Notes

INTRODUCTION

1. Scientists have long relied on specimen collectors from diverse populations and without formal science training, including amateurs, enslaved people, and people from Indigenous groups (e.g., Darwin 1913; Secord 1994; Kohler 2006; Bangham 2014; Delbourgo 2017). These workers are rarely recognized in exhibits or scientific papers for their contributions.
2. On the history of paleontology, see Sepkoski and Ruse 2009; Brinkman 2010; Sepkoski 2012; Rieppel 2019. On the philosophy of paleontology, see Turner 2007, 2019; Currie 2018. On the history of geology, see Rudwick 1976, 1985, 2005, 2008. On historic and recent taxidermy, see Haraway 1984; Star and Griesemer 1989; Star 1992; Alberti 2008; Patchett and Foster 2008; Poliquin 2008. On the sociology and philosophy of archaeology, see Holtorf 2002; Wylie 2002; Edgeworth 2006; Chapman and Wylie 2016.
3. I collected most of this book's data in 2008–2012, with follow-up visits to labs and conferences in 2012–2017. These data represent a particular moment in the nebulous community of fossil research workers. The data are not universal or timeless, and of course experiences and opinions vary between individuals and can change over time. Nonetheless, these interviews and observations offer compelling insights into laboratory life.
4. Interviews followed a semistructured protocol of prepared questions with space for unexpected topics (Bryman 2008). Interviewees signed a consent form and had the opportunity to comment on their interview transcripts. I conducted sixty-four formal interviews and countless informal conversations. I coded the transcripts and my field notes following inductive analysis and grounded theory.
5. For example, I mixed plaster, repaired fossils, molded and cast a dinosaur footprint to create replicas, and cut open the plaster-and-burlap protective casing (called a jacket) around recently collected fossils.

CHAPTER 1

1. The Fossil Preparation and Collections Symposium has been held annually since 2008. In 2015, it became part of the newly founded Association for Materials and Methods in Paleontology.

CHAPTER 2

1. I distributed the survey in 2010 at conferences, lab visits, and online via the PrepList. I analyzed the seventy-nine responses with basic statistics.
2. As one indicator of the size of the preparator population, the PrepList had 231 subscribers in 2011 (and 415 in 2018). But not all preparators belong to the PrepList, and most of its subscribers live in North America. People from several countries responded to my survey, but I do not try to compare global cultures of fossil preparation.
3. On prosopography, see Shapin and Thackray 1974; Bourdieu 1988.
4. A person-year means 2,000 hours of work.
5. These studies investigate volunteers in zoos, "human services, arts and culture, religion, youth development, education and health," not in labs or science museums (Bussell and Forbes 2002, 247). As an exception, Deborah Edwards has done extensive research on museum volunteers (Edwards 2005, 2006, 2007a, 2007b; Edwards and Graham 2006; Holmes and Edwards 2008). But Edwards's participants were primarily docents, so her studies overlook volunteers who do research tasks. Likewise, David Grazian's (2015) study of zoo workers includes animal care volunteers and docents, but not research volunteers.

   Perhaps surprisingly, no volunteer mentioned to me the institutional perks as motivating factors, such as free museum entry, shop discounts, subsidized travel costs, or volunteer appreciation events. This suggests that these benefits serve to celebrate volunteers rather than compensate them. Recognition of their work—or more often, lack thereof—is a crucial factor for volunteers' level of commitment (Edwards 2007a). Few of the volunteers I spoke with, however, reported feeling unappreciated; in fact, the vast majority expressed gratitude for being allowed to volunteer. This difference indicates that volunteer preparators, and perhaps skilled volunteers in general, may value their internal, personal motivations more than external motivations such as recognition, as compared to other kinds of volunteers.

CHAPTER 3

1. Another rock removal technology is acid preparation, in which preparators soak specimens in acid to slowly dissolve away matrix. I don't address acid preparation here because it's not widely used on vertebrate fossils. Specifically, it only works on certain kinds of matrix, it can be destructive to fossils, and only some institutions have the facilities to do it (e.g., the space, safety equipment, and potentially hazardous materials to bathe fossils in acid for days at a time).
2. Museum displays became more interactive during the twentieth century, arguably lessening their focus on specimens. Also, the posture of fossil mounts has changed considerably with new beliefs about animals' weight distribution and functional morphology. Changes in fossil research include the emerging interest in the 1960s in whether dinosaurs were warm or cold blooded, leading to searches for fine fossilized details such as the impressions of feathers and blood vessels. On twentieth-century fossil research, see Sepkoski and Ruse 2009; Sepkoski 2012.

3. Brinkman (2009, 32) points out that it was most likely the museum's preparator, Adam Hermann, who was experimenting with the sandblast, not Osborn himself, who was a busy museum administrator as well as a researcher.

4. It's not clear how many people worked as preparators in the early twentieth century or today. Brinkman documents at least one well-known preparator at each major museum in the early twentieth century, plus a cadre of lesser-known workers who were preparing fossils. As one indicator of today's preparator population, the PrepList had 415 subscribers in 2018.

5. The authors propose that the mammal-like reptile may have been estivating (i.e., in a low metabolic state similar to hibernation) in the burrow and for unknown reasons "tolerated the amphibian's presence" (Fernandez et al. 2013, 1). The two were trapped inside the burrow by a fast flood, which probably killed them and then quickly fossilized their remains.

CHAPTER 4

1. He said "but-var" (/bʌtvar/), while preparators say "butte-var" (/bju:tvar/).

2. One famous case of a nicknamed fossil is "Sue," a T. rex. The skeleton's collectors named it after its discoverer, Sue Hendrickson. The press picked up the name when high-profile federal lawsuits arose to determine the fossil's ownership. Chicago's Field Museum later bought Sue at auction for a record-setting $8.4 million in 1997 (Fiffer 2000). Preserving the name probably had marketing benefits because it identifies the fossil as an individual and is more familiar than a Latin species name, even one as well-known as T. rex. I only met one scientist who nicknames fossils. Jenny Clack, a researcher at the University of Cambridge, named her various *Acanthostega* specimens Boris, Pop, Patch, Fido, Grace, and Rosie (Lewis 2012). Clack, however, told me that she had learned to prepare fossils; perhaps her penchant for specimen names was inspired by her time spent with preparators.

3. This uncertainty about whether the holes existed prior to preparation might seem unresolvable, but there are no matching holes on the snout's opposite side, which the volunteer had not prepared. Also, human-made holes tend to have jagged edges, unlike a natural hole's smooth edges.

4. In the later publication describing this specimen, Henry and his coauthors explained that a volunteer had damaged one side of the skull. This is a rare example of preparation appearing in a research paper. It matches Shapin's (1989, 1994) observation that technicians are made visible in situations of questionable research results, for which researchers label them the scapegoats, deservedly or not.

5. Interestingly, three years later the authors changed the fish's genus name because they discovered that *Psammorhynchus* had already been assigned to another genus (Grande and Hilton 2009). To avoid duplication, they replaced it with *Priscosturion*, for primitive (*priscus*) sturgeon (*sturio*). This name loses the references to the fossil's matrix and morphology. The fish's species name, which has not changed, is *longipinnis*, meaning "long sail" for its distinctively tall dorsal fin.

6. Scientists have named species after preparators, such as the remarkably preserved nodosaur *Borealopelta markmitchelli*, whose name "honors Mark Mitchell for his more than 7,000 hours of patient and skilled preparation of the holotype" (Brown et al. 2017, 2514). As far as I know, only one of the preparators I've met is the namesake of a species, suggesting that it is an unusual practice.
7. With apologies to Robert Frost (1914), whose poem "Mending Wall" suggests the opposite.

CHAPTER 5

1. For studies of visitors to glass-walled fossil preparation labs, see Gavigan 2007, 2009; Noble 2016, chap. 12. For examples of visitors' reactions to these labs, see Wylie 2020.
2. Preparators also work on important fossils while on display, including type and famous specimens, for convenience or publicity. For example, preparators prepared the Field Museum's Sue the T. rex almost entirely in a purpose-built and well-publicized glass-walled lab ("SUE the T. rex" 2018).

CONCLUSION

1. Only 28 percent of workers in science and engineering in the United States were women in 2015 (National Science Foundation 2017).
2. There aren't official demographics data for fossil preparators. As one measure, I have not met or heard about an African American preparator, and I know of only a few Hispanic, Latinx, or Asian preparators. Nearly everyone is White. Preparators in the United States resemble scientists in their racial and ethnic homogeneity.
3. See the 2017 special issue of *Osiris* titled "Historicizing Big Data," especially historian Mirjam Brusius (2017) on archaeological artifacts.

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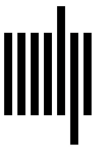

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