although for most of his career at the museum (i.e., after he returned in 1963) Auffenberg was not officially a VP curator (his assigned responsibility was Herpetology) he mentored UF graduate students who studied fossils, including Jesse Robertson (*Bison*), Dale Jackson (turtles), and Peter Meylan (reptiles, including turtles).

About Auffenberg, Ray (2005, p. 157) reflects that: "His productivity and infectious enthusiasm in the field, laboratory, and conversation are unforgettable to all with the good fortune of his acquaintance." A Florida native and world-class scientist, he also was the first home-grown student to receive his PhD on Florida fossils (Auffenberg, 1956; published version Auffenberg, 1963). My own personal reflections are that Walter was very charismatic, full of ideas, and he gave a captivating banquet talk on Komodo Dragons at the 1980 Annual SVP meeting held in Gainesville.

David Steadman.—Steadman was a UF graduate student who received his M.S. degree with Brodkorb and then returned as a faculty curator in Ornithology in 1995. He has been actively involved in VP-related field work, including Thomas Farm and Montbrook. Steadman has trained five graduate students through the Zoology (Biology) department that have used parts of our collections for their research, in particular, the Brodkorb collections.

In addition, two other faculty members in the Biology (Zoology) department have contributed to the VP program. Paleo-ornithologist Pierce Brodkorb (Fig. 3) worked independently from the museum (he apparently did not get along in the early days with his former PhD student Dickinson). Pierce, who was an irreverent, outspoken sort, had a major impact both in terms of his own publications as well as the dozen graduate students that he trained who worked with fossil vertebrates (Campbell, 1992). His comparative research collections, which were developed independently from the museum, ultimately became part of the FLMNH in 1992 (Bloch et al., 2011) and constitute a world-renowned resource for fossil and recent bird comparative osteology. Ronald G. Wolff was likewise a professor in the Zoology department and specialized in taphonomy. He participated in some field work, e.g., in Bolivia in the late 1970s and 1980s and mentored PhD graduate student Ann Pratt. He was also a dedicated and popular teacher of the comparative vertebrate anatomy course that for decades served cohorts of premedical students at UF. To this end he wrote the textbook *Functional*

Chordate Anatomy (Wolff, 1991).

VP Collections Staff

There have been many grant and state supported staff and student assistants that have worked in VP over the years. The first record of support staff in VP was Robert Allen, who otherwise started as an amateur fossil collector from northern Florida (Ray, 2005) and Jesse Robertson, who was a graduate student (Dickinson, 1964). Starting in 1962, Allen was funded on a NSF grant to help prepare specimens (Dickinson, 1963). So far as records indicate, the first full-time collections support staff dedicated to VP during this period was Chandra Aulsbrook, who left the FLMNH in 1977 (the year that I arrived). Since that time VP collections managers have included Arlene Kauffman (1978–1979), Diderot Gicca (1979–1982), Gary Morgan (1981–1994; Fig. 7), Marc Frank (1995–1999), and currently Richard Hulbert (2000–present). Arthur Poyer started in the collections in 1985 in a grant-funded position that was then converted to a state line. He has been responsible for many aspects within VP, including field logistics and microfaunal processing. Concurrent with the collections staff, the VP program has had a separate preparation laboratory staff, including Howard Converse (1971–1987), Russell McCarty (1981–2006), Jane Mason (2007–2009) and currently Jason Bourque (2009–present). This solid level of support staff relative to other peer collections in the U.S. is both a testimony to the investment that was placed in it during this time period, but also has allowed the collections-based program to flourish. Over the years some of these staff members, in particular, Morgan, Hulbert, and Bourque, have conducted VP-related research

Figure 7. Gary Morgan and former UF Zoology graduate student Ann Pratt collecting fossil vertebrates at the early Pleistocene Leisey Shell Pit, Hillsborough County, Florida, 1984 (Richard Hulbert photo).

and, in so doing, added value, productivity, and increased visibility to the program.

Graduate students

Graduate students have been an integral part of our program since its inception during the formative decade. During the past 60 years the VP program (broadly interpreted to include all relevant faculty advisors and their students) has graduated (or currently in progress) a total of 80 students with 40 PhD and 46 Masters degrees (Supplementary Document 1). The biology department awarded the majority of these degrees, with 29 PhDs. The geology department did not have a PhD program until 1985 (Duncan, 2016) and has since awarded four of these degrees to our students (one more is currently in progress). Although a minor component, other departments awarding graduate degrees to our students include Anthropology, Interdisciplinary Ecology, Museum Studies, Veterinary Medicine, and Wildlife. Largely following the strengths and emphasis of our collections and programmatic mission, the graduate students have primarily focused their studies on the Cenozoic of Florida and circum-Caribbean region. Outcomes of our graduate program have been largely successful. Masters students interested in pursuing PhDs elsewhere have gone on to other prominent programs (e.g., Arizona, Berkeley, and Columbia) and the majority of students graduating with a PhD from our program have developed careers in higher education and/or museums. Our graduates have done relatively well in an economic climate in which it is increasingly difficult to gain employment and develop a career in the field in which they were trained. According to the NSF (2014), 50% of science and engineering PhDs do not stay in their chosen discipline.

Student interns and volunteers

It is somewhat disingenuous to lump students and volunteers into a single category. Nevertheless, the contributions of these people likewise need to be recognized because during this interval hundreds of students other than graduate, i.e., undergraduates and from local high schools, have worked or volunteered in our collections and many have gone on to further education inspired by VP. Likewise, our program has benefitted from a steady stream of volunteers over the years. The volunteers have primarily assisted in the field, preparation laboratory, or collections, although for years we also had dedicated volunteers in the Simpson Library. Bloch et al. (2011) reported that in the preceding year volunteers contributed about 2,500 hours in vertebrate paleontology, and in so doing, represented the equivalent of 1.25 FTE. Many of our dedicated volunteers have been retirees and worked alongside students and staff, sometimes for decades. During intensive excavation campaigns in the field we sometimes have had hundreds of volunteers collecting fossils with us. For example, during the past two years over 350 volunteers have helped with the excavations at the late Miocene Montbrook site near Williston.

Postdocs and scientists on sabbatical

During this period numerous postdocs from other institutions and visiting scientists have spent extended periods of time working in our collections. In 1963–1964 the prominent Finnish vertebrate paleontologist Björn Kurtén was in residence as a NSF Visiting Foreign Scientist (Dickinson, 1964). He studied Florida fossils that produced several important publications (e.g., Kurtén, 1965; 1966). In 1980 to 1981 Annalisa Berta spent two years as a FSM postdoctoral fellow continuing her work on carnivore systematics from South America, new studies from Florida, and she also participated in field work in Bolivia. Elise Renders from the Netherlands studied *Hipparion* footprints from Laetoli, Tanzania (Renders, 1984). In the 1990s Bob Hunt spent his sabbatical in VP working on Miocene mammals and Barry Albright was a postdoc (1997 to 1999) jointly funded with a National Park Service Challenge Grant when he studied the magnetostratigraphy of the Oligocene-Miocene John Day sequence in Oregon that ultimately led to Albright et al. (2008). Pennilyn Higgins was a postdoc from 2000 to 2004 and was instrumental in developing many stable isotope projects (e.g., Higgins and MacFadden, 2004). In 2015 to 2016 Leonardo Avilla and Dimila Mothé used the FLMNH as their home base as they studied Neogene horses and gomphotheres,

respectively. Bloch sponsored Ross Secord (2007 to 2008) which resulted in a high-profile, and now highly cited, article published in Science (Secord et al., 2012) on stable isotopes and horse evolution across the Paleocene-Eocene Thermal Maximum. Likewise, Bloch sponsored Mary Silcox, who spent a sabbatical year here in 2008, and who also has been a regular visitor to VP at other times (e.g., Silcox et al., 2009). Bloch currently sponsors Lauren Gonzales as a postdoc working on 3-D imaging of Eocene notharctines from the Bridger Basin of Wyoming to better understand early primate evolution.

The Panama project supported several postdocs, including Aaron Wood (2011-2014), Jorge Vélez-Juarbe (2013-2014), Nathan Jud (2014-2016), and Cristina Robins (2014-2016). Notable publications from this group as these relate to Panama include descriptions of new fossil terrestrial vertebrates (Wood and Ridgwell, 2015), marine vertebrates (Vélez-Juarbe et al., 2015), and plants (e.g., Jud et al., 2016).

While their duration with us is relatively short, these scholars have enriched and made significant contributions to our program and, as a result, we have gained more visibility as a center for VP research.

VP COLLECTION GROWTH AND INFRASTRUCTURE

Collections

Dickinson recalled to me that during the formative decade (1956 to 1965), the entire vertebrate paleontology collection when it got started consisted mostly of Pleistocene and Thomas Farm fossils that were housed in a few specimen cabinets. After a period of dormancy, UF biology professor Robert Bader began to catalog fossils into the VP collection starting in 1955 (Grobman, 1955). Indeed, from its modest beginnings in the mid 1950's, the number of catalogued specimens approached 10,000 by 1964 (Fig. 8).

In 1972, a report was produced entitled "Fossil Vertebrates in the United States" (Langston et al., 1972) that included collections-related data from the FSM. Relative to the formative decade, the FSM VP collections had experienced steady growth, i.e., with 90,000 total specimens reported in table III (Langston et al., 1972, page 112), which represented about 22,000 catalog numbers (VP Catalog V, on file in the VP division). In the most recent compilation (Bloch et al., 2011), our collections had the following characteristics as documented in Table 1: our obvious strengths are Cenozoic of the southeastern U.S., and in particular, Florida, which accounts for about 80% of our catalogued holdings. Other sizeable components of our collections have resulted from periodic field work in Bolivia, Panama, Nebraska, Wyoming, and the Quaternary of the Caribbean Islands.

This collection has been amassed since the mid 1950's primarily from the dedicated field work of the VP people and generous donations from interested and supportive amateur paleontologists. As of 2016 and thanks to recent NSF collections support, e.g., the integration of the John Waldrop collection of about ~50,000 specimens/lots, the size of our collection now stands at more than 450 K specimens/lots (Fig. 8).

In 1976 the FSM integrated the FGS (Florida Geological Survey) vertebrate paleontology collection, which added about 10,000 catalogued specimen numbers. Starting in about 1980, as demonstrated in Figure 8, the FSM collection has experienced a significantly greater increase in the annual rate of growth. The primary factor influencing this increase is the influx of six NSF collections improvement grants and other NSF research grants that had large collecting agendas. Other notable additions to the collections include the donation of the Brodkorb fossil collection in 1992 consisting of about 8,500 catalogued specimens and 42 holotypes, and the Waldrop collection (Bloch et al., 2011).

Simpson Library

As the VP collection began to develop, so did a small library consisting mostly of reprints, reports, books, incomplete runs of journals, and dissertations and theses. This resource, in addition to sizeable personal libraries of the curators and the holdings of the main UF libraries, resulted in a solid resource for research. In 1985 the donation of the George Gaylord Simpson Library of Paleontology,

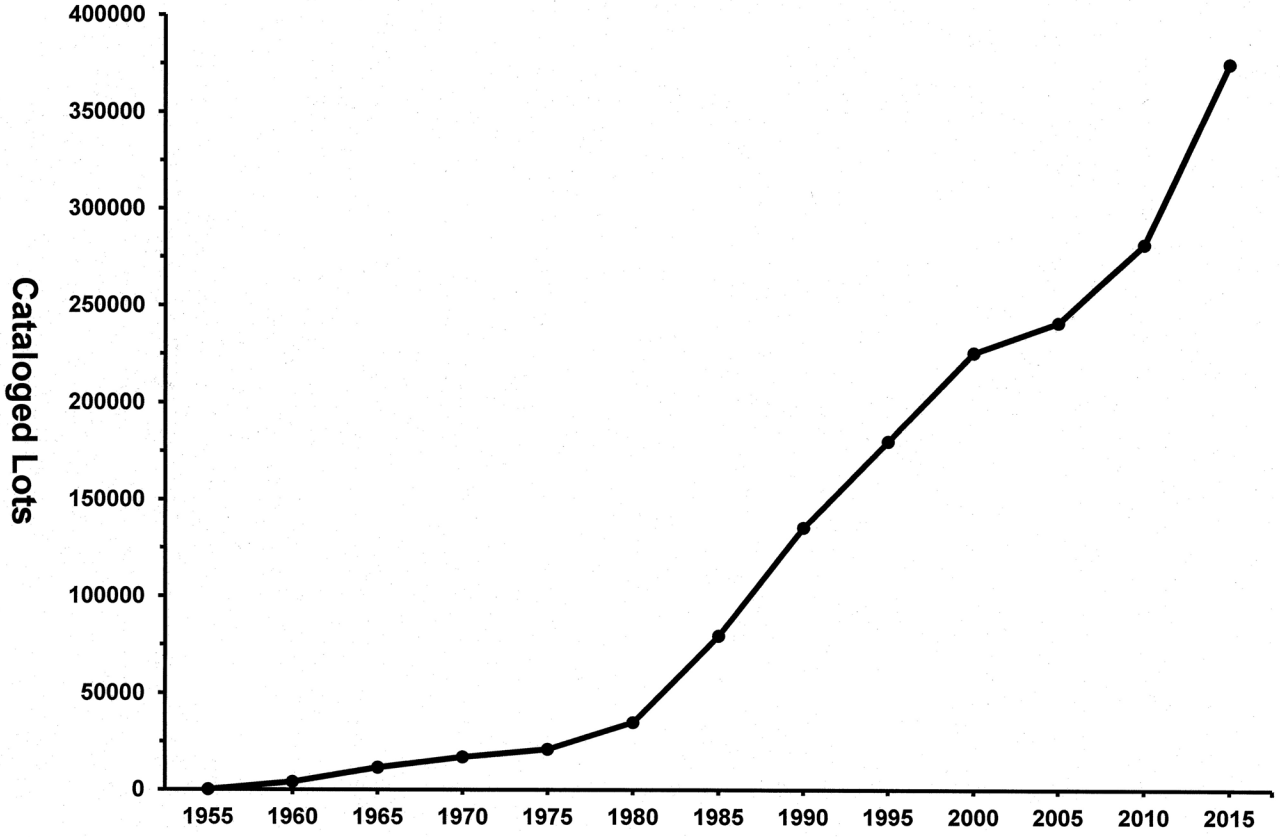

Figure 8. Growth of the FSM/FLMNH Vertebrate Paleontology collection plotted as total number of cataloged specimens (or lots) by year. Modified and updated from Bloch et al. (2011).

Table 1. Assigned specimen catalog numbers in the FLMNH vertebrate paleontology collection (combined UF, UF/FGS, UF/PB, UF/IGM, and UF/TRO collections) as of February 20, 2017. Numbers do not include casts of specimens in other museums or private collections.

Taxonomic Diversity		**Areas of Geographic/Geologic Concentration**		**Chronologic Distribution of Specimens**	
Osteichthyes	19,699	Paleogene of WY, UT, MT	19,302	pre-Cenozoic	167
Chondrichthyes	40,719	White River Group of NE, SD, WY, CO	3,818	Paleocene	806
Amphibia	6,563	Cenozoic Mexico and Central America	8,353	Eocene	21,098
Reptilia	52,684	Cenozoic Bolivia	2,897	Oligocene	10,197
Aves	32,198	Cenozoic Caribbean Islands	28,260	Miocene	114,911
Mammalia	228,676	Cenozoic Southeastern United States	318,349	Pliocene	51,719
Other	3,425			Quaternary	185,146

consisting of about 2,000 books, runs of 50 technical journals, about 50,000 reprints, and a small endowment to maintain this library, greatly increased relevant literature for research. With the advent of digital resources over the past decade, the utility of physical libraries has decreased in demand. The Simpson library, however, does have important and unique resources such as reprints published in South American journals that have yet to be digitized and some books and monographs not duplicated in the UF library system.

In summary, over the past 60 years since its inception as a formal collection (i.e., when catalog entries began), VP has grown to almost 400 K catalog numbers, with an estimated number of uncatalogued specimens that would yield a total size of the collection of about 750 K. In terms of overall size, the number of catalogued specimens places the FLMNH within the top five vertebrate paleontology research collections along with the AMNH, LACM, Field Museum, and Smithsonian.

The FSM invested early in computerization of museum specimen catalogs. In the 1980s natural history collections at the FSM, including VP, were cataloged using SELGEM, which then gave way to a custom Access-based catalog. In 2016 the VP collections were transferred to the Specify6 collections management database, and our collections are now aggregated within iDigBio (Page et al., 2015).

Physical infrastructure

From modest beginnings as part of dispersed natural history collections on the UF campus, VP transitioned from a "temporary" wooden building on stilts with no running water to the Seagle Building in the early 1960s and was housed in the basement (Dickinson, 1965; Ray, 2005). In these new digs VP shared space with other museum collections, e.g., Herpetology. Dickinson had a vision that the FSM needed a new building, and one that would be located on the main UF campus. He led the development of a grant proposal to NSF for a new 91,854 square foot building that was submitted in 1965. The total budget request for this "bricks and mortar" project, the likes of which are no longer funded by NSF, was $2,112,642 that included a $1,000,000 match from State and private sources and $1,112,642 requested from NSF (Dickinson, 1965). The original vision for the building was a rectangular, somewhat uninspiring design (Fig. 9) that ultimately gave way to the current building designed by architect William Morgan AIA. This NSF request was awarded in 1966 (Dickinson, 1966) and J.C. was also instrumental in amassing the other matching funds that were committed in the original proposal. Ground was broken for the new ~100,000 square foot building in 1969 and its dedication was held in 1971. This design, which ended up very different from Figure 9, was viewed at the time as being innovative and received national recognition (Anonymous, 1971). It took many years to finish the exhibits once the building was completed and the Grand Opening was held in the Fall of 1977.

Starting in 1971, the VP program and collection was moved to the new building, which is now called Dickinson Hall (as of 1983). For the time it was both ample and an enviable space consisting of about 9,000 square feet, including 5,000 square feet of collections storage, and the remainder devoted to a preparation labs, office and laboratory spaces, and, what was innovative for the time, an indoor screenwashing facility. In 1985 we added the Simpson Library that occupies 600 sq. ft. of adjacent space (Bloch et al., 2011). Notwithstanding the original concrete roofing slabs that demonstrated mass wasting as retaining bolts rusted and then failed, and some leaks during major rainfalls, Dickinson Hall has served the VP program well during the past half century. Nevertheless, given sustained collection growth, over the past decade we have had to resort to off-campus storage for low-use collections, over-sized specimens, and the steady influx of field collections before they are processed and curated at Dickinson Hall.

RESEARCH ACCOMPLISHMENTS AND IDENTITY

Since its inception about 60 years ago, the VP program has produced almost 500 publications in the peer-reviewed literature, as documented by the University of Florida Contributions to Paleobiology (on e-file in the VP division), and nearer 800 if

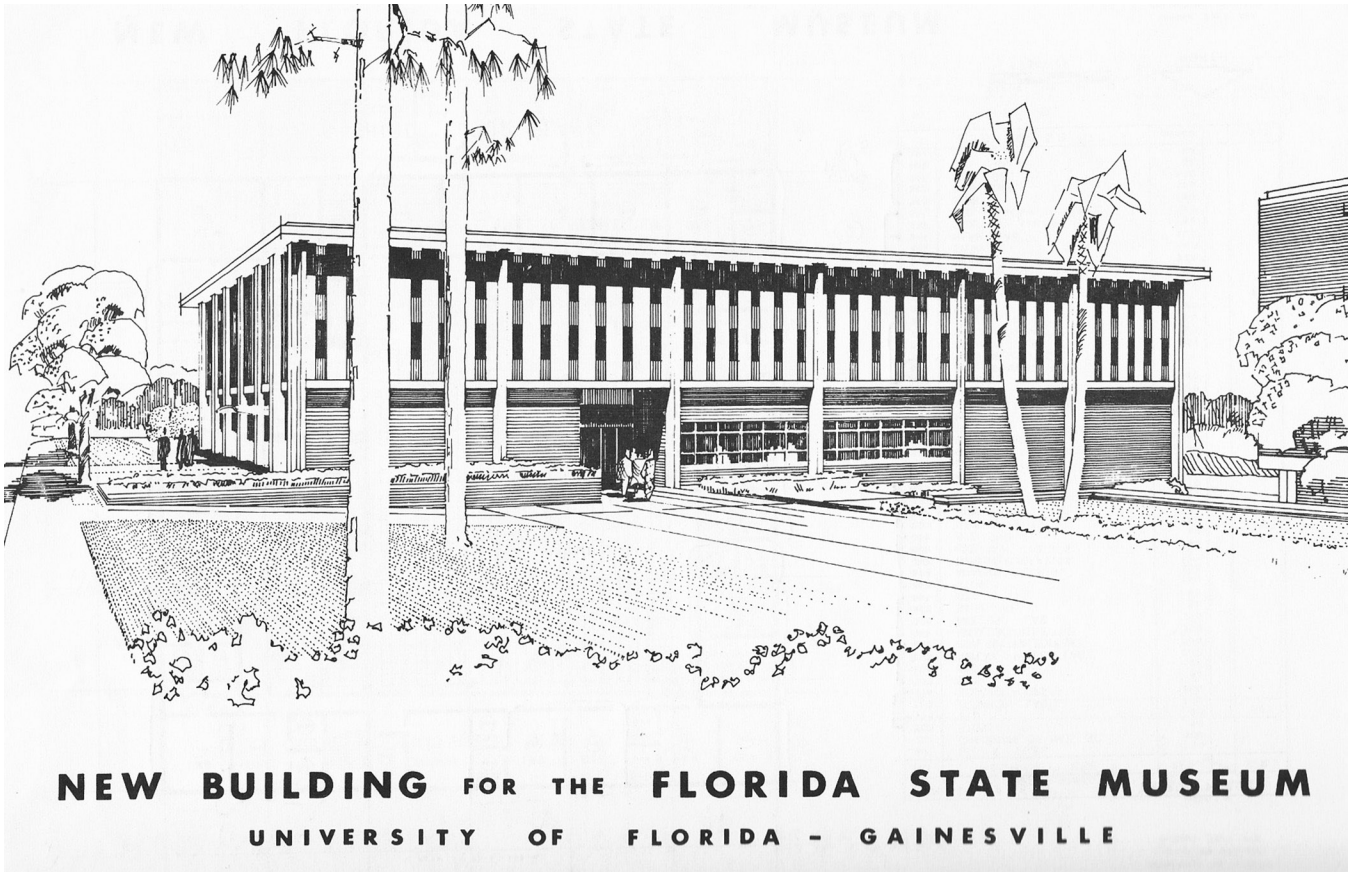

Figure 9. Original concept for the Florida State Museum to be built on the present site of Dickinson Hall (Dickinson, 1965).

publications by other researchers (not affiliated with UF and not logged into our Contributions) are also included. The overall theme of our research has been Cenozoic vertebrates from Florida and the circum-Caribbean region, although there are important contributions made from other regions, e.g., Wyoming, Panama, Colombia, and Bolivia. It is thus difficult to parse out this massive amount of scholarship, but several examples are presented here. Some of these categories are not mutually exclusive, but do form thematic units. Hulbert (2001) also provides an excellent synthesis in his book *The Fossil Vertebrates of Florida*.

Taxonomic and phylogenetic clade studies, primarily from Florida

Auffenberg (1956) produced the first "home-grown" PhD dissertation, which was a masterful study of fossil snakes of Florida ranging from the early Miocene Thomas Farm to the late Pleistocene. During the same year, Bader (1956) published a comparative study of horses from Thomas Farm. These started what has become a long tradition of taxonomic and clade-based phylogenetic and evolutionary studies that has been a dominant theme in our program. For much of the past 60 years about 15 theses and dissertations and many referred publications have been devoted to studies of fossil birds starting with Brodkorb, Steadman, and their students. Perhaps among the most surprising avian occurrences in Florida was the large flightless bird, *Titanis* (Brodkorb, 1963; also see comments on its discovery by Ray, 2005) and the Pleistocene condor, *Gymnogyps* (Emslie, 1988). Numerous taxonomic studies have also involved turtles (e.g., Auffenberg, 1966; Bourque, 2013; 2015a; 2016; Jackson, 1975; Meylan, 1995) and crocodylians

(Auffenberg, 1954; Snyder, 2001). Bhullar and Smith (2008) describe the amazing occurrence of a Gila Monster from Thomas Farm.

There have been numerous studies on fossil mammals, with examples (there are many more) of those primarily focused on Florida including xenarthrans (Edmund,1987; Cartelle and De Iuliis, 1995; McDonald, 1995; 2005), chiropterans (Morgan, 1985; 1991), rodents (Ahern and Lance, 1980; Wilkins, 1984; Ruez, 2001; Hulbert et al., 2014) carnivores (Kurtén, 1965; 1966; Webb, 1968; Frailey, 1974; Baskin, 1982; 1985; Berta and Morgan, 1985; Berta, 1981; Berta, 1987; Baskin, 2005), artiodactyls (Robertson, 1974; Webb, 1973; 1981; 1983; MacFadden and Morgan, 2003; Meachen, 2005), proboscideans (Lambert, 1994; Webb and Dudley, 1995), sirenians (Domning, 1988; 1989a; 1989b; Vélez-Juarbe and Domning, 2014), and perissodactyls (horses: MacFadden and Waldrop, 1980; MacFadden, 1986; Webb and Hulbert, 1986; Hulbert, 1988a, 1988b; rhinos: Wood, 1964; and tapirs: Hulbert, 2005; 2010).

Pleistocene of Florida

The rivers, sinkholes, beaches, and shell pits of Florida are an excellent source of Pleistocene vertebrates. During the 1950s there was an all-hands approach where even the museum Director Grobman reported that he had collected Pleistocene mammals from Florida (Grobman, 1955). Realizing the importance of Florida's waterways for potential research discoveries, at that time the UF administration allocated funds to buy the necessary equipment (Grobman, 1955). Likewise, Ray greatly benefitted from the discoveries of local divers Robert Allen and Ben Waller, who made important collections from the Santa Fe River (Ray, 2005). After Webb's arrival, he continued this theme and subsequently developed an almost unique aspect to our program, i.e., the use of SCUBA to develop projects in underwater paleontology (Webb, 1976b; Latvis and Quitmyer, 2006). The worked mammoth bone collected by Ben Waller from the Santa Fe River further exemplifies this line of research as well as the collaboration between FSM scientists and the local collectors (Bullen et al., 1970). Many of the underwater paleontology projects have concentrated on the exceedingly rich record of Pleistocene vertebrate fossils in our state.

About half of our collections, numbering about a quarter million specimens (Table 1), from 870 individual localities, are Pleistocene in age. Given these parameters and the hundreds of papers and about half of our UF dissertations and theses produced in VP that deal with the Florida Pleistocene, vertebrate fossils from this epoch are a core feature of our research identity. The majority of these studies represent locality-based descriptions or taxonomic studies, including the many avifaunal studies of Brodkorb and his students, as well as *Megalonyx,* camels, carnivores, just to name a few. Some studies have investigated paleoecology, e.g., looking at niche partitioning of grazers (Feranec and MacFadden, 2000) and others have compared migration patterns of mastodons and mammoths in the Pleistocene of Florida (Koch et al., 1998). Webb (1974) edited a seminal volume of contributed papers entitled *Pleistocene Mammals of Florida*.

The Florida record has also been investigated as it pertains to the latest Pleistocene, including investigations of megafaunal extinctions and human interactions. Webb, Jim Dunbar from Tallahassee, and colleagues and students (e.g., Andy Hemmings) spent more than a decade collecting latest Pleistocene mammals and human artifacts from the Aucilla River in northcentral Florida and a synthetic book was published on this topic (Webb, 2006). As discussed elsewhere in this paper, the Vero Man and Devil's Den sites have yielded important latest Pleistocene vertebrates that are of relevance to an understanding of the peopling of Florida (also see Purdy, 2008).

Great American Biotic Interchange (GABI)

Given the wealth of Pleistocene localities and faunas, Florida has been a central focus for an understanding of the Great American Biotic Interchange in the southeastern U.S. The discovery of South American immigrant sloths in the late Miocene of Florida (e.g., Hirschfeld and Webb, 1968) added complexity to the traditional notion of a single floodgate opening in the Pleistocene. (Sloths had previously been discovered from the classic late Miocene Mixson's Bone Bed, but these

were mistakenly considered to be Pleistocene, not Miocene [Hay, 1919]). As exemplified by a series of early papers, (Webb, 1976a, 1978, 1991), and one that was the cover article for *Science* (Marshall et al., 1982), Dave Webb devoted much of his career to understanding the GABI. This research represents a lasting contribution not just to his career, but the identity of our program as well (Ray, 2005). In these and later papers Webb applied modern evolutionary and ecological principles (e.g., MacArthur and Wilson's [1967] equilibrium theory) to understand the faunal dynamics of the GABI. So many other studies and papers on the GABI have been produced by researchers at the FSM/FLMNH that it would be impossible to do them all justice in the limited space here. In a modern context, Morgan (2005) gives a comprehensive and authoritative synthesis (including many pertinent references) of the GABI in Florida and its ramifications, particularly for a larger understanding of the North American fossil record. Since that time additional studies have documented early northward immigrants, e.g., *Titanis* (MacFadden et al., 2007) into Florida during the early Pleistocene, and depending upon where you draw the line for the beginning of pre-GABI events, the early Miocene northward dispersal of primates into southernmost North America, i.e., Panama (Bloch et al., 2016).

Vertebrate faunas and provinciality in Florida

A fundamental foundation of our identity is how the FLMNH VP program develops field to museum research, descriptions of faunas and, in a modern context, the understanding of extinct alpha-level biodiversity. There are over 1,000 discrete localities in our collections, and it is impossible to give them all justice here; Hulbert (2001) also provides a comprehensive analysis, including helpful charts displaying the key localities in temporal order. In this section I will, in chronological order, discuss the "top ten" Florida localities that comprise much of the collections and in so doing, define and have guided the research activities of our program over the past 60 years:

(1) I-75.—The oldest terrestrial vertebrate site in Florida is I-75, its name derived from the fact that it was collected in southwestern Gainesville during excavations for the interstate highway. Although the fauna is limited, as was the opportunity to make collections from I-75, it includes micromammals (marsupials, bats, and rodents), carnivores, horse, peccaries, oreodonts, and leptomerycid (*sensu* Hulbert, 2001). Since the initial note that announced this fauna (Patton, 1969b), little work was published until decades later with the reports of snakes (e.g., Holman and Harrison, 2001), marsupials (Hayes, 2005) and bats (Czaplewski and Morgan, 2012; Morgan and Czaplewski, 2012). The I-75 mammals indicate faunal connections with the midcontinent and is likely transitional Whitneyan--Arikareean in age (Hulbert, 2001).

(2) White Springs.—During field trips mostly led by Gary Morgan along the Suwannee River near White Springs in northern Florida, bones of sirenians were collected and subsequently described (Domning, 1989b; 1997). In addition, during times of lowered river level, i.e., typically during the drier seasons, terrestrial sediments are exposed at White Springs. These sediments are referred to the Parachucla Formation (Morgan, 1989), including a specific horizon on "oredont island," in reference to more than a half dozen cranial, dental and postcranial skeletons of *Mesoreodon floridanus* (MacFadden and Morgan, 2003). The age of the White Springs Local Fauna. (*sensu* Morgan, 1989) is late early Arikareean (Ar2, Tedford et al., 2004), and represents an interval in Florida that otherwise is poorly represented in the fossil record.

(3) Thomas Farm.—Thomas Farm (Figs. 1 and 3) was discovered in 1931 by Clarence Simpson (no relation to G. G. Simpson) and during that decade until the mid-1950s it was worked by crews from the Museum of Comparative Zoology (Harvard University) under the direction of Director Thomas Barbour, who purchased the site; it was ultimately deeded to UF. Thereafter, and largely starting with the study of fossil snakes (Auffenberg, 1956; also 1963) and horses (Bader, 1956), Thomas Farm has been a mainstay of the VP collections, research, and outreach programs. It also anchors our understanding of pre-Pleistocene terrestrial faunas in the eastern North America. Our collections have about 61,000 numbered specimens from Thomas

Farm, the largest from one of our sites. Given 80 years of research, it is estimated that more than 100 papers have been written specifically on Thomas Farm, or integrated as part of more comprehensive phylogenetic, or clade-based studies. Unlike some of our other signature sites from which fossils are no longer available, Thomas Farm is still an active site that will continue to produce interesting and even unexpected results, e.g., a diverse, mostly undescribed avifauna (e.g., Steadman, 2008) and the surprising presence of a Gila Monster (Bhullar and Smith, 2008).

(4) Love Site.—The Love Site (also called the Love Bone Bed) was discovered in 1974 about 1.5 km north of the town of Archer in western Alachua County (Manz, 2012). For a period of several years, field crews from the FSM would together spend one day per week during the academic year collecting fossils at the Love Site. This locality preserves an ancient stream channel with a rich, mostly terrestrial vertebrate fauna (Webb et al., 1981) consisting of a large collection of about 20,000 catalogued entries in the UF collection. Of latest Clarendonian age (Cl3), it has many important taxa, some of which indicate the diversity of local habitats, but for the first time in the Florida fossil record, the inferred presence of grassland ecosystems. Webb et al. (1981) identified Neotropical faunal elements at the Love site including procyonids, cricetids, and early records of llamine camels. In addition to a myriad of publications in the peer-reviewed literature, at least two dissertations describe the carnivores (Baskin, 1980) and horses (Hulbert, 1987) from the Love Site, and the latter of which at 570 pages, represents the longest dissertation to be produced by our program. The Love Site, which is now covered by a grassed-over retention pond and therefore no longer accessible, anchors our understanding of the Florida late Miocene, and because of the quality of preservation and wealth of specimens, deserves a presence on this list.

(5) McGehee Farm.—This site is also located in western Alachua County about 5 km north of Newberry. McGehee Farm was primarily worked in the early 1960s with support from the Frick Laboratories; now it is inactive and overgrown. McGehee is coeval with the historically important Mixson's Bone Bed (Leidy and Lucas, 1896) in adjacent Levy County; both of these have younger faunas than the Love Site. In contrast to the Love Site, McGehee has far fewer specimens in our collections (1710 cataloged numbers; although there is a considerable portion of this fauna (e.g., fish) that remains uncatalogued). The major taxonomic difference between Love and McGehee is the presence in the latter of South American immigrant sloths (Hirschfeld and Webb, 1968), including the biochronologically diagnostic genus *Pliometanastes*, which signals it to be early Hemphillian (Tedford et al., 2004). Although it can be argued that McGehee has other interesting occurrences (e.g., the mylagaulid rodent, Webb, 1966), the sloths are important evidence in Webb's subsequent papers concerning early pulses of GABI dispersal prior to the formation of the Panamanian land bridge in the Pliocene.

(6) Bone Valley (Palmetto Fauna).—After tourism and agriculture, historically mining of phosphate has been a significant part of Florida's economy. The immense, open-pit phosphate mines are concentrated in central Florida and from a paleontological point of view represent a sequence of fossil faunas extending from the poorly known Barstovian (e.g., Webb and Crissinger, 1983) into the late Miocene and Pliocene. The problem with these faunas, however, has been that the context of individual localities in this sequence is poorly known. Typically the localities are removed by mining so that we cannot go back and attempt to reconstruct their temporal and (bio)stratigraphic relationships. The Bone Valley had for decades been a productive collecting area for the local amateurs who found many important specimens, e.g., the last protoceratid *Kyptoceras amatorum* (Webb, 1981). Of all the faunal levels in the Bone Valley sequence, one zone in the upper Bone Valley Formation produces the Palmetto Fauna that is one of the most important latest Hemphillian (Hh4) localities in North America (Tedford et al., 2004). Unfortunately, scientific collecting has been significantly curtailed in recent decades due mostly to increasing concerns about liability on the part of

the corporations that oversee the phosphate mines.

(7) Santa Fe River.—Fossil vertebrates from the Santa Fe River have been a mainstay of our understanding of the latter part of the Neogene in Florida, largely as a result of dedicated amateur divers including Robert Allen and Ben Waller. The many individual sub-localities comprising the Santa Fe River sites were initially thought to be late Pleistocene, given the abundance of *Bison*, *Mammuthus*, *Mammut*, and *Odocoileus* (also see discussion of Rancholabrean below), and this likely led Brodkorb (1963) to his assertion that *Titanis* was a Pleistocene immigrant. In contrast, the numerous reports of Pliocene vertebrates from the Santa Fe River, e.g., Blancan *Nannippus* (MacFadden and Waldrop, 1980) plus rare earth elemental (REE) data demonstrate that *Titanis* from the Santa Fe River is from the Blancan and that this technique can be used to sort out taphonomically mixed temporal assemblages from these river sites (MacFadden et al., 2007; MacFadden and Hulbert, 2009). In contrast to some of the other "top ten" sites, the number of specimens from the Santa Fe River sites may be smaller, but the ancient biodiversity represented there is impressive as is its place in understanding the GABI (Morgan, 2005). There still are interesting research projects there, e.g., one of the largest and heretofore undescribed samples of the antilocaprid *Capromeryx*.

(8) Inglis 1A.—This fossil site was originally excavated from 1967 to 1974 from a sinkhole along the defunct Cross Florida Barge Canal in Citrus County. The ~10,000 fossil vertebrate specimens from Inglis 1A make it one of the larger collections (after, e.g., Leisey, Thomas Farm, and Love Site) recovered from a single site in our Florida collections. Dated at about 1.7 to 1.8 Ma, Inglis is known for a rich late Blancan fauna. It contains many examples of the GABI and a considerable microvertebrate assemblage, including squamate reptiles (Meylan, 1982) and birds (Emslie, 1988). Based on the taxonomic composition and relative abundances, Inglis seems to have been developed during a cooler glacial period (Hulbert, 2016).

(9) Leisey Shell Pit.—This locality south of Tampa was discovered by Frank Garcia in 1983 and worked thereafter by local amateurs and professionals (Fig. 7). Crews from the FSM worked Leisey intensively in 1984. It has produced more than 23,000 catalogued specimens in VP, making it the second largest single locality in our collections after Thomas Farm. This astoundingly rich fossil site, likely representing a coastal mangrove paleoenvironment, is early Pleistocene in age, and dated to between 1.5 to 1 Ma (Webb et al., 1989; Casebolt, 2012). Leisey documents a diverse vertebrate fauna at the height of the GABI. Given the large number of specimens, quality of preservation, and diversity, Leisey also is a cornerstone of our collection for an understanding of Irvingtonian faunas in North America. Many papers have been written on Leisey and Hulbert et al. (1995) edited a synthetic 660-page monograph consisting of 20 articles devoted to advancing knowledge about this extraordinary fossil locality. A recent PhD student, Lane Wallett, did her research (Wallett, 2015) on the incidence of the pathology laminitis in *Equus*, which afflicts modern horses often leading to euthanasia. There is a controversy about the etiology of this disease. Wallett, now a veterinary anatomy professor at Washington State University, found evidence of laminitis in fossil *Equus* from Leisey, thus, indicating the contribution of natural, and not human induced causes.

(10) Rancholabrean Fauna.—Although not a particular site or localized groups of sites like those presented above, since the early days of our program (e.g., Bader, 1957) the late Pleistocene has been of interest to understand native faunas in Florida. It therefore deserves discussion here. The Rancholabrean in Florida is represented by 67,859 catalog entries from 551 localities throughout our state; it therefore represents a central core of our collection. The individual faunas vary in size from a handful of representative specimens of the most common fossils, e.g., *Equus, Bison, Odocoileus, Mammut*, and *Mammuthus* to localities with thousands of fossils including microfauna, e.g., Reddick (Gut and Ray, 1964) and Cutler Hammock (Emslie and Morgan, 1995). The challenge with most Rancholabrean sites and fossils in Florida is the lack of temporal context and the paucity of valid radiocarbon age determinations relative to the number of fossils (few specimens preserve the

collagen needed for accurate radiocarbon dating). As mentioned in the introduction, Rancholabrean fossil vertebrates gained notoriety a century ago because of purported association with human remains at the Vero Man site in Vero Beach (Sellards, 1916; 1917) and the other important site at Devil's Den in Levy County (Martin and Webb, 1974). Given their ubiquitous distribution, Rancholabrean faunas still have potential to understand distributions and habitats leading up to the Great Megafaunal Extinctions; this would be more tractable if the dating could be improved.

Gulf Coastal Corridor and relictual taxa

In numerous publications Webb (e.g., Webb and Wilkins, 1984; also see Morgan, 2002 and Morgan and Emslie, 2010) postulated the idea of a Gulf Coastal Corridor that was an extension of the northern Neotropics and facilitated the dispersal and interchange of vertebrates within this zone as separate from the midcontinental and higher latitude faunas. This corridor functioned for most of the Neogene. During the Arikareean, Florida faunas share similarities to similar aged faunas from eastern Texas (Albright, 1998; 1999), but are different from classic sequences in Oregon and Nebraska. Recent work also demonstrates that this faunal province extended as far south as Panama, and has interesting occurrences at range extremes such as anthracotheres (Rincon et al., 2013) and amphicyonids. During the Hemingfordian, oreodonts are rare at Thomas Farm at a time when they were common elsewhere in North America (e.g., Lander, 1998). The distinct climatic regime of the southeastern U.S., including Florida, also provided a refugium for some late surviving species during the Hemphillian (Tedford et al., 2004). Examples include the burrowing rodent *Mylagaulus kinseyi* from McGehee (Webb, 1966) and the equid *Pseudhipparion simpsoni* from the upper Bone Valley Formation, the latter of which is the only equid documented in the fossil record to have had incipiently hypselodont (ever-growing) teeth (Webb and Hulbert, 1986).

Stable isotopes and other geochemical studies

In 1993–1994 MacFadden spent six months on sabbatical learning stable isotope techniques and collaborating with Thure Cerling at the University of Utah. Starting with Cenozoic horses of North America (Wang et al., 1994) and the Florida Neogene (MacFadden and Cerling, 1996), this collaboration and other subsequent research then led to a series of papers looking primarily at carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotopes to interpret ancient diets of Cenozoic mammals of the New World. These analyses were initially done by MacFadden, periodically returning to Utah, but then we transitioned to the excellent stable isotope laboratory in the geology department of UF. MacFadden's postdoc Pennilyn Higgins and about a half-dozen UF students have done research using stable isotopes that have resulted in a series of relevant papers (e.g., Feranec and MacFadden, 2000; Higgins and MacFadden, 2004; DeSantis et al., 2009; Nunez et al., 2010). Since Bloch arrived in 2004, he and his students, postdocs, and collaborators have also used stable isotopes of fossils from the VP collection that mostly document changes at the Paleocene-Eocene Thermal Maxima (PETM) as represented in Wyoming (Secord et al., 2012; Baczynski et al., 2016). Whiting et al. (2016) used stable isotopes to study the paleoecology of Florida crocodiles and alligators. All told, more than 1,000 stable isotope analyses have been made on specimens in our collections and resulted in many peer-reviewed publications. We are currently in the process of attaching these data to relevant digitized vouchered specimen records in our collections (Moran, et al., 2016).

Other geochemical and related chrono-stratigraphic methods have also been employed in VP research. Based on evidence from the Torreya Formation in the Florida panhandle, MacFadden et al. (1991) used Sr-ratio dating in conjunction with magnetostratigraphy to calibrate the base of the middle Miocene adaptive radiation of horses at 17.7 Ma. In the same vein, Jones et al. (1991) used a multiproxy approach, including Sr-ratio dating to constrain the age of the late Pliocene Macasphalt site near Sarasota. Hoppe et al. (1999) used Sr ratios preserved in fossil proboscideans to determine seasonal migration patterns of mammoths and mastodons during the Pleistocene. They found that whereas the mammoths were interpreted to be

year-round residents, the Sr ratios of mastodons indicated seasonal migrations northward into what is now Georgia.

Starting with MacFadden's PhD student Joann Labs (Labs-Hochstein and MacFadden, 2006), our program has undertaken numerus studies using REEs (rare-earth elements) to understand diageneses and as a relative dating technique in taphonomically mixed vertebrate faunas. Working with Joann and former PhD student Jon Baskin, our first paper using REEs (MacFadden et al., 2007) challenged the age of *Titanis* from Florida and Texas and demonstrated that this "terror bird" was not a late Pleistocene immigrant as first proposed by Brodkorb (1963). Many other papers have used REEs in this regard, including *Mammuthus* dispersal (MacFadden and Hulbert, 2009) and two that address the contemporaneity of humans and now extinct late Pleistocene megafauna from the Vero (MacFadden et al., 2012) and Devil's Den sites (Purdy et al., 2015).

Other themes and emerging core collections-based research

Magnetostratigraphy.—As a result of my PhD research, I brought an interest in this chronostratigraphic tool to UF. Along with colleagues in the UF geology department, we purchased a cryogenic magnetometer and demagnetizers and developed a functioning lab; this was later taken over and enhanced by Opdyke and Channel, both UF geology professors and distinguished paleomagnetists. The lack of long and continuous stratigraphic exposures in Florida and particularly recalcitrant magnetic properties limited the applicability of this technique close to home. Nevertheless, in Florida, magnetostratigraphy was used to help constrain the age of the Torreya Formation (Bryant et al., 1992) and, using fine-grained infillings of bivalves, the polarity of the Pleistocene Leisey Shell beds (MacFadden, 1995). Farther afield, a series of magnetostratigraphic studies calibrated important sections in Oregon (Albright et al., 2008), California (e.g., MacFadden et al., 1990), Nebraska (MacFadden and Hunt, 1998), Panama (MacFadden et al., 2014), Australia (Whitelaw, 1991), and numerous studies in Bolivia (e.g., Tarija, Salla).

Sharks.—Sharks, which are typically represented by their ubiquitous teeth in near-shore marine environments, represent a sizeable portion (between about 5 to 10%) of our collection, and are of great interest to the public. Tessman (1969) did his Masters thesis on the fossil sharks of Florida, but after his work there was a hiatus when little was published on sharks. This topic has resumed over the past two decades: four PhDs (Labs-Hochstein, Ehret, Pimiento, and Perez, in progress) and one Masters (Soto) projects have been done on fossil sharks over this interval, not just from Florida, but also from Panama and elsewhere (e.g., the highly-accessed papers of Pimiento et al., 2010 and Pimiento and Balk, 2015).

Paleogene of the Rocky Mountains and the PETM.—Bloch arrived as Assistant Curator in 2004 and has rapidly developed a high-profile research agenda that broadens the scope of our program and addresses dramatic climate change, i.e., the Paleocene-Eocene Thermal Maxima (PETM). In fact, the detailed stratigraphic field work laterally along strike by Bloch and his colleagues has resulted in the most detailed PETM section in the world. This field work in the Rocky Mountains, particularly in Wyoming, every summer since then has resulted in the addition of about 19,000 specimens to the collections (Table 1). A steady stream of students, and many papers, including the high-profile *Science* paper on horses at the PETM (Secord et al., 2012), as well as careful taxonomic studies (e.g., Bourque et al., 2015b; Manz and Bloch, 2015), have been important research outcomes of this work.

Panama.—For about a decade ending in 2016, field work along and adjacent to the Panama Canal was supported by NSF funding, in particular the Panama Canal Project (PCP). This has resulted in a chronologically controlled collection from numerous individual sites ranging from early Miocene (Hemingfordian) to late Miocene (probably Clarendonian) age and these are characterized by important provenience and, to the extent possible, geochronological control. More than 100 papers have resulted from the PCP and related projects in Panama, including the

high-profile papers on *Carcharocles megalodon* nurseries (Pimiento et al., 2010) and the early Miocene monkey (Bloch et al., 2016). This set of papers also includes biogeographically surprising discoveries of, for example, Holarctic mammals including anthracotheres (Rincon et al., 2013) and chalicotheres (Wood and Ridgwell, 2015).

Digitization and 3D scanning.—The FLMNH has invested in the digitization of research collections for decades since the days of SELGEM (Mello, 1975). More recently our collections, now numbering almost a half-million individuals or lots, have been upgraded to Specify and aggregated by iDigBio (Page et al., 2015). This is consistent with national trends in natural history museum collections digitization. These digitized collections are starting to be used for research, such as on the distribution of *Equus* (MacFadden and Guralnick, 2016). Along with this trend is the scanning of fossils for 3D imaging, which can elucidate anatomical structures such as early primate brains (Harrington et al., 2016), as well as the use of 3D printed *Carcharodon megalodon* teeth for K-12 education (Grant et al., 2017).

UNIVERSITY INSTRUCTION

Teaching responsibilities for museum curators have not been assigned like faculty in our affiliated teaching departments at UF. Nevertheless, it always has been an expectation that the museum faculty curators teach courses to contribute to the instructional mission of UF. In particular, this has been done at the graduate level, where the course offerings are designed to promote the discipline as well as provide appropriate professional training for the many graduate students that have come through the program. Since Clayton Ray's time, a graduate course or seminar in vertebrate paleontology has been taught on a regular basis. Webb developed an additional graduate course "Ancient Vertebrate Faunas," and for several years MacFadden taught an organized course for undergraduates and beginning graduate students on Vertebrate Paleobiology and Macroevolution. Bloch has led graduate seminars focused on vertebrate paleontology of Florida and other related themes, as well as mixed undergraduate/graduate courses on primate evolution. VP curators have also on occasion participated in undergraduate instruction, e.g., MacFadden co-taught (with Lincoln Brower) the Evolution course for biology majors and Bloch has taught a course on primate evolution. As of the 1980s, with the transfer of Jones from the UF geology department, and the early 1990s with the arrival of Dilcher and Manchester, paleontology as a discipline has been represented by invertebrates, plants, and vertebrates. Thus, in addition to vertebrate paleontology-related offerings, our graduate training has included courses in invertebrate paleontology (e.g., Jones), paleobotany (Dilcher and Manchester), and over the past several years, quantitative methods (Kowalewski). To broaden their respective training, our students have also been able to take courses in affiliated teaching departments including geology (e.g., stratigraphy, climate change, and stable isotopes), and biology (e.g., evolution and ecology themes).

MUSEUM EXHIBITS AND EDUCATIONAL OUTREACH

The FSM moved to the Seagle Building in 1939 where it occupied the basement and five other floors for collections, offices, and exhibits. A brief description (Dickinson, 1965) and photos in our archives reveal a series of natural history exhibits, mostly located on the second floor, including dioramas, specimen display cases, and wall panels. With regard to fossil vertebrates, there was a display case of a giant Miocene tortoise excavation (Fig. 10A) and comparisons with modern tortoises. Likewise, on the landing between the 1st and 2nd floors, there was a wall mural depicting Ice Age mammals accompanied by a small display case of fossils (Fig. 10B). These and the other exhibits at the FSM were fairly typical in scope, content, and quality of smaller natural history museums in the middle of the 20th century.

With the advent of the new building, the 1970s saw the development of new museum exhibits that included fossil content. Dickinson had hired Vince Gabianelli as Chairman of the Department of Interpretation from 1971 to 1991. Gabianelli

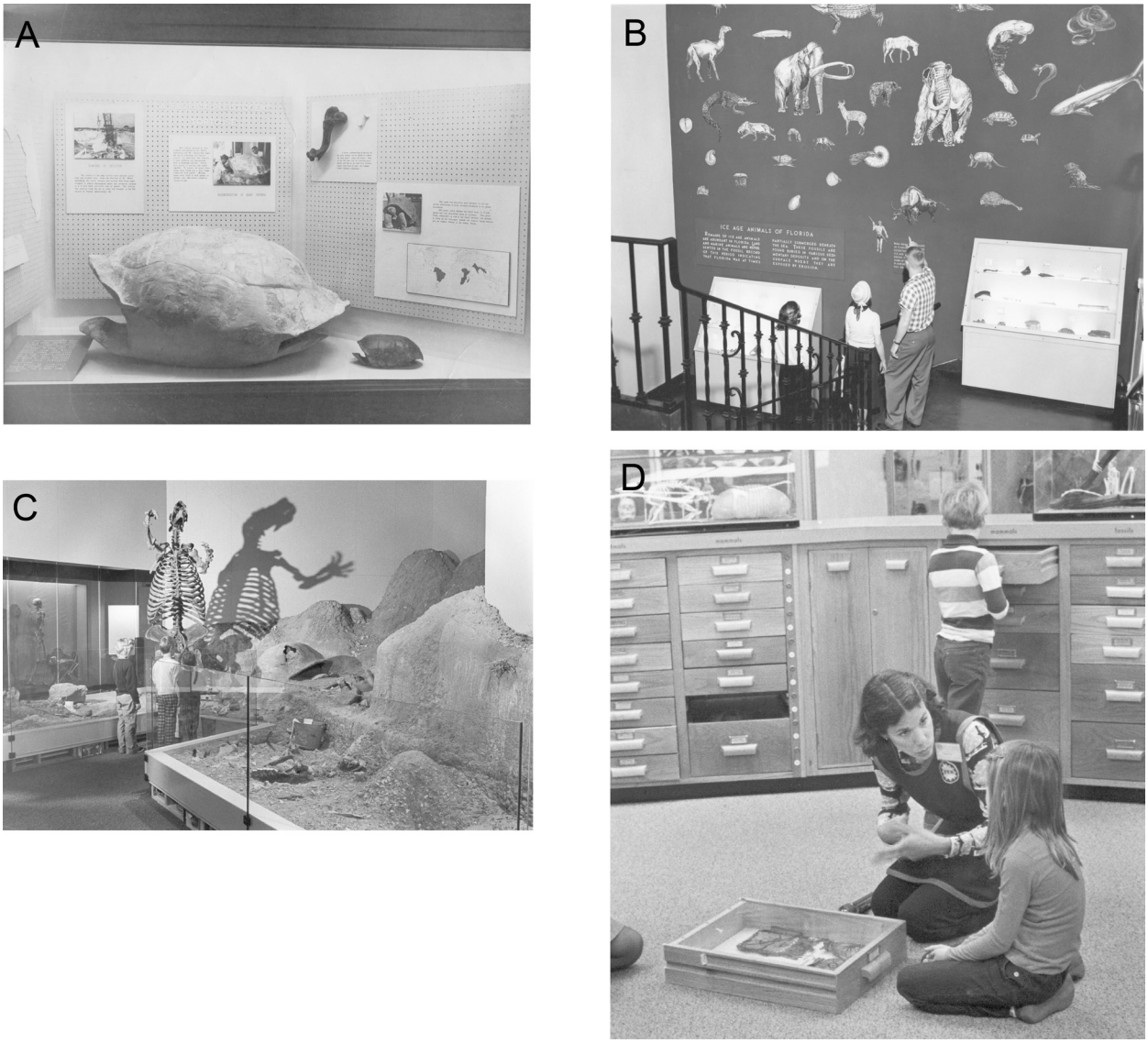

Figure 10. (A) Fossil tortoise on 2nd floor of Seagle Building (scan 08-24-15b-4). (B) Ice Age mammals mural (scan 08-27-15b-142). (C) The fossil display within the Change exhibition that opened in Dickinson Hall, October 1977 (scan 08-17-15b-3). (D) The Object Gallery with museum docent and young learners in Dickinson Hall (scan 08-14-15c-3), sometime between the 1970s and 1990s (FLMNH photo archives).

in turn oversaw a highly talented, creative, and passionate in-house exhibits design and fabrication team that produced innovative exhibits, ones that departed from the norm of thematic groupings of static specimens in cases, dioramas, and the like. The primary exhibition that focused on fossils and paleontology was "Change," which opened in 1977 and integrated biological, geological, and cultural content, and included controversial topics such as evolution. (Between the time Dickinson Hall opened in 1971 and until the first series of exhibitions were completed in 1977, visitors to the FSM, particularly those from the Gainesville area, still returned to the Seagle Building to take in the older displays; Taylor, 2016.) The Change exhibit allowed visitors to see the process of paleontology, from fossils in the field to mounted skeletons, including early immigrant sloths (Fig. 10C). In the 1970s, museum

educators were interested in public engagement with natural history specimens and inquiry based (self-directed), active learning. Another important exhibit in the new building was the Object Gallery. Here visitors could bring in their own specimens and artifacts to identify and compare with specimens from the museum's collections that were contained in a series of cabinets (Fig. 10D). Although we never did a formal evaluation of the efficacy of the Object Gallery, anecdotally from feedback from our visitors when we moved to Powell Hall in 1997, a frequent question (paraphrased) from them was: "Where are the specimen cabinets and the object gallery?" After the initial phase of exhibits development, Betty Dunckel then led the initiative to develop another active, hands-on exhibit called the Fossil Study Center. Funded by grants from the Florida Department of State, it remained open from 1991, until the exhibit in Dickinson closed to the public in 1997 (Dunckel, 2016).

The opening of the Exhibits and Education Center at Powell Hall in February 1997 represented another milestone in our museum's growth. However, when the doors opened to the public, and in a situation similar to Dickinson Hall a quarter century earlier, we had little to show because the permanent exhibits had not yet been built. On an interim basis, therefore, we developed a temporary exhibit called "Skeletons in Our Closet" (Fig. 11) that opened in 1999. Although it was done on a low budget, Skeletons did provide exhibit content, including fossils and paleontology, for our visitors (MacFadden, 2000).

As our first set of permanent exhibitions opened between 1997 and 2004, several of these have paleontology content, including Eocene fossils in the limestone walls of the cave as well as the mounted skeletons of late Pleistocene mammoth and mastodon from the Aucilla River, Florida. The ~2,000 square foot Hall of Florida Fossils: Evolution of Life and Land exhibition opened in 2004 and represents the focal point for fossils and paleontology within Powell Hall. Since at least the 1950s, the museum has developed travelling exhibits. With regard to fossils and paleontology, the most successful of these has been *Megalodon: Largest shark that ever lived* that opened in Powell Hall in 2007 and, as of the 2016, has been to 20 museums and other venues throughout the U.S. (https://www.flmnh.ufl.edu/index.php/rentmegalodon/home/). It has been seen by over two million visitors at these institutions.

In addition to our "home grown" travelling exhibits like *Megalodon*, we also collaborated with the Smithsonian and University of Nebraska to develop and host the *Titanoboa: Monster Snake* exhibit in 2013. Also of note because of great public interest in dinosaurs (which we realize never existed in Florida), we hosted the Field Museum's *A T. Rex Named Sue* exhibit in 2002 and 2015. This exhibit drew immense crowds and resulted in attendance spikes at our museum. All of these travelling exhibits capitalize on public interest in fossils and paleontology and the central importance of this discipline within the FLMNH.

In addition to exhibits, the VP program has been involved in a myriad of other public programs over the years. This includes, for example, talks at Science Cafes, fossil display tables at fairs and festivals, and other public events (e.g., "Can You Dig It," co-sponsored by the UF geology department, with 2400 visitors on 18 March 2017). The mutual benefit of involvement in exhibits and public programs has both broadened the experience

Figure 11. Logo of temporary exhibit on display at Powell Hall 1999 to 2004 (Ian Breheny design).

of VP people, but also promoted our program and Florida paleontology to a larger audience than would normally be available to us.

INTERACTIONS WITH AMATEURS AND FOSSIL CLUBS

Vertebrate fossils are found in many parts of Florida, and as such, a sizeable following of amateur paleontologists and fossil clubs has developed in the state over the past 60 years. These activities have yielded a steady stream of important specimens for research and donation to the VP collection. Therefore, a hallmark of the VP program since its inception has been relatively active and mostly cordial interactions with the local amateur paleontological community.

Although little is documented earlier about museum-amateur interactions, upon Clayton Ray's arrival in 1959 he soon realized the importance of working with knowledgeable local collectors. Ben Waller and Robert Allen were local divers of the Florida rivers who found many important specimens from the Pliocene and Pleistocene riverbeds. Clayton also collaborated with H. James Gut, an amateur fossil collector and sometimes mayor of Sanford, Florida, yielding the exceedingly rich Reddick Rancholabrean site in northern Marion County (Gut and Ray, 1964).

Following Clayton, Dave Webb understood the importance of amateur outreach almost from the time he arrived at the FSM. His early days involved scuba diving and he became friends with amateurs like Ben Waller from Ocala. In 1966 he started a series of newsletters, *The Plaster Jacket,* written about important fossils and the science of Florida paleontology geared for the statewide amateur community; publication of issues of this series continued for two decades through the mid-1980s. In 1978 Dave founded the Florida Paleontological Society (FPS) that united the professionals and many of the committed amateurs. Currently, the FPS is an active group with more than a hundred members. It continues to have an annual meeting, occasional technical publication, *Papers in Florida Paleontology*, and sponsors field trips, mostly to Florida fossil sites. It also provides annual student awards and the Howard Converse Award for contributions to Florida paleontology.

Over the past 80 years since the Depression, Thomas Farm has been an important and lasting venue for research and education. Prominent biologists at UF, such as Archie Carr and Walter Auffenberg, led or participated in collecting forays to Thomas Farm starting after WWII (Fig. 1), as did museum curators thereafter. From 1992 to 2004, Bruce MacFadden led an annual Spring Dig at Thomas Farm and published a technical newsletter, the *Pony Express,* geared toward the amateur community (MacFadden, 2004). In 2005 Steadman took over the annual spring digs at Thomas Farm with the "Hummingbird Challenge," which continued through 2016, and, although it did not result in hummingbirds, did produce published research (Steadman, 2008). These digs have involved hundreds of volunteers, amateurs, and club members, and produced thousands of fossils for the VP collection. Many other larger excavations, almost too numerous to mention here, but most notably including Leisey Shell Pit, Tyner Farm, several Haile sites, Millennium Park, and our current one at Montbrook, have involved hundreds of participants, and mostly built good will between the community and the VP program. Other examples of mutually beneficial interactions include museum people giving many talks each year to local fossil clubs and clubs sponsoring scholarships for aspiring students in paleontology.

In 2012 MacFadden and colleagues Dunckel, Ellis, and Crippen, the latter from UFs College of Education, received a NSF grant entitled FOSSIL (with the somewhat contrived but readily identifiable acronym Fostering Synergistic STEM with Informal Learners) from the lifelong learning program that seeks to unite amateur paleontologists and their fossil clubs and paleontological societies into a national learning community (MacFadden et al., 2016). As of the Fall 2016, FOSSIL had a large social media presence (almost 3,500 Facebook "Likes" and more than 1,200 Twitter Followers) and a steadily growing on-line community (www.myfossil.org) approaching 500 participants.

NATIONAL PROFESSIONAL LEADERSHIP

As mentioned above, in 1964 the FSM hosted the 24th Annual Meeting of the Society of Vertebrate Paleontology (SVP) with about 64 attendees (Figs. 3 and 4). This event elevated our program and set it on a course towards national prominence and leadership. From 1979 to 1984 the business office of SVP was located at UF in Dickinson Hall, with Susan Williams serving as the executive director. In 1980 we again hosted the SVP Annual meeting in Gainesville with about 300 attendees. With regard to SVP leadership, S. David Webb served as President from 1978 to 1979, Bruce MacFadden served as Secretary-Treasurer from 1979 to 1984 and President from 1986 to 1988, Jon Bloch served as Program Chair from 2009 to 2014, and Richard Hulbert served as Associate Editor of the *Journal of Vertebrate Paleontology* from 1998 to 2000. With regard to the Paleontological Society, MacFadden and Bloch served as editors of *Paleobiology* from 2011 to 2015 and MacFadden currently serves as President-Elect. In February 2014 the three paleontology programs (Invertebrate Paleontology, Paleobotany, and VP) at the FLMNH hosted the 10th North American Paleontological Convention to about 400 attendees. These events, leadership, and service attest to the national prominence of our program.

SUMMARY, CONCLUSIONS, AND "WHAT ARE WE KNOWN FOR?"

As described above, the Vertebrate Paleontology program at the FSM/FLMNH has experienced enormous growth over the past 60 years and has emerged as a nationally prominent leader in the field. During this time we have developed our own distinctive character, resulting in a unique identity for programs such as ours in the U.S. The core of our program is the collection of some half million specimens that in several categories rank in the top five in the U.S. It also is a collection that is still actively growing. These core strengths in turn drive all the programs built around it, including year-round active fieldwork, primarily focused in Florida, but also with other field areas over the years. The Cenozoic fossil vertebrate record of Florida is the most extensive in the eastern U.S. and documents major events including the emergence of the peninsula during the Miocene, the spread of grasslands during the late Miocene, and several pulses of the GABI since the late Miocene. This fossil record documents the Pleistocene fauna, now extinct, that is recorded from hundreds of Florida localities, as well as evidence for prehistoric peopling of the state. From modest beginnings, our collection and its related activities took a major leap forward with the advent of what were modern facilities nearly 50 years ago with the opening of Dickinson Hall in 1971.

At the core of our VP program is the people. This is exemplified with the visionary leadership of J. C. Dickinson during the second half of the formative decade. We have been blessed by a continuous series of faculty curators, staff, and about 80 graduate students, many of whom have contributed in many ways to the development and dissemination of research knowledge. Our program has hosted two SVP meetings (1964, 1980) in Gainesville, published more than 400 articles in peer-reviewed journals, several important books (most notably Hulbert, 2001), and received more than $15 million dollars in NSF grant support over the past 60 years.

Given the optimal situation of the VP program being nested within a full-service natural history museum, we have been fortunate to have been involved in exhibits and public programs. From traditional exhibits in the Seagle Building, we developed the innovative Change exhibit and Object Gallery in Dickinson Hall in the 1970s and then the Hall of Florida Fossils, which opened in 2004 in the new exhibits facility at Powell Hall. The travelling exhibit *Megalodon* highlights the work of the VP program and has been seen by two million visitors at 20 venues.

A view towards the future: Digitization and imaging

As also mentioned above, the advent of digital collections databases has revolutionized access to our VP catalogs, which can now be queried via the web. Just as Dickinson had vision for the future of the museum 60 years ago, in 2010 our current museum Director Douglas Jones encouraged a

group of curators (Page, MacFadden, and Soltis) to submit a grant to the NSF to fund the hub of the ADBC (Advancing the Digitization of Biological Collections) national collections network; we were successful with this proposal (Page et al., 2015). Thus, over the past six years the establishment of the iDigBio biocollections infrastructure hub, located at the FLMNH, has brought our museum's programs and leadership into national prominence. Although vertebrate paleontology has for a while been using locality occurrence data from the Paleobiology Database (e.g., Pimiento and Balk, 2015), the use of the vouchered specimen databases for big data research is just beginning (MacFadden and Guralnick, 2016), but shows much potential for future access. Likewise, Bloch and his students have integrated 3D visualization technology into their evolutionary studies of fossils (e.g., Harrington et al., 2016). In the same vein, Grant et al. (2017) used 3-D printed *Megalodon* teeth for K-12 lesson plans. Just as the VP collection has developed its own strengths and research identity over the past 60 years, the use of digitized and 3D collections will be part of our identity in the beginning of the 21st century.

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LITERATURE CITED

Ahearn, M. E., and J. F. Lance. 1980. A new species of *Neochoerus* (Rodentia: Hydrochoeridae) from the Blancan (late Pliocene) of North America. Proceedings of the Biological Society of Washington 93:435–442.

Albright, L.B., III. 1998. The Arikareean Land Mammal Age in Texas and Florida: southern extension of Great Plains faunas and Gulf Coastal Plain endemism. Pp. 167–183 *In* D.O. Terry, Jr., H.E. LaGarry, and R.H. Hunt, Jr., eds. Depositional environments, lithostratigraphy, and biostratigraphy of the White River and Arikaree Groups (late Eocene to early Miocene, North America). Geological Society of America Special Paper 325.

Albright, L. B., III, 1999. Ungulates of the Toledo Bend local fauna (late Arikareean, early Miocene), Texas coastal plain. Bulletin of the Florida Museum of Natural History 24:1–80.

Albright, L. B., III, M. O. Woodburne, T. J. Fremd, C. C. Swisher, B. J. MacFadden, and G. R. Scott. 2008. Revised chronostratigraphy and biostratigraphy of the John Day Formation (Turtle Cove and Kimberly Members), Oregon, with implications for updated calibration of the Arikareean North American Land Mammal Age. Journal of Geology 116:211–237.

Anonymous 1920. UF Report. FLMNH Archives, Office of the Director.

Anonymous 1964. Society of Vertebrate Paleontology News Bulletin, number 72, October 1964, p. 1–2.

Anonymous. 1971. Florida museum uses earth forms boldly. Architectural Record 150(3):121-126.

Anonymous. 2009. Joshua Dickinson Jr. Obituary. Gainesville [Florida] Sun, January 24 to 26, 2009.

Auffenberg, W. A. 1954. Additional specimens of *Gavalosuchus americanus* (Sellards) from a new locality in Florida. Quarterly Journal of the Florida Academy of Sciences 17:185–209.

Auffenberg, W. A. 1956. A study of the fossil snakes of Florida. Ph.D. Dissertation, Department of Biology, University of Florida, 268 pp.

Auffenberg, W. A. 1963. The fossil snakes of Florida. Tulane Studies in Zoology 10:131–216.

Auffenberg, W. A., W. T. Neill, T. H. Patton, and S. David Webb. 1964. Guidebook 1964 Field Book Society of Vertebrate Paleontology in

Central Florida. University of Florida [and] Florida Geological Survey November 15, 1964, Gainesville, 52 p.

Baczynski A. A., F. A. McInerney, S. L. Wing, M. J. Kraus, P. E. Morse, J. I. Bloch, A. H. Chung, and K. H. Freeman. 2016. Distortion of carbon isotope excursion in bulk soil organic matter during the Paleocene-Eocene thermal maximum. Geological Society of America Bulletin B31389–1. doi: 10.1130/B31389.1

Bader, R. S. 1956. A quantitative study of the Equidae of Thomas Farm. Bulletin of the Museum of Comparative Zoology 115:47–78.

Bader, R. S. 1957. Two Pleistocene mammalian faunas from Alachua County, Florida. Bulletin of the Florida State Museum Biological Sciences 2:53–75.

Baskin, J. A. 1980. Carnivora from the late Clarendonian Love Bone Bed, Alachua County, Florida. PhD dissertation, Department of Zoology, University of Florida, 229 p.

Baskin, J. A. 1982. Tertiary Procyoninae (Mammalia: Carnivora) of North America. Journal of Vertebrate Paleontology 2:71–93.

Baskin, J. A. 2005. Carnivora from the late Miocene Love Bone Bed of Florida. Bulletin of the Florida Museum of Natural History 44:413–434.

Berta, A. 1981. The Plio-Pleistocene hyaena *Chasmaporthetes ossifragus* from Florida. Journal of Vertebrate Paleontology 1:341–356.

Berta, A. 1987. The sabercat *Smilodon gracilis* from Florida and a discussion of its relationships (Mammalia, Felidae, Smilodontini). Bulletin of the Florida Museum of Natural History 31:1–63.

Berta, A., and G. S. Morgan.1985. A new sea otter (Carnivora:Mustelidae) from the late Miocene and early Pliocene (Hemphillian) of North America. Journal of Paleontology 59:809–819.

Bhullar, B.A. S., and K. T. Smith. 2008. Helodermatid lizard from the Miocene of Florida, the evolution of the dentary in Helodermatidae, and comments on dentary morphology in Varanoidea. Journal of Herpetology 42:286–302.

Bloch, J. I., R. C. Hulbert, Jr. and B. J. MacFadden. 2011. Curation and digitization of recently acquired, major fossil vertebrate research collections at the Florida Museum of Natural History. National Science Foundation proposal 1203222, on file in the VP Division, FLMNH.

Bloch, J. I., E. D. Woodruff, A. R. Wood., A. F. Rincon, A. R. Harrington, G. S. Morgan, D. A. Foster, C. Montes, C. A. Jaramillo, N. A Jud, D. S. Jones and B. J. MacFadden. 2016. First North American fossil monkey and early Miocene tropical biotic interchange. Nature doi: 10.1038/nature17415.

Bourque, J. R. 2013. Fossil Kinosternidae from the Oligocene and Miocene of Florida, USA. Pp. 459–475 *in* D. B. Brinkman et al., eds. Morphology and Evolution of Turtles, Vertebrate Paleobiology and Paleoanthropology. Springer, Dordrecht, The Netherlands.

Bourque, J. R. 2016. New mud turtles (Kinosternidae, *Kinosternon*) from the middle–late Miocene of the United States. Journal of Paleontology doi: 10.1017/jpa.2015.63.

Bourque, J. R., and B. W. Schubert. 2015a. Fossil musk turtles (Kinosternidae, *Sternotherus*) from the late Miocene–early Pliocene (Hemphillian) of Tennessee and Florida. Journal of Vertebrate Paleontology 35 e885441 (19 pages), DOI:10.1080/02724634.2014.885441.

Bourque, J. I., J. H. Hutchinson, P. A. Holroyd, and J. I. Bloch. 2015b. A new dermatemydid (Testudines, Kinosternoidea) from the Paleocene–Eocene Thermal Maximum, Willwood Formation, southeastern Bighorn Basin, Wyoming. Journal of Vertebrate Paleontology35:e905481 (19 pages), DOI: 10.1080/02724634.2014.905481.

Brodkorb, P. 1963. A giant flightless bird from the Pleistocene of Florida. Auk 80:111–115.

Bryant, J. D., B. J. MacFadden, and P. A. Mueller. 1992. Improved chronologic resolution of the Hawthorn and the Alum Bluff Groups in northern Florida: Implications for Miocene

chronostratigraphy. Geological Society of America Bulletin 104:208–218.

Bullen R. P., S. D. Webb, and B. I. Waller. 1970. A worked mammoth bone from Florida. American Antiquity 35:203–205.

Campbell Jr., K. E. 1992. Pierce Brodkorb: a biogeographical sketch. Pp. xiii-xix *in* K. E. Campbell Jr., ed. Papers in Avian Paleontology Honoring Pierce Brodkorb. Natural History Museum of Los Angeles County, Science Series 36:xxxvii–491.

Cartelle, C., and G. De Iullius. 1995. *Eremotherium laurillardi*: The Panamerican late Pleistocene megatheriid sloth. Journal of Vertebrate Paleontology 15:830–841.

Casebolt, S. 2012. Leisey Shell Pit 1A. Accessed on 15 November 2016 at https://www.flmnh.ufl.edu/florida-vertebrate-fossils/sites/leisey-shell-pit-1a/

Czaplewski, N. J., and G. S. Morgan. 2012. New basal noctilionoid bats (Mammalia: Chiroptera) from the Oligocene of subtropical North America. Pp. 162-209 *in* G. F. Gunnell and N. B. Simmons, eds. Evolutionary history of bats: Fossils, molecules, and morphology. Cambridge University Press, Cambridge.

DeSantis, L. R. G., R. S. Feranec, and B. J. MacFadden. 2009. Effects of interglacial warming on ancient mammalian communities and their environments. PLoS ONE 4:e5750.

Dickinson Jr., J. C. 1963. Florida State Museum Director's Report, University of Florida, 1962–1963, FLMNH Archives, Office of the Director.

Dickinson Jr., J. C. 1964. Florida State Museum Director's Report, University of Florida, 1963–1964, FLMNH Archives, Office of the Director.

Dickinson Jr., J. C. (Principal Investigator) 1965. Florida State Museum Application to the National Science Foundation–A Grant to Construct a Specialized Research Facility for Natural and Social Sciences. University of Florida, Gainesville–June 1965. FLMNH Archives, Office of the Director.

Dickinson Jr., J. C. 1966. Florida State Museum Director's Report (unpublished), University of Florida, 1964-1966, FLMNH Archives, Office of the Director.

Domning, D. P. 1988. Fossil Sirenia of the West Atlantic and Caribbean Region. I. *Metaxytherium floridanum* Hay, 1922. Journal of Vertebrate Paleontology 8:395–426.

Domning, D. P. 1989a. Fossil sirenians from the Suwannee River, Florida and Georgia. Pp. 54–60 *in* G. S. Morgan, ed. Miocene paleontology and stratigraphy of the Suwannee River basin of north Florida and south Georgia. Guidebook 30, Southeastern Geological Society, Tallahassee.

Domning, D. P. 1989b. Fossil Sirenia of the West Atlantic and Caribbean Region. II. *Dioplotherium manigaulti* Cope, 1883. Journal of Vertebrate Paleontology 9:415–428.

Domning, D. P. 1997. Fossil Sirenia of the West Atlantic and Caribbean region. VI. *Crenatosiren olseni* (Reinhart, 1976). Journal of Vertebrate Paleontology 8:395–426.

Duncan, P. 2016. Email communication to author dated 21 October 2016. (Duncan is Associate Dean of the UF Graduate School.)

Dunckel, B. A. 2016. Email communication to author dated 4 November 2016.

Edmund, A. G. 1987. Evolution of the genus *Holmesina* (Pampatheriidae Mammalia) in Florida with remarks on taxonomy and distribution. Pearce-Sellards Series, Texas Memorial Museum 45:1–20.

Emslie, S. D. 1988. The fossil history and phylogenetic relationships of condors (Ciconiiformes: Vulturidae) in the New World. Journal of Vertebrate Paleontology 8:212–228.

Emslie, S. D., and G. S. Morgan. 1995. Taphonomy of a late Pleistocene carnivore den, Dade County, FL. Pp. 65–83 *in* D. W. Steadman and J. I. Mead, eds. Late Quaternary environments and history: a tribute to Paul S. Martin. The Mammoth Site of Hot Springs. South Dakota, Rapid City, South Dakota.

Feranec, R. S., and B. J. MacFadden. 2000. Evolution of the grazing niche in Pleistocene mammals: Evidence from stable isotopes. Palaeogeography, Palaeoclimatology, Palaeoecology 162:155–169.

Frailey, C. D. 1974. The Ferungulates of the Buda Local Fauna (Arikaeean; Alachua County; Florida). Masters thesis, Department of Biology, University of Florida, 246 p.

Grant, C., B. J. MacFadden, P. Antonenko, and V. Perez. 2017. 3D fossils for K-12 education: A case example using the giant extinct shark *Carcharocles megalodon*. Journal of Paleontology (GSA Shortcourse Volume), in press.

Grobman, A. 1955. Florida State Museum Report [1954-1955] of the Director, University of Florida, Gainesville November 1955. FLMNH Archives, Office of the Director.

Grobman, A. 1957. Florida State Museum Report [1955-1956] of the Director, University of Florida, Gainesville January 1957. FLMNH Archives, Office of the Director.

Grobman, A. 1958. Florida State Museum Report [1956-1957] of the Director, University of Florida, Gainesville January 1958. FLMNH Archives, Office of the Director.

Grobman, A. 1959. Florida State Museum Report [1959], of the Director, University of Florida, Gainesville December 1959. FLMNH Archives, Office of the Director.

Gut, J. H., and C. Ray. 1964. The Pleistocene vertebrate fauna of Reddick, Florida. Quarterly Journal of the Florida Academy of Sciences 26:315–328.

Harrington, A. R., M. T. Silcox, G. S. Yapuncich, D. M. Boyer, and J. I. Bloch. 2016. First virtual endocasts of adapiform primates. Journal of Human Evolution 99:52–78.

Hay, O. P. 1919. Descriptions of some mammalian and fish remains from Florida of probably Pleistocene age. Proceedings of the U. S. National Museum 56:103–112.

Hayes, F. G. 2005. Arikareean (Oligocene-Miocene) *Herpetotherium* (Marsupialia, Didelphidae) from Nebraska and Florida. Bulletin of the Florida Museum of Natural History 45:335–353

Higgins, P., and B. J. MacFadden. 2004. "Amount Effect" recorded in oxygen isotopes of Late Glacial horse (*Equus*) and bison (*Bison*) teeth from the Sonoran and Chihuahuan deserts, southwestern United States. Palaeogeography, Palaeoclimatology, Palaeoecology 206:337–353.

Hirschfeld, S. E., and S. D. Webb. 1968. Plio-Pleistocene megalonychid sloths of North America. Bulletin of the Florida State Museum Biological Sciences 12:213–296.

Holman, J. A. and D. L. Harrison. 2001. Early Oligocene (Whitneyan) snakes from Florida (USA): remaining boids, indeterminate colubroids, summary and discussion of the I-75 Local Fauna snakes. Acta Zoologica Cracoviensia 44:25–36.

Hoppe, K. A., P. L. Koch, R. W. Carlson, and S. D. Webb. 1999. Tracking mammoths and mastodons: Reconstruction of migratory behavior using strontium isotope ratios. Geology 27:439–442.

Hrdlička, A. 1917. Preliminary report on finds of supposedly ancient human remains in Vero, Florida. Journal of Geology 25:43–51.

Hulbert Jr., R. C. 1987. Phylogenetic systematics, biochronology, and paleobiology of late Neogene horses (family Equidae) of the Gulf Coastal Plain and Great Plains. PhD dissertation, Department of Zoology, University of Florida, 570 p.

Hulbert Jr., R. C. 1988a. *Calippus* and *Protohippus* (Mammalia, Perissodactyla, Equidae) from the Miocene (Barstovian-early Hemphillian) of the Gulf Coastal Plain. Bulletin of the Florida Museum of Natural History 32:220–340.

Hulbert Jr., R. C. 1988b. *Cormohipparion* and *Hipparion* (Mammalia, Perissodactyla, Equidae) from the Late Neogene of Florida, Bulletin of the Florida Museum of Natural History 33:229–338.

Hulbert Jr., R. C. 2001. The Fossil Vertebrates of Florida. University Presses of Florida, Gainesville, Florida, 350 p.

Hulbert Jr., R. C. 2005. Late Miocene *Tapirus* (Mammalia, Perissodactyla) from Florida, with description of a new species, *Tapirus webbi*. Bulletin of the Florida Museum of Natural History 45:465–494.

Hulbert Jr., R. C. 2010. A new early Pleistocene

tapir (Mammalia: Perissodactyla) from Florida, with a review of Blancan tapirs from the state. Bulletin of the Florida Museum of Natural History 49:62–126.

Hulbert Jr., R. C. 2016. Inglis 1A. accessed 14 November 2016 at https://www.flmnh.ufl.edu/florida-vertebrate-fossils/sites/inglis-1a/

Hulbert Jr., R. C., A. Kerner, and G. S. Morgan. 2014. Taxonomy of the Pleistocene giant beaver *Castoroides* (Rodentia: Castoridae) from the southeastern United States. Bulletin of the Florida Museum of Natural History 53:26–43.

Hulbert Jr., R. C., G. S. Morgan, and S. D. Webb, eds. 1995. Paleontology and geology of the Leisey Shell Pits, early Pleistocene of Florida. Bulletin of the Florida Museum of Natural History 37 (parts I and II):1–660.

Jackson, D. E. 1975. A Pleistocene *Graptemys* from the Santa Fe River of Florida. Herpetologica 31:213–219.

Jones, D. S., B. J. MacFadden**,** S. D. Webb, P. A. Mueller, D. A. Hodell and T. Cronin. 1991. Integrated geochronology of a classic Pliocene fossil site in Florida: Linking marine and terrestrial biochronologies. Journal of Geology 99:637–648.

Jud, N. A., C. W. Nelson, and F. Herrera. 2016. Fruits and wood of *Parinari* from the early Miocene of Panama and the fossil record of Chrysobalanaceae. American Journal of Botany 103:277–289.

Koch, P. L., K. A. Hoppe, and S. D. Webb. 1998. The isotopic ecology of late Pleistocene mammals in North America: Part 1. Florida. Chemical Geology 152:119–138.

Kurtén, B. 1965. The Pleistocene Felidae of Florida. Bulletin of the Florida State Museum Biological Sciences 9:215–273.

Kurtén, B. 1966. Pleistocene bears of North America. 1. Genus *Tremarctos*, spectacled bears. Acta Zoologica Fennica 115:1–120.

Labs-Hochstein, J., and B. J. MacFadden. 2006. Quantification of diagenesis in Cenozoic sharks: Elemental and mineralogical changes. Geochimica et Cosmochimica Acta 70:4921-4932.

Lambert, W. D. 1994. The fauna and paleoecology of the late Miocene Moss Acres Racetrack site, Marion County, Florida. PhD dissertation, Department of Zoology, University of Florida, 359 p.

Lander, B. 1998. Oreodontoidea. Pp. 402–425 *in* C.M. Janis, K.M. Scott, and L.L. Jacobs, eds. Evolution of Tertiary mammals of North America, Volume 1: Terrestrial carnivores, ungulates, and ungulatelike mammals: 402–425. Cambridge University Press, New York.

Langston, W., R. L. Carroll, C. L. Gazin, J. A. Lillegraven, T. H. Patton, A. S. Romer and R. W. Wilson. 1972. Fossil Vertebrates in the United States: A Report of an ad hoc Committee of the Society of Vertebrate Paleontology on the Status of Fossil Conservation in the United States. Published by the Society of Vertebrate Paleontology.

Latvis, J. M., and I. C. Quitmyer. 2006. Underwater excavation methods. Pp. 1-30, *in* S. D. Webb, ed. First Floridians and last mastodon: The Page-Ladson Site in the Aucilla River, Springer, Dordrecht, The Netherlands.

Leidy, J. 1889. Description of vertebrate remains from Peace Creek, Florida. Transactions of the Wagner Free Institute of Science of Philadelphia 2:19–31.

Leidy, J., and F. A. Lucas. 1896. Fossil vertebrates from the Alachua Clays of Florida. Transactions of the Wagner Free Institute of Science of Philadelphia 4:1–61.

MacArthur, R. H., and E. O. Wilson. 1967. The Theory of Island Biogeography. Princeton University Press, Princeton, N. J. 203 p.

MacFadden, B. J. 1986. Late Hemphillian monodactyl horses (Mammalia, Equidae) from the Bone Valley Formation of central Florida. Journal of Paleontology 60:466–475.

MacFadden, B. J. 1995. Magnetic polarity stratigraphy and correlation of the Leisey Shell Pits, Hillsborough County, Florida. Bulletin of the Florida Museum of Natural History 37:107-116.

MacFadden, B. J. 2000. Skeletons in our closet: The treasures of a museum. Pony Express Florida Fossil Horse Newsletter 13(1):1, 3.

MacFadden, B. J. 2004. The *Pony Express*: Past,

present, and future. Pony Express Florida Fossil Horse Newsletter 9(1):7–8.

MacFadden, B. J., J. I. Bloch, H. Evans, D. A. Foster, G. S. Morgan, A. F. Rincon and A. R. Wood. 2014. Temporal calibration and biochronology of the Centenario Fauna, early Miocene of Panama. Journal of Geology 122:113–135.

MacFadden, B. J., Bryant, J. D. and P. A. Mueller. 1991. Sr-isotopic, paleomagnetic, and biostratigraphic calibration of horse evolution: Evidence from the Miocene of Florida. Geology 19:242–245.

MacFadden, B. J. and T. E. Cerling. 1996. Mammalian herbivore communities, ancient feeding ecology, and carbon isotopes: A 10 million-year sequence from the Neogene of Florida. Journal of Vertebrate Paleontology 16:103–115.

MacFadden, B. J., and R. P. Guralnick. 2016. Horses in the Cloud: big data exploration and mining of fossil and extant *Equus* (Mammalia: Equidae). Paleobiology doi: 10.1017/pab.2016.42

MacFadden, B. J., J. Labs Hochstein, R. C. Hulbert Jr., and J. Baskin. 2007. Revised age of the late Neogene terror bird (*Titanis*) in North America during the Great American Interchange. Geology 35:123–126.

MacFadden, B. J., and R. C. Hulbert Jr. 2009. Calibration of mammoth (*Mammuthus*) dispersal into North America using rare earth elements of Plio-Pleistocene mammals from Florida. Quaternary Research 71:41–48.

MacFadden, B. J., and R. M. Hunt, Jr. 1998. Magnetic polarity stratigraphy and correlation of the Arikaree Group, Arikareean (late Oligocene-early Miocene) of northwestern Nebraska. Geological Society of America Special Paper 325:143–65.

MacFadden, B. J., L. Lundgren, B. A. Dunckel, S. Ellis, and K. Crippen. 2016. Amateur paleontological societies and fossil clubs, interactions with professional paleontologists, and the rise of 21st century social paleontology in the United States. Paleontologica Electronica 19.2.1E.

MacFadden, B. J., and G. S. Morgan. 2003. New oreodont (Mammalia, Artiodactyla) from the late Oligocene (early Arikareean) of Florida. Bulletin of the American Museum of Natural History 279:368–396.

MacFadden, B. J., C. J. Swisher, M. O. Woodburne, and N. D. Opdyke. 1990. Paleomagnetism, geochronology, and negligible tectonic rotation of the middle Miocene Barstow Formation, Mojave Desert, California. Bulletin Geological Society of America 102:478–493.

MacFadden, B. J., B. A. Purdy, K. Church, and T. W. Stafford Jr. 2012. Humans were contemporaneous with late Pleistocene mammals in Florida: Evidence from rare earth elemental analyses. Journal of Vertebrate Paleontology 32:708–716.

MacFadden, B. J., and J. S. Waldrop. 1980. *Nannippus phlegon* (Mammalia, Equidae) from the Plio-Pleistocene (Blancan) of Florida. Bulletin of the Florida State Museum, Biological Sciences 25:1–37.

Marshall, L. G., S. D. Webb, J. Sepkoski, and D. Raup. 1982. Mammalian evolution and the Great American Interchange. Science 215:1351–1357 (plus cover).

Manz, C. L. 2012. Love site (also known as Love Bone Bed). Accessed 14 November 2016 at https://www.flmnh.ufl.edu/florida-vertebrate-fossils/sites/love-site/

Manz, C. L., and J. I. Bloch. 2015. Systematics and phylogeny of Paleocene-Eocene Nyctitheriidae (Mammalia, Eulipotyphla?) with description of a new species from the late Paleocene of the Clarks Fork Basin, Wyoming, USA. Journal of Mammalian Evolution 22(3):307-342.

Martin, R. A., and S. D. Webb. 1974. Late Pleistocene mammals from the Devil's Den Fauna, Levy County, Florida. Pp. 114–145 *in* S. D. Webb, ed. Pleistocene Mammals of Florida. University Presses of Florida, Gainesville.

McDonald, H. G. 1995. Gravigrade xenarthrans from the early Pleistocene Leisey Shell Pit 1A, Hillsborough County, Florida. Bulletin of the Florida Museum of Natural History 37:345–373.

McDonald, H. G. 2005. The paleoecology of extinct xenarthrans and the Great American Biotic Interchange. Bulletin of the Florida Museum of Natural History 45:313–334.

Meachen, J. A. 2005. A new species of *Hemiauchenia* (Artiodactyla, Camelidae) from the late Blancan of Florida. Bulletin of the Florida Museum of Natural History 44:435–448.

Mello, J. F. 1975. The use of the SELGEM system in support of systematics. Pp. 125-138 *in* J. P. M Brenan et al., eds., Computers in Botanical Collections. Plenum Press, London.

Meylan, P. A. 1982. The squamate reptiles of the Inglis 1A Fauna (Irvingtonian: Citrus County, Florida.) Bulletin of the Florida State Museum, Biological Sciences. 3:111-195.

Meylan, P. A. 1995. Pleistocene amphibians and reptiles from the Leisey Shell Pit Hillsborough County, Florida. Bulletin of the Florida Museum of Natural History 37:273–297.

Moran, S. M., R. C. Hulbert Jr., W. H. Brown, and B. J. MacFadden 2016. Increasing the research potential of digitized fossils: A pilot study using Specify to attach stable isotope data to vouchered museum specimens. Geological Society of America Abstracts with Programs. 48(7) doi: 10.1130/abs/2016AM-280994.

Morgan, G. S. 1985. Fossil bats (Mammalia: Chiroptera) from the late Pleistocene and Holocene Vero Fauna, Indian River County, Florida. Brimleyana 11:97–117.

Morgan, G. S. 1989. Miocene vertebrate faunas from the Suwannee River basin of north Florida and south Georgia. Pp. 26–53 *in* G. S. Morgan, ed. Miocene paleontology and stratigraphy of the Suwannee River basin of north Florida and south Georgia. Southeastern Geological Society, Guidebook 30.

Morgan, G. S. 1991. Neotropical Chiroptera from the Pliocene and Pleistocene of Florida. Bulletin of the American Museum of Natural History 206:176–213.

Morgan, G. S. 2002. Late Rancholabrean mammals from southernmost Florida, and the Neotropical influence in Florida Pleistocene faunas. Smithsonian Contributions to Paleobiology 93:15–38.

Morgan, G. S. 2005. The Great American Biotic Interchange in Florida. Bulletin of the Florida Museum of Natural History 45:271–311.

Morgan, G. S., and N. J. Czaplewski. 2012. Evolutionary history of the Neotropical Chiroptera: the fossil record. Pp. 105-161 *in* G. F. Gunnell and N. B. Simmons, eds. Evolutionary history of bats: Fossils, molecules, and morphology. Cambridge University Press, Cambridge.

Morgan, G. S., and S. D. Emslie. 2010. Tropical and western influences in vertebrate faunas from the Pliocene and Pleistocene of Florida. Pp. 143-158 *in* E. Scott and G. McDonald, eds. Faunal dynamics and extinction in the Quaternary: Studies in honor of Ernest L. Lundelius, Jr. Quaternary International 217.

NSF (National Science Foundation). 2014. S&EI (Science and Engineering Indicators). http://www.nsf.gov/statistics/seind/, accessed April 2015.

Nichols, R. 1965. Society of Vertebrate Paleontology News Bulletin, number 73, February 1965, p. 9.

Nunez, E. E., B. J. MacFadden, J. I. Mead, and A. Baez. 2010. Ancient forest and grasslands in the desert: Diet and habitat of late Pleistocene mammals form northcentral Sonora, Mexico. Palaeogeography, Palaeoclimatology, Palaeoecology 297:391–400.

Page, L. M., B. J. MacFadden, J. A. Fortes, P. S. Soltis, and G. Riccardi. 2015. Digitization of biodiversity collections reveals biggest data on biodiversity. Bioscience doi: 10.1093/biosci/biv104

Patton, T. H. 1964. The Thomas Farm fossil vertebrate locality. Pp. 12–20 *in* W. A. Auffenberg, W. T. Neill, T. H. Patton, and S. David Webb. Guidebook 1964 Field Book Society of Vertebrate Paleontology in Central Florida. University of Florida [and] Florida Geological Survey November 15, 1964, Gainesville.

Patton, T. H. 1969a. Miocene and Pliocene artiodactyls, Texas Gulf Coastal Plain. Bulletin of the Florida State Museum, Biological Sciences 14:115–226.

Patton, T. H. 1969b. An Oligocene land vertebrate fauna from Florida. Journal of Paleontology 43:543–546.

Pimiento, C., and M. Balk. 2015. Body-size trends of the extinct giant shark *Carcharocles megalodon*: a deep-time perspective on marine apex predators. Paleobiology doi: 10.1017/pab.2015.16

Pimiento, C., D. J. Ehret, B. J. MacFadden, and G. Hubbell. 2010. Ancient nursery area for the extinct giant shark *Megalodon* from the Miocene of Panama. PLoS ONE, 5:e10552.

Purdy, B. 2008. Florida's People during the Last Ice Age. University Press of Florida, Gainesville. 192 p.

Purdy, B. A., K. M. Rohlwing, and B. J. MacFadden. 2015. Devil's Den, Florida: Rare earth element analysis indicates contemporaneity of humans and latest Pleistocene fauna. PaleoAmerica 1:266–275.

Ray, C. E. 2005. An idiosyncratic history of Floridian vertebrate paleontology. Bulletin of the Florida Museum of Natural History 45:143–170.

Renders, E. 1984. The gait of *Hipparion* sp. from fossil footprints in Laetoli, Tanzania. Nature 308:179–181.

Rincon, A. F., J. I. Bloch, B. J. MacFadden, and C. A. Jaramillo. 2013. First Central American record of Anthracotheriidae (Mammalia, Bothriodontinae) from the early Miocene of Panama. Journal of Vertebrate Paleontology 33:421–433.

Robertson, J. 1974. Fossil *Bison* of Florida. Pp. 214–246, *in* S. D. Webb, ed. Pleistocene Mammals of Florida. University Presses of Florida, Gainesville.

Ruez Jr., D. R. 2001. Early Irvingtonian (Latest Pliocene) rodents from Inglis 1C, Citrus County, Florida. Journal of Vertebrate Paleontology 21:153–171.

Secord, R., J. I. Bloch, S. G. B. Chester, D. M. Boyer, A. R. Wood, S. L. Wing, M. J. Kraus, F. A. McInerney, and J. Krigbaum. 2012. Evolution of the earliest horses driven by climate change in the Paleocene-Eocene Thermal Maximum. Science 335:959–962.

Sellards, E. H. 1916. Human remains and associated fossils from the Pleistocene of Florida. Pp. 121–160 in Florida State Geological Survey, Eighth Annual Report, Tallahassee, Florida.

Sellards, E. H. 1917. On the association of human remains and extinct vertebrates at Vero, Florida. Journal of Geology 25:4–24.

Silcox, M. T., C. K. Dalmyn, and J. I. Bloch. 2009. Virtual endocast of *Ignacius graybullensis* (Paromomyidae, Primates) and brain evolution in early Primates. Proceedings of the National Academy of Sciences 106:10987–10992.

Simons, E. 2000. The good ole days at the Thomas Farm 'Bone Hole.' Pony Express Florida Fossil Horse Newsletter 9(1):1, 3.

Simpson, G. G. 1932. Miocene land mammals from Florida. Florida State Geological Survey Bulletin 10:11–41.

Snyder, D. 2001. Evolution of the modern Alligator lineage. Masters thesis, University of Florida, Gainesville. 102 p.

Steadman, D. W. 2008. Doves (Columbidae) and cuckoos (Cuclidae) from the early Miocene of Florida. Bulletin of the Florida Museum of Natural History 48:1–16.

Taylor, L. 2016. Personal communication on 12 November 2016 concerning the status of the Seagle Building exhibits in the 1970s.

Tedford, R. H., L. B. Albright III, A. D. Barnosky, I. Ferrusquia-Villafranca, R. M. Hunt Jr., J. E. Storer, C. C. Swisher III, M. R. Voorhies, S. D. Webb, and D. P. Whistler. 2004. Mammalian biochronology of the Arikareean through Hemphillian interval (late Oligocene through early Pliocene epochs). Pp. 169–231 *in* M. O. Woodburne, ed. Late Cretaceous and Cenozoic Mammals of North America: Biostratigraphy and Geochronology. Columbia University Press, New York.

Tessman, N. T. 1969. The fossil sharks of Florida. M.S. thesis, Department of Geology, University of Florida, 132 p.

Van Hyning, T. 1915. Letter to UF President Murphree, FLMNH Archives, Office of the Director.

Vélez-Juarbe, J., and D. P. Domning. 2014. Fossil Sirenia of the West Atlantic and Caribbe-

an region. IX. *Metaxytherium albifontanum*, sp. nov. Journal of Vertebrate Paleontology 32:444-464.

Velez-Juarbe, J., A. R. Wood, C. De Gracia, and A. J. W. Hendy. 2015. Evolutionary patterns among living and fossil kogiid sperm whales: Evidence from the Neogene of Central America PLoS ONE 10(4):e0123909.

Wallett, L. A. 2015. The natural history of chronic laminitis: Evidence form the fossil and archaeological record of *Equus*. Ph.D. dissertation, College of Veterinary Medicine, University of Florida, 223 p.

Wang, Y., T. E. Cerling, and B. J. MacFadden. 1994. Fossil horses and carbon isotopes: New evidence for Cenozoic dietary, habitat, and ecosystem changes in North America. Palaeogeography, Palaeoclimatology, and Palaeoecology 107:269–280.

Webb, S. D. 1966. A relict species of the burrowing rodent *Mylagaulus*, from the Pliocene of Florida. Journal of Mammalogy 47:401–412.

Webb, S. D. 1968. The Pliocene Canidae of Florida. Bulletin of the Florida State Museum 14:273–308.

Webb, S. D. 1969. The Burge and Minnechaduza mammalian faunas from north-central Nebraska. University of California Publications in Geological Sciences 78:1–191.

Webb, S. D. 1973. Pliocene pronghorns of Florida. Journal of Mammalogy 54:203–221.

Webb, S. D., ed. 1974. Pleistocene Mammals of Florida. Gainesville, University Presses of Florida, 270 pp.

Webb, S. D. 1976a. Mammalian faunal dynamics of the great American interchange. Paleobiology 2:230–234.

Webb, S. D. 1976b. Underwater paleontology of Florida's rivers. National Geographic Society Research Reports, 1968 Projects, p. 479–481.

Webb, S. D. 1978. Evolution of savanna vertebrates in the New World. Part II. South America and the Great Interchange. Annual Reviews of Ecology and Systematics 9:393–426.

Webb, S. D. 1981. *Kyptoceras amatorum*, new genus and species from the Pliocene of Florida, the last protoceratid artiodactyl. Journal of Vertebrate Paleontology 1:357–365.

Webb, S. D. 1983. A new species of *Pediomeryx* from the late Miocene of Florida, and its relationships within the subfamily Cranioceratinae (Ruminantia: Dromomerycidae). Journal of Mammalogy 64:261–276.

Webb, S. D. 1991. Ecogeography and the Great American Interchange. Paleobiology 17:266–280.

Webb, S. D. ed. 2006. First Floridians and Last Mastodons: The Page-Ladson Site in the Aucilla River. Springer, Dordrecht, The Netherlands, 588 p.

Webb, S. D., and D. B. Crissinger. 1983. Stratigraphy and vertebrate paleontology of the central and southern phosphate districts of Florida. Geological Society of America, Southeastern Section, Field Trip Guidebook, pp. 28–72.

Webb, S. D., and J. Dudley. 1995. Proboscidea from the Leisey Shell Pits, Hillsborough County, Florida. Bulletin of the Florida Museum of Natural History 37:645–660.

Webb, S. D., and R. C. Hulbert Jr. 1986. Systematics and evolution of *Pseudhipparion* (Mammalia, Equidae) from the late Neogene of the Gulf Coastal Plain and the Great Plains. Pp. 237-272 *in* K. Flanagan and J. Lillegraven, eds. Vertebrates, Phylogeny and Philosophy. Contributions Geology, University of Wyoming. Special Paper 3.

Webb, S. D., B. J. MacFadden, and J. A. Baskin. 1981. Geology and paleontology of the Love Bone Bed from the late Miocene of Florida. American Journal of Science 281:513–544.

Webb, S. D., G. S. Morgan, R. C. Hulbert Jr., D. S. Jones, B. J. MacFadden and P. A. Mueller. 1989. Geochronology of a rich early Pleistocene vertebrate fauna, Leisey Shell Pit, Tampa Bay, Florida. Quaternary Research 32:96–110.

Webb, S. D., and K. T. Wilkins. 1984. Historical biogeography of Florida Pleistocene mammals. Pp. 370-383 *in* H. Genoways and M. Dawson, eds. Special Publication, Carnegie Museum of Natural History, no. 8.

Whitelaw, M. 1991. Magnetic polarity stratigraphy

of Pliocene and Pleistocene fossil vertebrate localities in southeastern Australia. Geological Society of America Bulletin 103:1493–1503.

Whiting, E. T., D. W. Steadman, and J. Krigbaum. 2016. Paleoecology of Miocene crocodylians in Florida: Insights from stable isotope analysis. Palaeogeography, Palaeoclimatology, Palaeoecology 451:23-34.

Wilkins, K. T. 1984. Evolutionary trends in Florida Pleistocene pocket gophers (genus *Geomys*), with description of a new species. Journal of Vertebrate Paleontology 3:166–181.

Wolff, R. G. 1991. Functional Chordate Anatomy. D. C. Heath, Lexington MA. 752 text + 88 appendix pages.

Wood, A. R., and N. M. Ridgwell. 2015. The first Central American chalicothere (Mammalia, Perissodactyla) and the paleobiogeographic implications for small-bodied schizotheriines. Journal of Vertebrate Paleontology. doi: http://dx.doi.org/10.1080/02724634.2014.923893

Wood, H. E. 1964. Rhinoceroses from the Thomas Farm Miocene of Florida. Bulletin of the Museum of Comparative Zoology 130:361–86.

Wood, H. E. (Chairman), R. W. Chaney, J. Clark, E. H. Colbert, G. L. Jepsen, J. B. Reeside Jr., and C. Stock. 1941. Nomenclature and correlation of the North American Continental Tertiary. Bulletin Geological Society of America 52:1–48.

Woodburne, M. O., ed. 2004. Late Cretaceous and Cenozoic Mammals of North America: Biostratigraphy and Geochronology. Columbia University Press, New York, 391 p.