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REPORTS

Notes on Paleofecal Materials from Chapman Caves No. 1 (CA-INY-1534A), Naval Air Weapons Station (NAWS), China Lake, California

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Two coprolites recovered from the excavations at Chapman Caves 1 (CA-INY-1534A) were analyzed to determine their origins, and if possible to obtain data on human resource use at the site. Both specimens were determined to probably be canid in origin, but their presence within the cultural deposit may suggest they were from dogs belonging to the human occupants of the site. In addition, the results of protein residue analysis from three other coprolites found on the surface of the site are reported.

Chapman Caves (CA-INY-1534), located in upper Renegade Canyon in the Coso Range of eastern California, on the North Range of the Naval Air Weapons Station (NAWS) China Lake (Fig. 1), was excavated by Hillebrand (1972) as part of his investigations of the Coso Range. Hillebrand recovered some 45 coprolites (preserved fecal material) from the deposit at Chapman Cave 1 but did not discuss them in his report on the site, perhaps due to uncertainty as to their being of human origin. Here we report on the analysis of two of those specimens.

Preserved fecal material, or paleofeces, can be a source of significant information regarding prehistoric diet, including food and condiments (e.g., Sutton and Reinhard 1995; Trigg et al. 1994), nutrition (e.g., Cummings 1994), health (e.g., Reinhard and Bryant

1992), behavior (e.g., Reinhard and Bryant 1992:270–273), pharmacology (e.g., Hillman 1986:103; Reinhard 1993; Reinhard et al. 1991; Sobolik and Gerick 1992; Trigg et al. 1994), and processing technology (e.g., Callen 1967; Robins et al. 1986; Rylander 1994). Recent reviews of paleofecal studies are available in Bryant and Dean (2006) and Sutton et al. (2010).

Analysis of the two specimens suggests that they are canid in origin. Nevertheless, coprolites from nonhuman species associated with humans, such as dogs, may contain direct information about human/animal interactions, such as what kinds of foods the animals may have been fed and their general health. If the animals were coprophagous, as dogs tend to be, their own coprolites could contain indirect data on the diet and health of the associated humans (Hopkins et al. 1997; Traub et al. 2002). In this case, the two analyzed canid coprolites contain data relevant to the human occupation of the site, including information on human diet and fuel selection.

SITE DESCRIPTION

The Chapman Caves site (CA-INY-1534) was discovered in 1965 by Thomas Chapman of China Lake, while he was hunting chukar with his father (Hillebrand 1972:30–32). Two small caves or rockshelters were found, both at the foot of a basalt cliff in collapsed lava tubes. Cave 1 (CA-INY-1534A; Fig. 2) is about 6 m. (20 ft.) deep and 4.5 m. (15 ft.) wide at its mouth (Hillebrand 1972:30). Cave 2 (CA-INY-1534B) is located approximately 45 m. (150 ft.) southwest of Cave 1 and measures 2.5 m. (8 ft.) deep and 6 m. (20 ft.) wide (Hillebrand 1972:32). A single petroglyph of a bighorn sheep was found at the entrance of Cave 1, and one of us (LaPierre) noted a panel of painted “dots” near Cave 2. Other rock art is known to be nearby (Hillebrand 1972:30).

The site is located at approximately 1,743 m. (5,720 ft.) amsl. The vegetation in the immediate vicinity of the site (Keeler-Wolf 2007; MacMahon 1985; Munz 1974; Rowlands et al. 1982; Vasek and Barbour 1977) includes Joshua trees (*Yucca brevifolia*), sagebrush (*Artemisia* spp.), blackbrush (*Coleogyne ramosissima*), shortspine

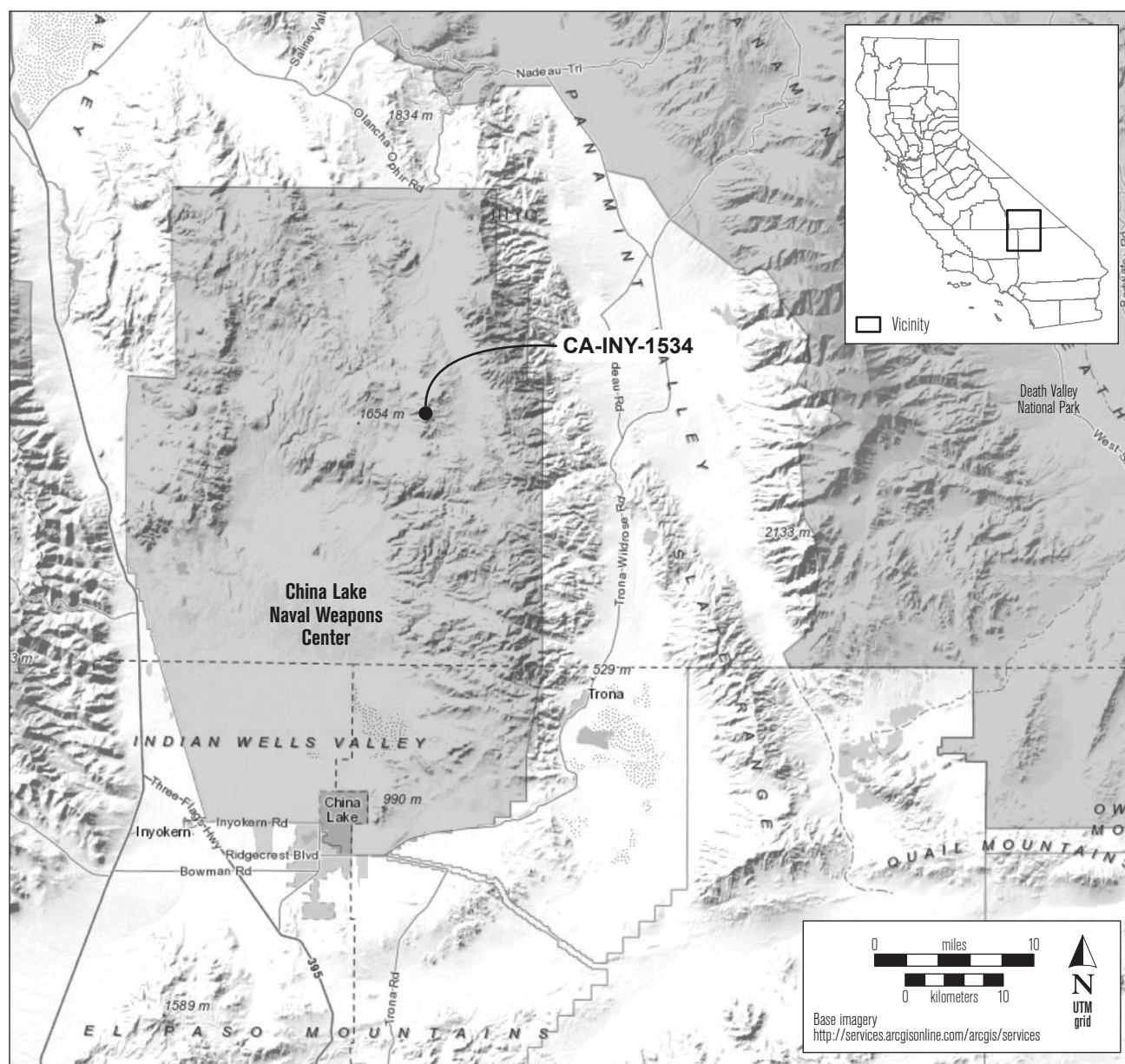


Figure 1. Location of the Chapman Caves site (CA-INY-1534) on the North Range of the Naval Air Weapons Station, China Lake, southeastern California.

horsebrush (*Tetradymia spinosa*), and mormon tea (*Ephedra* spp.). Various other plants such as jumping cholla (*Opuntia bigelovii*), desert trumpet (*Eriogonum inflatum*), and ricegrass (*Oryzopsis hymenoides*) are found nearby. At lower elevations just to the south, a creosote scrub community is present that includes creosote (*Larrea tridentata*), bursage (*Ambrosia dumosa*), sagebrush (*Artemisia spinescens*), desert holly (*Atriplex hymenelytra*), ricegrass (*Oryzopsis hymenoides*), ephedra (*Ephedra nevadensis*), and other varieties of *Atriplex*. A

number of these plants were used ethnographically by the inhabitants of the region for food, medicine, and utilitarian purposes (e.g., Bean and Saubel 1972; Zigmond 1981).

INVESTIGATIONS AT THE SITE

Both caves were investigated by Hillebrand (1972) as part of his research in the Coso region (Hillebrand 1972, 1974). Phil Wilke made some additional collections at Cave 1 in 1980, and Gilreath (2000) conducted an inventory of the



Figure 2. View of Chapman Caves 1 (CA-INY-1534A), looking northwest.

site materials, analyzed the skeletal remains, and obtained additional dating information from the site.

Cave 1

At Cave 1, a variety of materials were observed on the surface, including manos, metates, perishables (basketry and arrow main- and foreshafts), historical items, pottery, projectile points, and debitage (Hillebrand 1972:31–32). Bedrock mortars and a low rock “wall” within the cave were also noted. Hillebrand excavated eight units or pits (generally five-foot squares in 6-inch levels) in Cave 1 (Fig. 3) and discovered a deposit some 2.0 m. (6 ft.) deep. A number of features were found, including four hearths, four cache pits, and five human burials. In addition, considerable prehistoric material was found, summarized in Gilreath (2000:Table 2). Hillebrand (1972:Table 34) obtained 37 obsidian hydration readings from Cave 1, ranging between 1.5 and 14.1 μm . Previous studies have included an analysis of burials (Zelson 2000), of basketry (Polanich 2000), and of a collection of artifacts by Wilke (as reported in Gilreath 2000:9, Table 2). Three apparent

human coprolites collected by Wilke were subjected to protein residue analysis, with one returning a positive for rat (Parr 2005).

Three radiocarbon dates and 10 additional obsidian hydration readings were obtained by Gilreath (2000). The radiocarbon dates were obtained on charcoal from the midden, one from the upper portion of the deposit (580 ± 70 RCYBP) and two from the lower portion (320 ± 60 and 760 ± 60 RCYBP) (Gilreath 2000:27). The 10 new obsidian hydration readings range between 3.0 and 9.8 μm . (Gilreath 2000:Table 4). These data, coupled with the projectile point data, suggest a use of Cave 1 as early as 4,000 B.P. but primarily after about 1,500 B.P. (Gilreath 2000:32).

Cave 2

At Cave 2, only a metate and some debitage were seen on the surface (Hillebrand 1972:32). Initially, a single unit was excavated in Cave 2, but upon discovery of a burial feature, two additional units were excavated (Hillebrand 1972:41). The cultural deposit was 60 cm. (2 ft.) deep. The

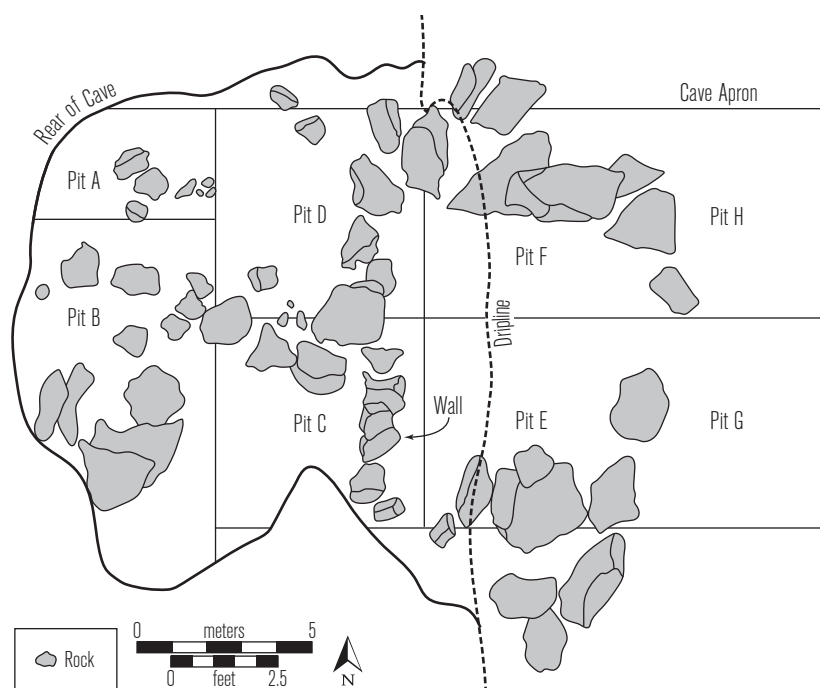


Figure 3. Map of Chapman Caves 1 (CA-INY-1534A) showing the excavation units/pits (redrawn from Hillebrand 1972: Fig. 1).

recovered items of material culture primarily consisted of flaked stone artifacts (points, bifaces, and debitage) and beads (Gilreath 2000:Table 7). Hillebrand (1972:Table 34) obtained 36 obsidian hydration readings from Cave 2, with values ranging between 1.2 and 6.9 μm . The three burials from the cave were described by Zelson (2000).

Gilreath (2000:50) obtained two radiocarbon dates from Cave 2, one (230 ± 60 RCYBP) from the upper portion of the deposit and another (470 ± 80 RCYBP) from the bottom of the deposit. Also, additional obsidian hydration data from Cave 2 ($N=10$; Gilreath 2000:Table 10) were all below 3.8 μm . These data clearly indicate that the use of Cave 2 dated after about 750 B.P. (Gilreath 2000:54).

THE CURRENT INVESTIGATION

Hillebrand (1972) recovered 45 items from Cave 1 that were classified as coprolites (Gilreath 2000:Table 2), and Wilke recovered three more specimens from the surface of Cave 1 (Gilreath 2000:Table 2). Two of the coprolite specimens recovered by Hillebrand were selected for analysis because their morphology was similar to that of human coprolites. The first specimen (Cat. No. 633) was

found in the 2.5 to 3.0-foot level of Pit D (see Fig. 3) and weighed 32 g. The second specimen (Cat. No. 699) was found just below the first, in the 3.0 to 3.5-foot level of Pit D, and weighed 30.6 g. Approximately one-half of each specimen was submitted for micro-constituent analyses. Two radiocarbon dates were also obtained from the second specimen.

The Analyses

The two coprolite specimens were submitted to PaleoResearch Institute, in Golden, Colorado, for pollen, phytolith, starch, parasite, macrobotanical analyses, and radiocarbon dating. The methods employed in those analyses were standard, as described by Cummings et al. (2012).

Each of the specimens was rehydrated and each yielded a light, yellowish-colored liquid, indicating that they were probably canid in origin. In addition, canid hairs were found in both samples. The results of the analysis by Cummings et al. (2012) are presented in Table 1.

Specimen 633. Specimen 633 contained a considerable variety of pollen, representing local vegetation. However, the phytolith record was dominated by a single morphological type of cool season grass (Pooideae), suggesting that a single species was consumed. A single starch grain was recovered, probably representing a grass seed.

The recovered macrobotanical material consisted mostly of unidentified plant debris. Small fragments of *Artemisia* and *Atriplex/Krascheninnokovia* charcoal were found, suggesting that sagebrush and saltbush/winterfat wood was burned, likely in hearths (otherwise charcoal would not be expected), and that this material had adhered to the food consumed by the animal.

Other materials recovered included several small mammal bones and numerous rodent hair fragments, suggestive of the consumption of one or more rodents. In addition, the sample contained canid hairs, deteriorated hair fragments morphologically consistent with rodents, and a few unidentified hairs. Finally, the specimen

Table 1

RESULTS OF ANALYSES OF TWO COPROLITES FROM CHAPMAN CAVE 1 (CA-INY-1534A)

Analysis/Specimen	Cat. No. 633 (Pit D, 2.5 to 3.0 ft.)	Cat. No. 699 (Pit D, 3.0-3.5 ft.)
Pollen	<i>Pinus</i> , <i>Artemisia</i> , Low-spine Asteraceae, High-spine Asteraceae, Cheno-am, <i>Collomia</i> -type, <i>Ephedra nevadensis</i> -type, <i>Eriogonum</i> , <i>Persicaria</i> , Fabaceae, Poaceae, and Rosaceae.	<i>Pinus</i> , <i>Artemisia</i> , Low-spine Asteraceae, High-spine Asteraceae, Cheno-am, <i>Ephedra nevadensis</i> -type, <i>Eriogonum</i> , Fabaceae, Poaceae.
Phytolith	Only cool season grasses noted, mostly from trapeziform sinuates from the subfamily Pooideae.	Mostly cool season C ₃ metabolism grasses (e.g., Pooideae and Stipeae), some warm season C ₄ grasses (cf. Panicoideae and Chloridoideae), presence of numerous pennate diatoms, a few centric and filamentous diatoms, and sponge spicules.
Starch	Angular starch, probably representing a grass seed.	None noted.
Macrobotanical	Unidentified plant debris, small fragments of <i>Artemisia</i> and charcoal from <i>Atriplex</i> or <i>Krascheninnokovia</i> , one small unidentified hardwood twig fragment.	A few uncharred and partially charred Cactaceae areole fragments, a moderate amount of vascular bundle fragments of a monocot, such as grass, numerous fragments of unidentified plant debris, a few fragments of <i>Atriplex</i> or <i>Krascheninnokovia</i> charcoal plus abundant microscopic charcoal.
Other Constituents	Several small mammal bone fragments, numerous rodent hair fragments, a few canid hairs, and some unidentified hairs, unidentified insect parts, rock.	Canid hair.
Parasites	Contained whipworms (<i>Trichuris vulpis</i>).	
Origin	Probably canid.	Probably canid.

Data summarized from Cummings et al. (2012:Tables 1–4).

contained whipworms (*Trichuris vulpis*), a parasitic species common in canids. The specimen was not dated.

In sum, Specimen 633 likely represents a coprolite from a canid infected with an endoparasite. The presence of charcoal in the specimen can be explained by contamination from site soils.

Specimen 699. Specimen 699 contained types of pollen similar to those in the previous sample, but lacked *Collomia*-type, *Persicaria*, and Rosaceae types (Table 1), representing local vegetation. The phytolith record was dominated by cool season C₃ grasses (mostly Pooideae and Stipeae). However, phytoliths from warm season C₄ grasses (Panicoideae and Chloridoideae) also were present, suggesting that these grasses were consumed in early summer. The phytoliths appear to have come from leaves and woody parts rather than seeds. Numerous diatoms and sponge spicules, indicative of water consumption, were also present. No starch grains were noted.

Recovered macrobotanical materials included a few uncharred and incompletely charred Cactaceae areole fragments, likely from fruits or pads (Cummings et al. 2012:8), indicating that cactus had been consumed. No cactus seeds were recovered (assuming that if areole were preserved, so would seeds be if any were present),

suggesting that the cactus pads and not the fruits were consumed.

In addition, fragments of a monocot, such as a grass, were found, along with numerous fragments of unidentified plant debris. A few fragments of charcoal from *Atriplex*/*Krascheninnokovia* suggest the burning of saltbush or winterfat wood, probably in hearths. Microscopic charcoal was particularly abundant. Fungal spores (unidentified) were also present in the specimen. Other materials found in the sample included canid hairs but no other faunal remains.

Two AMS radiocarbon dates were obtained on Specimen 699 (Cummings et al. 2012). The first date was obtained on two partially charred Cactaceae areole fragments, and they returned a date of 700±20 RCYBP (676 to 663 cal B.P.). A single fragment of *Atriplex*/*Krascheninnokovia* charcoal was also dated and returned a date of 910±20 RCYBP (894 to 801 cal B.P.). This earlier date may be derived from “old” charcoal adhering to the sample, and it seems probable that the more recent date reflects the real age of the specimen. Both results are consistent with previously reported chronometric information indicating that the use of the cave primarily post-dates 1,500 B.P. (Gilreath 2000:32).

This coprolite is probably canid in origin. However, the presence of charred cactus areole fragments, probably from pads, suggests that the canid had consumed cactus pads brought to the site by humans.

DISCUSSION

The analysis of two apparent canid coprolites from Chapman Cave 1 provided some interesting results. The combined pollen, phytolith, and macrobotanical data indicate that at about 670 B.P., the vegetation regime was similar to that of today and that the inhabitants of the cave utilized the local flora. This suggests that the modern climate was established at least by the time the Medieval Climatic Anomaly is thought to have ended (e.g., Lamb 1965; also see Anderson and Smith 1991; Gardner 2007; Graumlich 1993; and Jones et al. 1999).

The presence of charred cactus areole (pad?) fragments in Specimen 699 suggests that the canid responsible for that specimen had consumed foods processed by humans, or that it had consumed human feces. The charring of the areole indicates that it was processed by humans and not eaten “raw” off a cactus plant by a canid.

Several possibilities present themselves as explanations for this pattern. First, it is possible that the responsible canid was a dog living with the human occupants of the cave that was fed or scavenged cooked cactus. Second, as dogs are known to be coprophagous (Hopkins et al. 1997; Traub et al. 2002), a dog living with humans may have consumed human coprolites that contained cactus remains. Third, it is possible that a coyote consumed human coprolites during a time when the cave was unoccupied by humans.

Data from canids (dogs) have been used as a proxy for human diet and health. This “canine surrogacy approach” was reviewed and detailed by Guiry (2012, 2013; Guiry and Grimes 2013), who summarized a number of studies involving dogs as proxies, including the use of stable isotopes from bone, hair, and enamel. In addition, information regarding human/dog interactions, such as dependence, service, and even the use of dogs as food may be gained from these types of data. For example, Cannon et al. (1999) obtained stable isotope data from dog remains from the Namu site in coastal British Columbia to demonstrate that dogs were eating

salmon as early as 7,000 B.P., suggesting that humans were also using that resource.

The data from Chapman Cave comprise a further example of this research strategy. The presence of processed cactus in canid feces from Chapman Cave No. 1 is used as proxy data to indicate that people were using cactus some 670 years ago. This finding adds to an understanding of resource availability and use, despite a general absence of data on cactus in the regional ethnographic literature (e.g., Steward 1938; Thomas et al. 1986; Zigmond 1981, 1986). In addition, the presence of charcoal from *Atriplex/Krascheninnokovia* indicates that saltbush or winterfat wood was probably used as fuel.

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