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DENTAL MICROWEAR ANALYSIS OF EXTINCT FLAT-HEADED PECCARY (*PLATYGONUS COMPRESSUS*) FROM SOUTHERN INDIANA

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ABSTRACT. Dental microwear analysis (DMA) is a valuable means of dietary reconstruction for extant and extinct animals because it provides insight independent of dental morphology. It was employed to elucidate the diet of the extinct Late Pleistocene Flat-headed Peccary, *Platygonus compressus*. The study sample came from Megenity Cave in southern Indiana, which has produced the largest assemblage of *P. compressus* remains in the world. Ten mandibular molars were molded and replicated with resin casts following standard procedures. The molds were viewed with a scanning electron microscope at a magnification of 500x. Microscopic pits and scratches were quantified with a semi-automated software program specifically designed for microwear study. The *P. compressus* microwear profile was compared to profiles generated for several extant grazers, mixed feeders, and browsers. Its diet was patently intermediate in its percentage of pits (i.e., hardness) and average scratch widths (i.e., abrasiveness). Generally, its diet was more consistent with that of the browsers, although its diet was also similar to that of the mixed-feeders. By contrast, its microwear profile was not similar to the grazers. A follow-up comparison with more faunivorous animals (including suids, bats, humans, and non-human primates) indicated that the *P. compressus* diet is more consistent with faunivores that ate softer resources such as certain invertebrates. Overall, *P. compressus* had a varied diet that included a comparative balance of hard and soft as well as abrasive and non-abrasive foods.

Keywords: Pleistocene, diet, teeth

Dental microwear analysis (DMA) is the study of microscopic pits and scratches on dental enamel created, for the most part, during mastication. Microwear-based dietary reconstructions are of particular value because they provide a means for determining diet that does not depend on dental morphology. The fact that it is non-destructive makes it useful for paleontological applications. In fact, its utility in paleontology has been demonstrated frequently. For example, DMA was used to determine the diets of Miocene giraffids, late Miocene antelope, fossil equids and rhinoceros (Solounias et al. 1988; Solounias & Hayek 1993, Fortelius & Solounias 2000; Solounias & Semprebon 2002). Additional fossil animals that have been studied via DMA include sheep (Rivals & Deniaux 2003), mammoths (Capozza 2001), primates (e.g., Teaford 1988, 1993; Ungar 1996, 1998; King 1999; Rafferty 2002; Ungar et al. 2004; Galbany 2005; Merceron et al. 2006), hominins (e.g., Grine 1981; 1987a,b; Teaford & Walker 1984; Kay & Grine 1988; Ungar & Grine 1991; Pérez-Pérez et al. 1999, 2003; Teaford & Ungar 2000; Grine et al. 2006; Ungar et al. 2004, 2006) and dinosaurs (e.g., Fiorillo 1991; Abler 1992; Schubert & Ungar 2005).

This study sought to determine the dental microwear profile of the extinct Flat-headed Peccary, *Platygonus compressus*. Most interpretations of the *P. compressus* gross dental morphology have suggested that it was a browser (e.g., Holman 2001). Kurten & Anderson (1980) stated that "the hypsodont teeth were adapted to chew coarse vegetation, and the dentition suggests browsing habits." Its distinction as a browser stems largely from its pronounced premolar and molar bilophodonty. The cusps are tall and evoke a zygodonty that is reminiscent of lightly-worn *Mammut* teeth (e.g., Janis et al. 1998). It is presumed that, like *Mammut*, the tall cusps were ideal for triturating hard browse and were less effective for chewing grasses. Hood & Hawksley (1975) reported "gum-line notching" on the mandibular canines that they argue probably resulted from browsing on "vegetation rich in silica or silica dust covering the vegetation." This microwear study examined the assessment that

P. compressus was a browser by looking for microscopic evidence of this assertion on the molars.

Platygonus compressus was first identified in 1806 and was fully described by the mid-19th century (i.e., LeConte 1848; Leidy 1853). It stood about 760 mm high at the shoulder, was long-legged, and had a large and heavily turbinated nasal passage (Hood & Hawksley 1975; Kurten & Anderson 1980). The *P. compressus* dentition was more specialized than that of extant peccaries in that the incisors and canines were more gracile, the maxillary second incisor was reduced to a small peg, and I3 was lost entirely (Kurten & Anderson 1980).

Flat-headed Peccaries were widely distributed in North America during the late Pleistocene ranging from California to New York (Kurten & Anderson 1980). They also have been reported in Texas and Mexico (Slaughter 1966). In the midwestern U.S., Flat-headed Peccary are known from numerous sites, many of which are caves, including Megenity Cave and Indun Cave in Indiana, Welsh Cave in Kentucky, Sheriden Cave/Indian Trail Caverns in Ohio, Castle Rock Cave in Wisconsin, and Zoo and Bat caves in Missouri (Guilday et al. 1971; Hawksley et al. 1973; Hood & Hawksley, 1975; Richards & Munson 1988; Feldman & Hackathorn 1996; Holman 2001). These cave sites tend to produce many individuals. Zoo Cave had over 81 individuals (Hood & Hawksley 1975) while Sheriden Cave/Indian Trail Caverns had a minimum of 39 (Feldman & Hackathorn 1996). Thirty-one individuals were recovered from Welsh Cave (Guilday et al. 1971). Megenity Cave will be discussed in greater detail later, but it has yielded hundreds of individuals and is clearly the most prolific *P. compressus* site in North America (Fig. 1).

Flat-headed peccaries may have inhabited various environments, including grasslands and pine forests and apparently used caves as refuges (Kurten & Anderson 1980). Hood & Hawksley (1975) suggested that they lived in dry and/or dusty environments. They supported this by citing the large nasal cavity and significant turbination that would have helped to minimize the effects of dust in the respiratory tract. It is presumed that the Flat-headed Peccary lived in herds because groups of individuals have been found in loess deposits huddled together as if they were protecting themselves during a sandstorm (Martin & Guilday 1967). Most *P. compressus* remains tend to date to the last interglacial and glacial periods, and there is no evidence that the species interacted with humans. Tankersley & Redmond (2005) noted that the late Pleistocene/Early Holocene Sheriden Cave archaeological site in Wyandot County, Ohio contained thousands of faunal fragments including *P. compressus*, but none of the peccary bones showed evidence of human modification.

DENTAL MICROWEAR ANALYSIS

Microscopic wear features on teeth have been studied for decades (e.g., Dahlberg 1960; Walker et al. 1978), and are divided into two categories: scratches and pits. Scratches are linear features with a length-to-width ratio that is equal to or greater than 4 to 1. Pits tend to be more ovoid or circular. While it is impossible to know what caused every feature found on a given tooth (see Teaford & Walker 1984), it seems that most microwear is created by hard or abrasive particles, such as exogenous grit, that find their way into the food supply. Other feature-causing agents include phytoliths, some nuts and seeds, fragments of bone, and some insect exoskeletons (Teaford & Walker 1984; Danielson 1988; Strait 1991).

In general, microwear studies are able to place dietary regimes into two dichotomous, although not mutually exclusive, categories: hard/soft and abrasive/non-abrasive. Hard diets are those that produce numerous pits compared to the number of scratches (Teaford 1991). Abrasive diets are those with wider scratches (Schmidt 2001). Looking at different species of hyrax, Walker et al. (1978) were among the first to show that grazing animals had softer diets, while browsers had harder ones. Solounias & Semprebon (2002) corroborated this finding with their detailed study of extant herbivores. Teaford's work with extant primates provides complementary evidence that hard-object feeders, primates that eat seeds and nuts, have more pits while those that eat leaves have more scratches (Teaford & Oyen 1989; Teaford & Robinson 1989; Teaford & Lytle 1996; Teaford et al. 2006). Dental microwear formation is a dynamic process, with new features constantly replacing old ones. This means that microwear provides a record of recent food consumption—what was eaten over the last few weeks or days—and does not

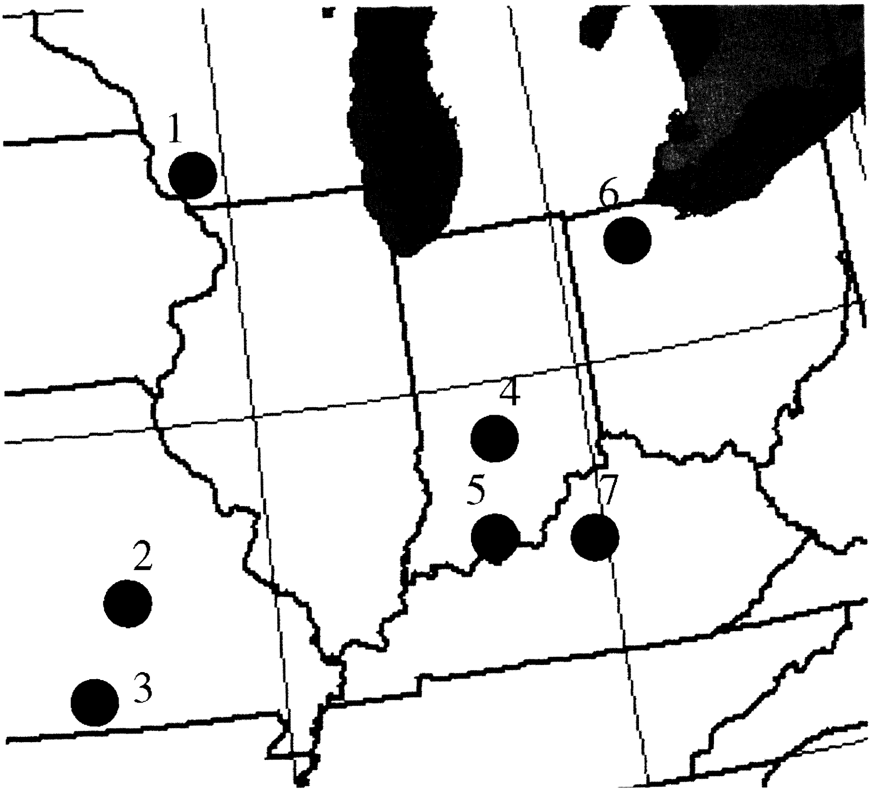

Figure 1.—Locations of selected *Platygonus compressus* cave sites: 1. Castle Rock Cave (Grant County, Wisconsin); 2. Bat Cave (Pulaski County, Missouri); 3. Zoo Cave (Taney County, Missouri); 4. Indun Cave (Monroe County, Indiana); 5. Megenity Cave (Crawford County, Indiana); 6. Indian Trail Caverns/Sheriden Cave (Wyandot County, Ohio); 7. Welsh Cave (Woodford County, Kentucky).

necessarily represent an organism's diet over the course of its life (see Teaford 1994).

Since the late 1970s efforts have been made to standardize DMA because dental microwear can vary profoundly on the various areas of individual teeth. For example, Phase I facets, which are used for shearing food, and Phase II facets, which are used for crushing food, tend to have very distinct microwear patterns. Long scratches dominate shearing facets as corresponding maxillary and mandibular cusps slide past each other. By contrast, compression facets form as the intercuspated teeth reach centric occlusion. Here, the cusps are tightly opposed created small compression fractures. Thus, current standard practices have observers documenting the type of occlusal wear facet they study (among other variables) to make sure their results are suitable for comparison.

However, many of the improvements in standardizing DMA are due to the fact that today it is increasingly automated, with digital micrographs being produced directly from the scanning electron microscope and then studied via software specifically designed for microwear analysis. The automation helps to ensure that variables such as magnification, feature classification, and size are appropriately controlled for when the features are quantified. In general, it is allowing more observers to view teeth in a uniform fashion, lowering the likelihood of interobserver discrepancies (Grine et al. 2002).

HYPOTHESIS

The hypothesis of this study was that the DMA profile would demonstrate that *P. compressus* was a browser. Determination of this was made by comparing the *P. compressus* percentage of pits and scratch widths to values exhibited by other extant and extinct grazers, browsers, and mixed diet animals. A relatively high percentage of pits and wider scratches were anticipated because these represent harder and more abrasive diets – conditions that are characteristic of browsers. If the DMA profile failed to suggest a browsing diet, then a dietary reassessment must be considered for this particular species.

METHODS

Molars from 10 individuals were used for this study, all of which are from the Megenity Cave site in southern Indiana. This site, located in Crawford County, has been excavated for nearly two decades by Ron Richards of the Indiana State Museum, and has produced by far the greatest number of *P. compressus* remains in the world. To date, the MNI (minimum numbers of individuals) is in excess of 500 and rises each year as excavations and analyses continue. Animals of all ages are present, and it is thought that the cave was used as a shelter. Most of the peccary remains were highly fragmented and commingled and were found throughout the cave in nearly every room and in nearly every stratum; the highest and lowest bone bearing levels were separated by approximately 7 m. Some peccary bones were dated to over 50,000 years ago, although those studied herein are approximately 25,000 years old and came from a single room within the cave (the Bat Room). The context of the remains used in the current study indicates that they entered the cave over time and do not represent a single contemporaneous group. Radiocarbon dates from the strata from which these teeth came range from 25,620 ± 100 to 24,420 ± 340 years BP. Thus, the sample includes individuals that are separated by as much as 1200 years. Despite their abundance, the teeth are considered highly fragile; and only a small sample was available for DMA. Moreover, the teeth used here were among the few that had not yet been coated with preservative, making them better suited for microwear analysis.

Molds and casts of the teeth were made following standard procedures (e.g., Teaford 1994). At the Indiana State Museum, the teeth were rinsed with a 95% ethanol solution, cleaned with a soft-bristled toothbrush, and allowed to air dry. Molds were made with a polyvinylsiloxane impression material, Coltene's President Jet Light Body. The impression material was placed directly on the teeth, forced from a dual cartridge through a mixing tip. Care was taken to guard against trapping air between the impression material and the dental surface. After approximately 10 min, the molds were removed and placed in labeled plastic bags where they were allowed to degas for a minimum of 24 h.

The cured molds were then rinsed with the ethanol solution to remove any dirt that may have adhered to the molding material, especially around the pericervical area. The molds were filled with Tap Plastics' 4 to 1 Super Hard Epoxy Resin to make the casts. The filled molds were then placed in a manual centrifuge for approximately 30 sec to force the resin into the deep recesses of the mold and to displace any air that may have been trapped between the two materials. The casts were allowed to cure overnight at room temperature.

The casts were prepared for scanning electron microscopy by mounting them to aluminum stubs with conductive silver paint and copper tape and coating them with approximately 200 Å of gold palladium. Coated casts were viewed at 500× magnification in a JEOL JSM-840 scanning electron microscope housed at the Electron Microscopy Laboratory in Agriculture at Purdue University, West Lafayette, Indiana.

Observations were made of mandibular molar Phase II wear facets. Attention was given to the Phase II facets because these are created at the greatest point of intercuspation and, therefore, should provide the most inclusive representation of the diet. Predominantly, these facets were found on the mesiobuccal aspect of the protoconids and were manifest as cusp-tip facets, although Phase II facets on the hypoconid were viewed on a few specimens that had poorly preserved protoconids.

Micrographs were taken of the facets and were imported into a semi-automated computer program specifically designed for the study of dental microwear (Microwear 3.0, Ungar 1995). The program allows the analyst to identify and measure each microwear feature. However, it automatically determines if the feature is a pit or a scratch.

The data generated were compared to those from a selection of herbivores described in published reports from extant grazers, browsers, and mixed feeders (Solounias et al. 1988; Solounias & Hayek 1993; Fortelius & Solounias 2000; Solounias & Semprebon 2002). These animals were categorized as grazers if their diet is comprised of at least 90% grass. Browsers are those that consume less than 10%

grass, and mixed feeders are those animals with intermediate percentages of grass in their diet (Fortelius & Solounias 2000).

The grazing group included: *Bison bison* (American bison), *Cervus duvauceli* (swamp deer), *Connochaetes taurinus* (wildebeest), *Hippotragus niger* (sable), *Kobus ellipsiprymnus* (common waterbuck) and *Tetracerus quadricornis* (chousingha). The browsing group consisted of: *Boocerus euryceros* (bongo), *Giraffa camelopardalis* (giraffe), *Litocranius walleri* (gerenuk), *Tragelaphus imberbis* (lesser kudu), *Tragelaphus strepsiceros* (greater kudu), and *Okapia johnstoni* (okapi). The mixed feeders were *Axis axis* (chital), *Gazella granti* (Grant's gazelle), and *Taurotragus oryx* (eland). The percentages of pits and mean scratch widths (Fig. 2) were computed for each dietary strategy (grazer, browser, and mixed feeder) using the means for each species published in Solounias & Hayek (1993).

The *P. compressus* percentage of pits and scratch width data were compared to those from the grazers, browsers, and mixed feeders in an effort to see if the peccary data aligned with a particular dietary strategy. Although the bulk of the data analysis was qualitative, a discriminate function analysis was conducted to see which dietary group *P. compressus* best represented and to what extent it typifies a particular dietary regime. In addition, the *P. compressus* data were compared to data from insectivorous animals, extant pigs, and to human foragers and agriculturists to see if any other insight could be gained into the Flat-headed Peccary diet.

RESULTS AND DISCUSSION

The reasonably good preservation of the molars meant that a large number of features could be detected, with each micrograph yielding an average of 207.20 features; of those, an average of 67.50 (32.58%) were pits and 139.70 (67.42%) were scratches. The average scratch width was 1.59 microns (see Table 1).

When compared to the grazer, browser, and mixed feeder data, the *P. compressus* percentage of pits was intermediate. It was impractical to display the data from all of the comparison species, but Fig. 3 shows pit percentage data from a subsample of 10 species as well as *P. compressus*. Its mean was much higher than the mean for the grazers of 19.07% and somewhat lower than the means for the browsers and the mixed feeders that were 47.08 and 38.55%, respectively (Table 2). The relative position of these means is consistent with the findings of Walker et al. (1978) who found more pits in browsers. When compared to the Solounias et al. (1988) and Solounias & Hayek (1993) data, the mean percentage of pits for *P. compressus* is higher than all but one grazer. However, it is lower than nearly all of the browser means. Only the giraffe, a dedicated leaf-browser, had a lower percentage of pits. The *P. compressus* pit percentage was close to the mixed-feeder mean, but the mixed-feeder values were highly variable.

Like the pit percentage data, the mean scratch width for *P. compressus* was intermediate (see Table 2). Figure 3 shows that *P. compressus*' values are neither sharply lower nor higher than those of the comparison species. Excluding *T. quadricornis*, which had by far the greatest scratch width of all studied species (2.84), the grazers tended to have narrower scratches than the browsers (because of its extreme mean scratch width and low sample size ($n = 6$) in Solounias & Hayek (1993). *Tetracerus quadricornis* has been omitted from all of the scratch width comparisons until more is known about the circumstances behind the remarkable widths of its microwear scratches). The grazer mean is 1.39 microns. The browser mean is 1.71 microns and the mixed feeder mean is 1.60 microns. Presumably, the grazers' teeth were being abraded by microscopic phytoliths within the comparatively soft grass blades. By contrast, the browsers were probably being exposed to harder plant parts that were more likely to create wider scratches as they were fragmented during mastication and drawn across occlusal surfaces.

The mean scratch width for *P. compressus* was closer to the values of the mixed feeders and browsers and exceeded the means for all but one of the grazing species. The *P. compressus* value was in the midrange for browsers, as three of the six browser species had higher scratch width means. Again, the *P. compressus* value was toward the middle of the mixed feeder group and was almost identical to the mixed feeder mean.

A bivariate plot shows a distinction between the grazers and browsers, with *P. compressus* in-between the two groups. The three mixed feeders have relatively consistent scratch widths, but their percentages of pits range from

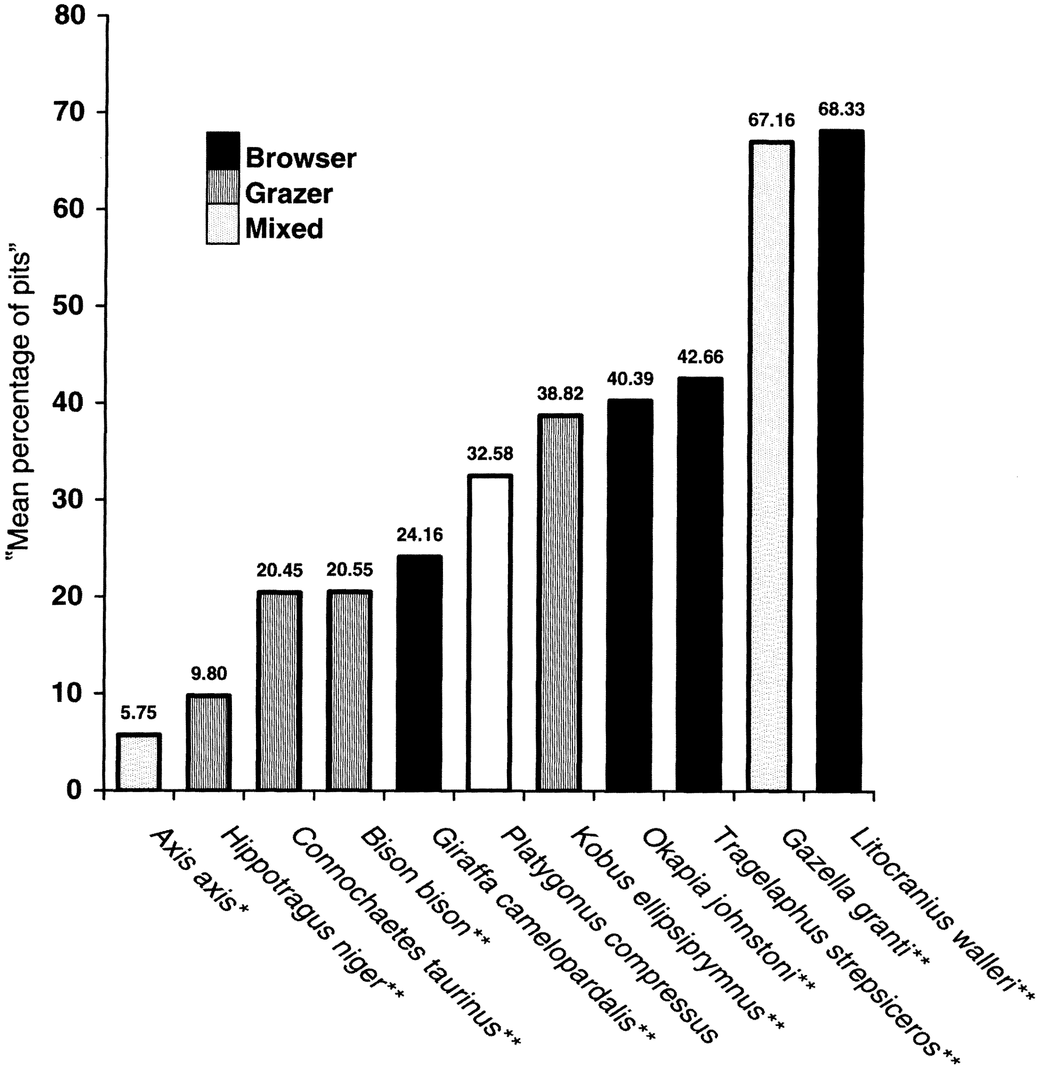

Figure 2.—Mean percentage of pits for *Platygonus compressus* and 10 other taxa. The single asterisk (*) indicates mixed feeder designation from Solounias & Semprebon (2002). The double asterisk (**) indicates data for these species are derived from Solounias & Hayek (1993).

among the highest to among the lowest values (Fig. 4). The *P. compressus* value is intermediate to grazing and browsing, but appears to be closer to the mixed feeders and browsers. A discriminant function analysis was run to determine if it could predict group membership for each of the browsers, grazers, and mixed feeders. It correctly placed all but one of the grazers and one of the browsers; however, it only placed one of the three mixed feeders appropriately. Therefore, the mixed feeder group was eliminated when *P. compressus* was

Table 1.—Summary statistics for *Platygonus compressus* dental microwear data ($n = 10$).

Variable	Mean	SE Mean	SD	Minimum	Maximum
Pit percentage	32.58	3.06	9.67	21.56	53.47
Scratch width (μm)	1.59	0.10	0.33	1.27	2.40

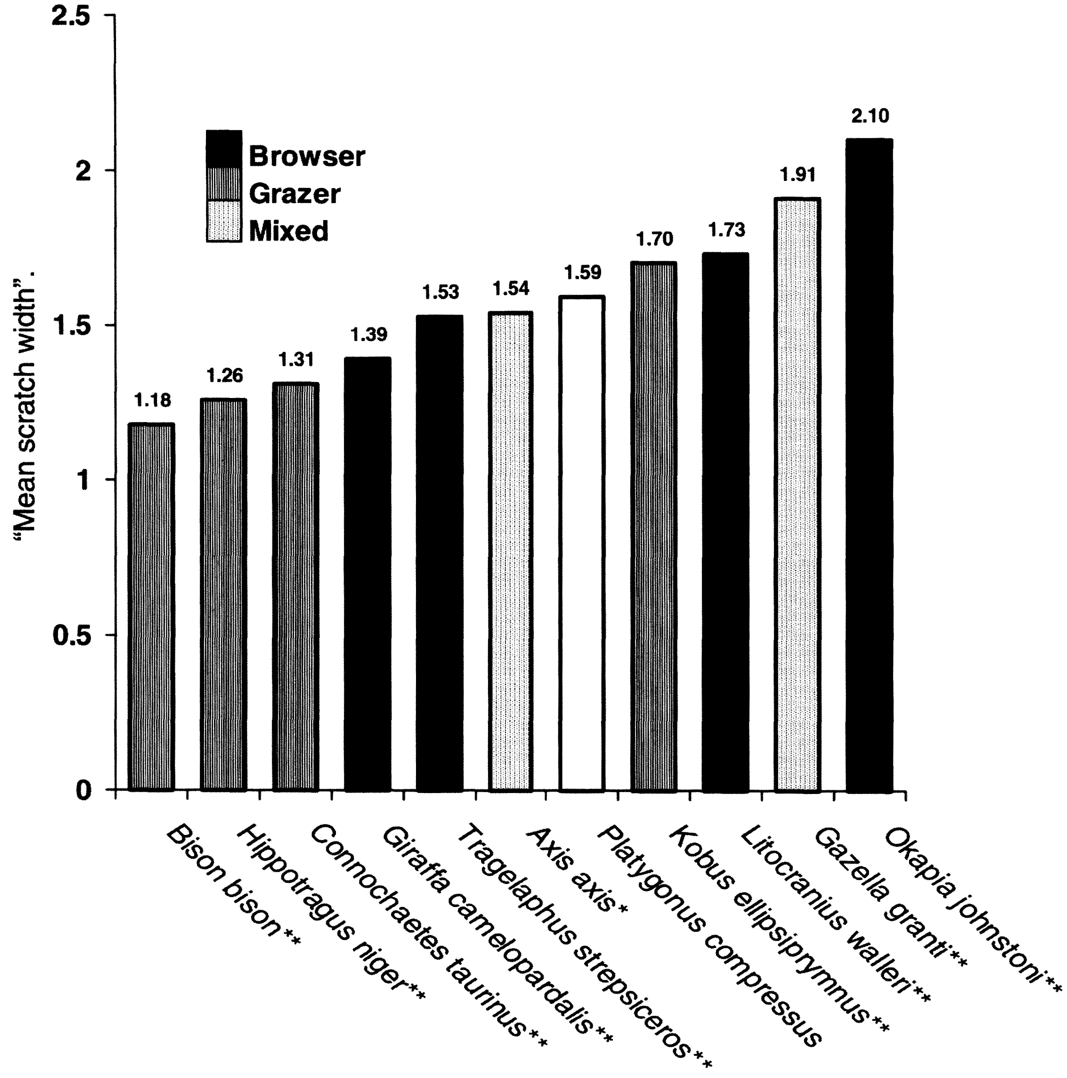

Figure 3.—Mean scratch width in microns for *Platygonus compressus* and 10 other taxa. The single asterisk (*) indicates mixed feeder designation from Solounias & Semprebon (2002). The double asterisk (**) indicates data for these species are derived from Solounias & Hayek (1993).

included in the analysis. A subsequent test that included *P. compressus* placed it in the browser category (posterior probability: 0.6148; typicality: 0.4046). While it is important not to overemphasize the result of the discriminate function since there were only two groups and two variables, it is worth noting that it is consistent with the qualitative assessment and bears a reasonably strong posterior probability.

Thus, the *P. compressus* had dental microwear that was more similar to that of the browsers than the grazers, even though its values were intermediate to the two. Perhaps later study of mixed feeders will show that there is a connection between them and *P. compressus* since both have microwear values that cluster toward the middle of the spectrum. In fact, a look at the *P. compressus* raw data may provide more evidence to support an association with mixed feeders. The range of variation within the *P. compressus* microwear variables was relatively high. From Table 2, one sees that the pit percentages for the ten peccary individuals are as low as 21.56 and as high as 53.47, giving a range of 31.91. This intra-specific range is less than the inter-specific ranges for

Table 2.—Summary of comparison species. Pit percentage was determined using data from Solounias et al. (1988) and Solounias & Hayek (1993), while the scratch width data were taken directly from those sources. The grazer scratch width mean does not include the *Tetracerus quadricornis* value.

Common name	Scientific name	Pit %	Scratch width
Browsers			
bongo	*B. euryceros*	52.47	1.94
gerenuk	*L. walleri*	68.33	1.73
lesser kudu	*T. imberbis*	54.46	1.56
greater kudu	*T. strepsiceros*	42.66	1.53
giraffe	*G. camelopardalis*	24.16	1.39
okapi	*O. johnstoni*	40.39	2.10
	Means:	47.08	1.71
Grazers			
wildebeest	*C. taurinus*	20.45	1.31
waterbuck	*K. ellipsiprymnus*	39.82	1.70
chousingha	*T. quadricornis*	18.83	2.84
bison	*B. bison*	20.55	1.18
sable	*H. niger*	9.80	1.26
swamp deer	*C. duvauceli*	4.95	1.52
	Means:	19.07	1.39
Mixed feeders			
chital	*A. axis*	5.75	1.54
gazelle	*G. granti*	67.16	1.91
eland	*T. oryx*	42.75	1.34
	Means:	38.55	1.60

the grazers (34.87), browsers (44.17), and mixed feeders (61.41) and probably is not alarming. However, the *P. compressus* scratch width range tells a different story. *Platygonus compressus* had a scratch width range of 1.13 µm (1.27–2.40 µm). This intra-specific range is much greater than the inter-specific ranges seen in the mixed feeders (0.20 µm), grazers (0.52 µm), and browsers (0.71 µm). Clearly, some individual Flat-headed Peccaries had very wide scratches while others had the opposite. It may be that the *P. compressus* dietary variation shown here stems from animals dying during different times of the year when different resources were available. In any event, the wide range of scratch widths indicates that the *P. compressus* diet was rather diverse.

Follow-up comparisons.—Most of the comparisons thus far have been to hypsodont herbivores. Another avenue of comparison was that between *P. compressus* and brachydont/bunodont animals like other suids. Unfortunately, there are very few microwear data available from suids; and the author is unaware of any microwear studies on living peccary. One study by Solounias & Semprebon (2002) used different methods than those employed in the current study to view and compute the microwear of two browsing suids, *Hylochoerus meinertzhageni* (the giant forest hog) and *Potamochoerus porcus* (the African bush pig). Because of their alternate means of quantifying microwear, comparing their findings to the *P. compressus* data here can only be accomplished rather informally.

According to Solounias & Semprebon (2002) both *P. porcus* and *H. meinertzhageni* have high percentages of pits, although *P. porcus* has more and larger pits and larger scratches. In contrast, *H. meinertzhageni* microwear generally consists of small pits and many fine scratches. *Platygonus compressus* has many pits, but qualitatively they are not particularly large. Its scratches are both fine and wide. As such, it seems that the *P. compressus* microwear is perhaps somewhat more like that of *H. meinertzhageni.*

Potamochoerus porcus is a rooter, an animal that uses its rostrum to root up plants, while *H. meinertzhageni* is not. The authors state that more pits, larger pits, and larger scratches may be associated with rooting. At this point the *P. compressus* data do not imply that it was a predominant rooter. However, the idea that it

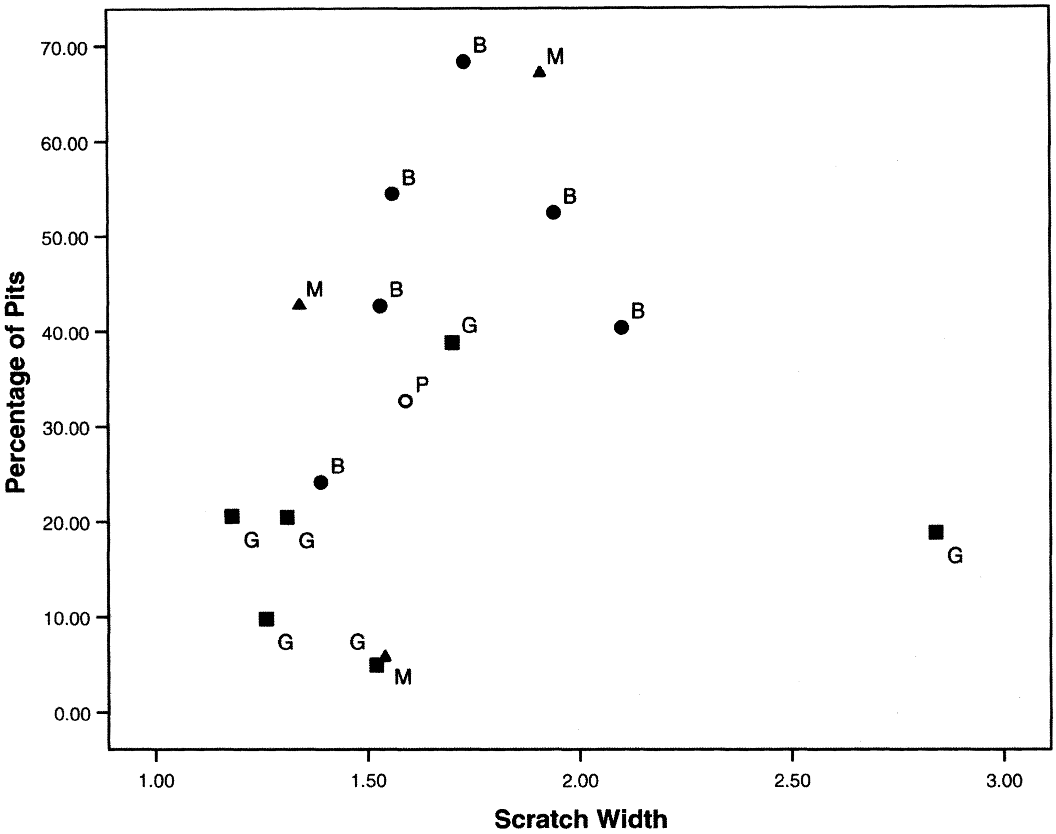

Figure 4.—Scatterplot of herbivore microwear data. Data for all 15 species are from Solounias & Hayek (1993). Scratch widths are in microns. G = grazer, B = browser, M = mixed feeder, P = *Platygonus compressus.*

engaged in some rooting cannot be completely disregarded as dental microwear is but one indicator of rooting. In other words, if it were a rooter, it did so to a much less extent than what is seen in *P. porcus.*

Omnivory is certainly a dietary strategy that also needs to be addressed when studying peccaries because many extant suids are omnivorous. Vertebrate soft tissues themselves are not hard enough to scratch or pit teeth, although grit and bone fragments are capable of doing so (e.g., Strait 1993). Invertebrate exoskeletons and shells will scratch and pit teeth. Strait (1993) found a higher percentage of pits among faunivorous primates and bats that ate hard objects (such as bones and dense invertebrate exoskeletons) than among faunivorous primates and bats that ate soft objects (such as caterpillars). Summarizing Strait's (1993) data, the hard-object feeders mean percentage of pits is 49.98 while the mean for the soft-object feeders is 32.43. Thus, if *P. compressus* consumed any fauna at all, it seems unlikely that they routinely ate hard animal parts like bones or dense exoskeletons.

Another option for qualitative study is to compare *P. compressus* to humans. Like suids, humans have brachydont/bunodont teeth. A study of prehistoric humans from Indiana found that foragers who lived approximately 3000–5000 years ago (during what is called the Late Archaic Period) had a pit percentage of 18.8 percent and scratch widths averaging 1.8 µm. Humans that lived a little more than a millennium later (during the Middle Woodland Period) were just beginning to supplement their diet with horticulturally derived foods. Their average pit percentage was 26.4 and average scratch width was 1.4 µm (Schmidt 2001). Later peoples tended to have even lower percentages of pits and narrower scratches. By just 700 years ago (during the Mississippian

Period) humans had a pit percentage under 15 and scratch widths no greater than one micron (Schmidt 1998). Compared to the humans, the *P. compressus* pit percentage was high, even higher than that for the very nut/seed-reliant horticulturalists of the Middle Woodland. The *P. compressus* scratch width was almost as wide as that of the Late Archaic people who presumably had a great deal of sand in their diet as they harvested riverine resources like mussels and subterranean plants like tubers. This comparison suggested the *P. compressus* diet included sizeable contaminants that probably came directly from the ground (e.g., sand) rather than exclusively from microscopic plant-bound phytoliths.

Recent years have seen a major advance in DMA. This new approach, called dental texture analysis (DTA) uses a white light confocal imaging profiler to three-dimensionally re-create tooth surfaces at submicron resolutions. The resulting data clouds are analyzed using scale-sensitive fractal analysis software, which calculates surface complexity and homogeneity. This approach has significant advantages over SEM-based dental microwear including automated data collection and the ability to study data in the z-dimension. Unfortunately, currently only one dental texture lab exists in the US, and only a handful of DTA studies have yet commenced (e.g., Scott et al. 2005; Ungar et al 2006; Merceron et al. 2006; El Zaatari 2007, 2008; Zolnierz & Schmidt 2007, 2008). As this approach becomes more common, more comparative data that are germane to the peccary study will become available. Thus, it is hoped that DTA of Flat-headed Peccary will commence in the near future.

The dental microwear profile of *P. compressus* indicated a diet that was moderately hard and moderately abrasive. In all likelihood, it was not grazing-based because the percentage of pits and mean scratch widths are more similar to browsers. However, *P. compressus*, like browsers in general, shared some characteristics with mixed feeders and overall the *P. compressus* dental microwear profile was intermediate. Neither microwear variable was extremely high or low when compared to various herbivores. Therefore, it is appropriate to consider *P. compressus* a browser until an approach that is better at distinguishing browsers and mixed feeders (i.e., Solounias & Semprebon 2002) is employed. It is unclear if *P. compressus* engaged in any faunivory; but if it did, it is unlikely that it consumed significant amounts of hard animal parts.

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