Brief Communication: Beyond the South African cave paradigm—*Australopithecus africanus* from Plio–Pleistocene paleosol deposits at Taung

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ABSTRACT Following the discovery of the "Taung Child" (*Australopithecus africanus*) in 1924 in the Buxton-Norlim Limeworks near Taung, the fossil-bearing deposits associated with the Dart and Hrdlička pinnacles have been interpreted as the mined remnants of cave sediments that formed within the Plio–Pleistocene Thabaseek Tufa: either as a younger cave-fill or as contemporaneous carapace caves. When combined with the Plio–Pleistocene dolomitic cave deposits from the "Cradle of Humankind," a rather restricted view emerges that South African early hominins derived from cave deposits, whereas those of east and central Africa are derived from fluvio-lacustrine and paleosol deposits. We undertook a sedimentological and paleomagnetic analysis of the pink-colored deposit (PCS) from which the "Taung Child" is purported to have derived and demonstrate that it is a calcrete, a carbonate-rich pedogenic sediment, which formed on the paleo-land surface. The deposit extends 100 s of meters laterally beyond the Dart and Hrdlička Pinnacles where it is interbedded with the Thabaseek Tufa, indicating multiple episodes of calcrete development and tufa growth. The presence of in situ rhizoconcretions and insect trace fossils (*Celliforma* sp. and *Coprinisphaera* sp.) and the distinctive carbonate microfabric confirm that the pink deposit is a pedogenic calcrete, not a calcified cave sediment. Paleomagnetic and stratigraphic evidence indicates that a second, reversed polarity, fossil-bearing deposit (YRSS) is a younger fissure-fill formed within a solutional cavity of the normal polarity tufa and pink calcrete (PCS). These observations have implications for the dating, environment, and taphonomy of the site, and increase the likelihood of future fossil discoveries within the Buxton-Norlim Limeworks. Am J Phys Anthropol 151:316–324, 2013. © 2013 Wiley Periodicals, Inc.

The surficial deposits of the Kalahari basin are characterized by the sandstones, calcretes, ferricretes, and pan sediments of the Kalahari Group, which are home to some of the thickest and most extensive calcrete deposits in the world (Goudie, 1973; Watts, 1980). Kalahari Group sediments (Fig. 1a) can be in excess of 100 m thick (Netterberg, 1980); however, poor exposure and poor dating has hampered the development of a regional lithostratigraphy (Haddon, 2000). Calcretes occur at numerous stratigraphic levels throughout the Kalahari Group and are often found interbedded with fluvial and/or pan deposits (Thomas and Shaw, 1991). At the southeast margin of the Kalahari, in the North West Province of South Africa, the dolomitic Ghaap Plateau forms an east–west trending escarpment at the boundary with quartzites and slates of the Precambrian Transvaal Supergroup. Groundwater exits the dolomite in a series of springs along the Ghaap escarpment, forming complex sequences of tufa deposits including waterfall tufas and carapaces that accumulate over the underlying bedrock and surficial deposits (Butzer et al., 1978) which often contain fossils (Peabody, 1954; Curnoe et al., 2005). Such deposits include the Buxton-Norlim Limeworks, which is located on the northeast escarpment edge of the Ghaap Plateau, 15 km SW of Taung (Fig. 1a), and exposes an extensive sequence of tufa deposits extending from the late Pliocene to the Holocene. This limeworks (often only referred to as "Taung" or "Taungs" in early literature) was the location of the first hominin fossil found in South Africa in 1924, the "Taung Child" *Australopithecus africanus* (Dart, 1925), as well as numerous other fossil and archaeological deposits potentially dating from

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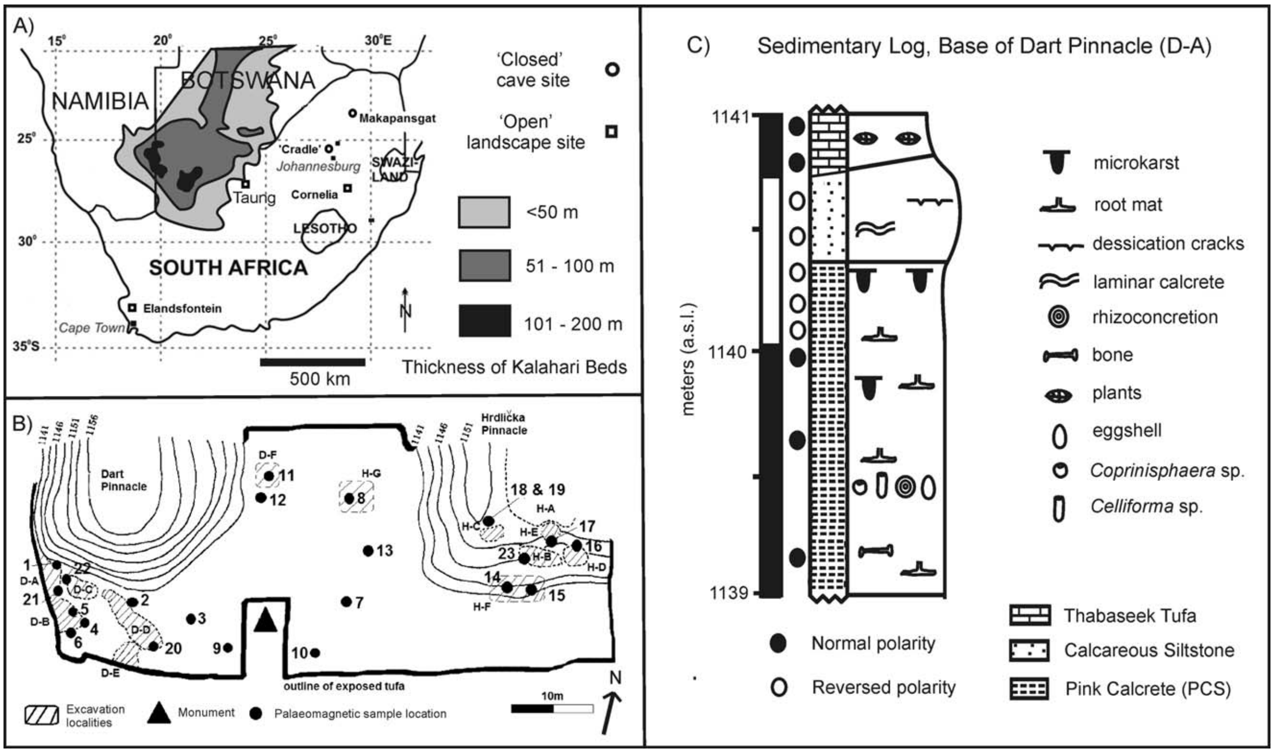

Fig. 1. (**a**) Location of the Buxton-Norlim Limeworks (Taung) in relation to other cave and land surface hominin localities in South Africa. The thickness and extent of the Tertiary Kalahari Group sediments are indicated (from Thomas and Shaw, 1991). (**b**) The location of outcrops (dotted lines) and sampling localities around the Dart and Hrdlička Pinnacles, Buxton-Norlim Limeworks (after McKee et al., 1995). (**c**) Sedimentological log and magnetostratigraphy at the base of the Dart Pinnacle (excavation locality, D-A).

the Pliocene to the Holocene (Peabody, 1954; McKee, 1994).

The limeworks commenced its quarrying operations in 1916 and by 1919 the blasting had unearthed a number of fossil-bearing deposits (Wybergh, 1920; Haughton, 1925; McKee, 1994). On the instruction of the director of the quarry company, two pinnacles were left in place on either side of the fossil deposit and slightly to the north of the suspected discovery site (Peabody, 1954; Partridge, 2000; Fig. 1b). The western pinnacle is known as the "Dart Pinnacle" (Tobias et al., 1993) and has been previously referred to as the "Australopithecus Pinnacle" by some authors (Partridge et al., 1991; Partridge, 2000). The more eastern pinnacle is named after Aleš Hrdlička who visited the site soon after the "Taung Child" discovery in 1925 and who attempted to excavate baboon fossils from this pinnacle although only one more complete specimen was removed Hrdlička (1925). Subsequently, Young (1925), Cipriani (1928), Broom (1934), and Peabody (1954) all made a number of trips to the Taung fossil sites, collecting sporadically from a number of deposits, as have later authors (McKee, 1994). All agreed that the exact provenience of the *A. africanus* specimen had been lost during mining activities.

Further excavations into the Hrdlička Pinnacle by the University of the Witwatersrand (under the direction of Philip Tobias) as well as at the base of the Dart Pinnacle took place in 1988 by Toussaint and McKee and by McKee from 1989 to 1993 (McKee and Tobias, 1990, 1994). Excavations and examination of bore cores by Partridge (Partridge et al., 1991; Tobias et al., 1993) indicated that two lithologies occur across the Dart and Hrdlička Pinnacles. Tobias et al. (1993) described the first lithology as a pale reddish brown to pink clay and siltstone (PCS aka "Pink Fill") and the second as a yellowish-red sand and siltstone (YRSS aka "Red Fill"). One of the key findings of this study was that the PCS deposits at the base of the Dart Pinnacle were sedimentologically similar to the matrix of the "Taung Child" and contained similar fossil eggshell and crab remains (Partridge et al., 1991; Tobias et al., 1993). This work demonstrated that the PCS deposits were surviving remnants of the deposit from which the "Taung Child" was recovered (McKee, 1993a,b, 1994; McKee and Tobias, 1994).

Since the discovery of the "Taung Child" in 1924 (Dart, 1925) and the initial sedimentological study of Young (1925), the deposits associated with the Dart and Hrdlička pinnacles have been interpreted as cave sediments that formed within the Plio–Pleistocene Thabaseek Tufa: either as a younger cave-fill or as contemporaneous carapace caves (Peabody, 1954; Butzer, 1974; McKee, 1993a,b; McKee and Tobias, 1994; McKee, 2010). When combined with the Plio–Pleistocene dolomitic cave deposits from the "Cradle of Humankind" (Gauteng Province) and Makapansgat Caves (Limpopo Province; Herries et al., 2010; Fig. 1a), a rather restricted pattern of depositional environments and taphonomy emerges that South African early hominins are derived from cave deposits, whereas those of east and central African are derived from fluvio-lacustrine deposits.

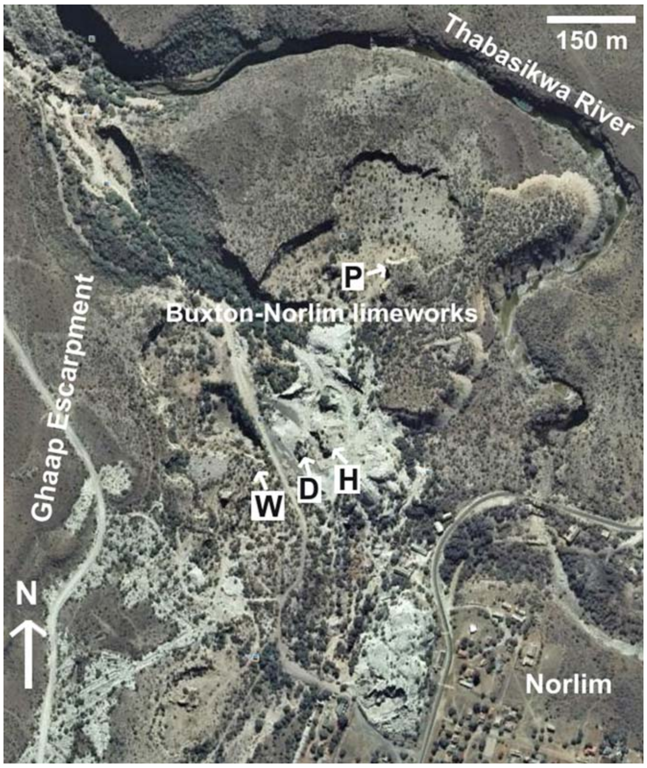

Fig. 2. Satellite Image of the Buxton-Norlim Limeworks near Taung (courtesy of Google Earth^{TM}), showing the outcrop localities of the Pink Calcrete (PCS). D, Dart Pinnacle; H, Hrdlička Pinnacle; W, Western Outcrop; P, Peabody Pinnacle. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

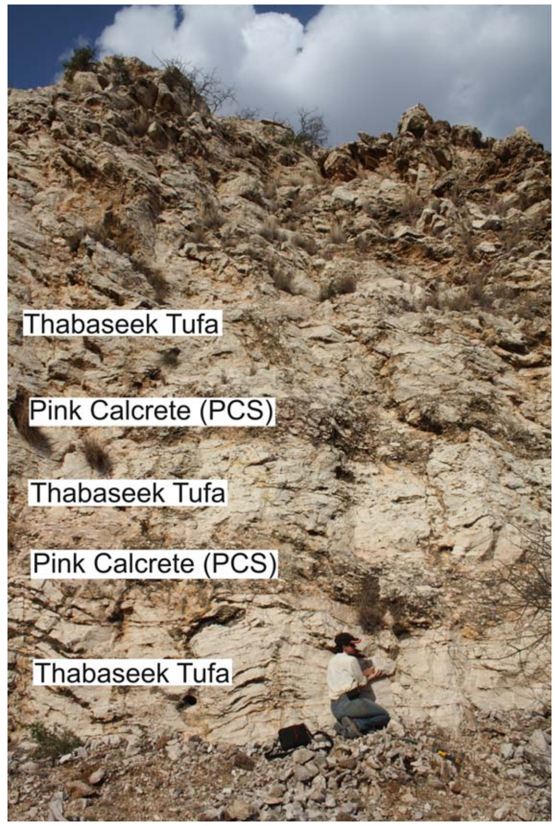

Fig. 3. Photograph of interbedded Thabaseek Tufa and Pink Calcrete (PCS) from the Peabody Pinnacle, a newly described outcrop located to the north–northeast of the Dart and Hrdlička Pinnacles (Fig. 2). Photograph faces east. [Color figure can be viewed in the online issue, which is available at wileyonline library.com.]

METHODS

Utilizing the previous exposures produced by the University of the Witwatersrand excavations (1988–1993) (McKee and Tobias, 1994; Fig. 1b) and newly identified exposures, we have undertaken an initial sedimentological and paleomagnetic analysis to further our understanding of the depositional context of the "Taung Child" and associated fauna from the Buxton-Norlim Limeworks. Geological samples were taken from the sediments outcropping at the base of the Dart Pinnacle, the Hrdlička Pinnacle, and in the intervening area (Fig. 1b). The trench at the base of the Dart Pinnacle is 2.5 m deep and offers the potential for sampling vertically within the sedimentary sequence (Fig. 1c), whereas the Hrdlička Pinnacle exposes approximately 10 m of the stratigraphy although some is still obscured by mine waste. A series of samples were collected laterally, both east–west and north–south across the exposed area of the mined tufa. The near vertical dip of the Thabaseek Tufa in this area meant that more than 20 m stratigraphic thickness of tufa was exposed. Samples were also collected from two new localities, 60 m west of the Dart Pinnacle (Western outcrop) and ~300 m north–northeast of the Hrdlička Pinnacle (what we now refer to as the "Peabody Pinnacle"; Fig. 2). Routine sedimentological observations were undertaken on hand specimens, polished blocks, and thin sections. Paleomagnetic analysis followed the procedures outlined by Herries and Shaw (2011) and Herries et al. (2006).

RESULTS

The Thabaseek Tufa is a white highly porous microbally mediated carbonate which is well bedded, displaying either steeply dipping beds or horizontal beds with occasional domal structures. The Thabaseek Tufa is a phytohermal and stromatolitic tufa, which formed in riverine and lacustrine environments (following Pedley, 2009); steeply dipping beds of tufa or "carapaces" (McKee, 1993b) are suggestive of tufa precipitation over a waterfall. The PCS is a massive pink unit, largely devoid of bedding, and composed principally of micrite (a matrix of microcrystalline calcite), with a small proportion of sparry calcite cement and silt-sized quartz grains. Lithic clasts are rare in the PCS, although angular clasts of Precambrian bedrock and Thabaseek Tufa occur in discrete brecciated layers, either at the base of the unit or where the unit interbeds with the Thabaseek Tufa. The PCS deposits also outcrop in two newly studied sections to the west and east of the pinnacles, extending at least 400 m in a northeasterly direction (Fig. 2), indicating that they are not restricted to the Dart and Hrdlička Pinnacles. The "Western Outcrop" is located 70 m SW of the Dart Pinnacle and is characterized by PCS deposits unconformably overlying the Precambrian shale and underlying the Thabaseek Tufa. At the Peabody Pinnacle, the PCS deposits are interbedded with the Thabaseek tufa (Fig. 3), indicating a cyclic deposition of the two lithological units rather than the sediment fill of a cave within the tufa, as suggested by the authors of the previously published literature (Partridge, 2000; McKee, 2010).

The PCS deposits display a number of sedimentological characteristics typical of massive calcretes (Fig. 4a,b). Rhizoconcretions (Fig. 4c), root mats (Fig. 4b,d), and trace fossils belonging to the *Coprinisphaera* ichnofacies, *Celliforma* sp. (Fig. 4g), and *Coprinisphaera* sp. (Fig. 4h), are all indicative of paleosol development. Holes between 1 and 3 mm in the rhizoconcretions and root mats indicate the position of the roots prior to decay. In thin section, the calcified root mats resemble the alveolar septal fabric of root growth within the soil (Fig. 4f). Much of the PCS deposits are composed of peloidal micrite (Fig. 4a) cemented by at least one phase of carbonate cement. The PCS contains silt-sized quartz grains "floating" within the micrite matrix (Fig. 4e), as it is typical of the expansive growth of calcretes (Watts, 1978).

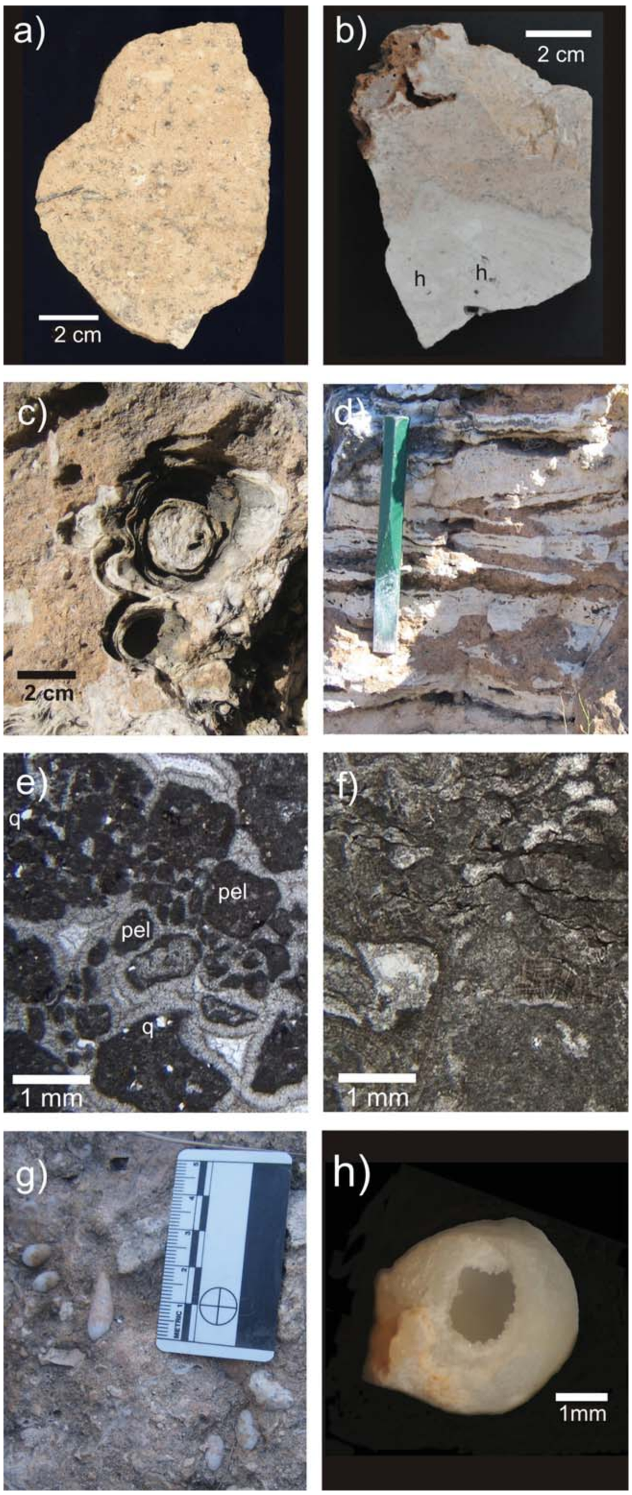

Fig. 4. Pedogenic features of the PCS deposits from the Dart and Hrdlička Pinnacles. (**a**) Polished block of PCS from the base of the Dart Pinnacle. Massive pink calcrete with typical mottled appearance. (**b**) Polished block of PCS from the base of the Dart Pinnacle with calcified root-mat. Note the 1-mm diameter root holes (h) surrounded by concentric calcite growth. (**c**) Rhizoconcretion in PCS from the base of the Dart Pinnacle. Note the root holes in the center of the concretion. (**d**) Calcified root mats in PCS deposits, Hrdlička Pinnacle. Chizel length is 25 cm. (**e**) Thin section of (a) showing micritic peloids (pel) and floating silt-sized quartz grains (q) surrounded by an isopachous rim cement and a drusy spar cement; p.p.l., 5 mm field of view. (**f**) Thin section of the cream-colored root mats shown in (d). Note sparite in-fill of root casts surrounded by fibrous calcite, as observed in other Kalahari calcretes (Watts, 1978, 1980); p.p.l., 5 mm field of view. (**g**) Five solitary bee cells belonging to the *Celliforma* ichnogenus; PCS deposit, base of the Dart Pinnacle. (**h**) Dung beetle brood ball belonging to the *Coprinisphaera* ichnogenus; PCS deposit, base of the Dart Pinnacle. Note the small size of this specimen.

The YRSS is a brown-red nodular and laminated carbonate deposit outcropping at the top and on the south face of the Hrdlička Pinnacle and 350 m to the north–northeast at the top of the Peabody outcrop. Like the PCS, it has a micritic matrix with floating grains of silt-sized quartz, suggesting a pedogenic origin. Unlike the PCS, however, the YRSS is well bedded and in places is seen filling karstic fissures formed within the Thabaseek Tufa, such as that exposed on the south side of the Hrdlička Pinnacle. Karstic processes have exploited weaknesses within the Thabaseek Tufa, often following steeply dipping bedding planes, and replaced the tufa with the younger soil-derived material, in a manner typical of subtropical karstic weathering (Laverty, 2012).

Mineral magnetic measurements and demagnetization spectra indicate that magnetite is the dominant carrier in the deposits owing to detrital inputs (Herries and Shaw, 2011). Samples record weak, but extremely stable remanence, in contrast to the previous paleomagnetic analysis of cored samples from the site which did not produce consistent results (Partridge et al., 2000). Herries and Shaw (2011) have noted similar problems with paleomagnetic analysis of drilled cores from Sterkfontein. In contrast to the earlier study at Taung, both reversed and normal polarity directions are recorded from the site (Fig. 5). Across the Dart and Hrdlička Pinnacles, all of the Thabaseek Tufa samples analyzed record normal polarity directions. The underlying PCS samples record normal polarity directions at the base of the exposure and reversed polarity directions toward the top of the exposure (Fig. 1c). In contrast, the YRSS deposits record reversed polarities. This preliminary paleomagnetic evidence indicates that the PCS and YRSS fossil deposits are not of the same age. Combining the stratigraphic and paleomagnetic evidence, it is clear

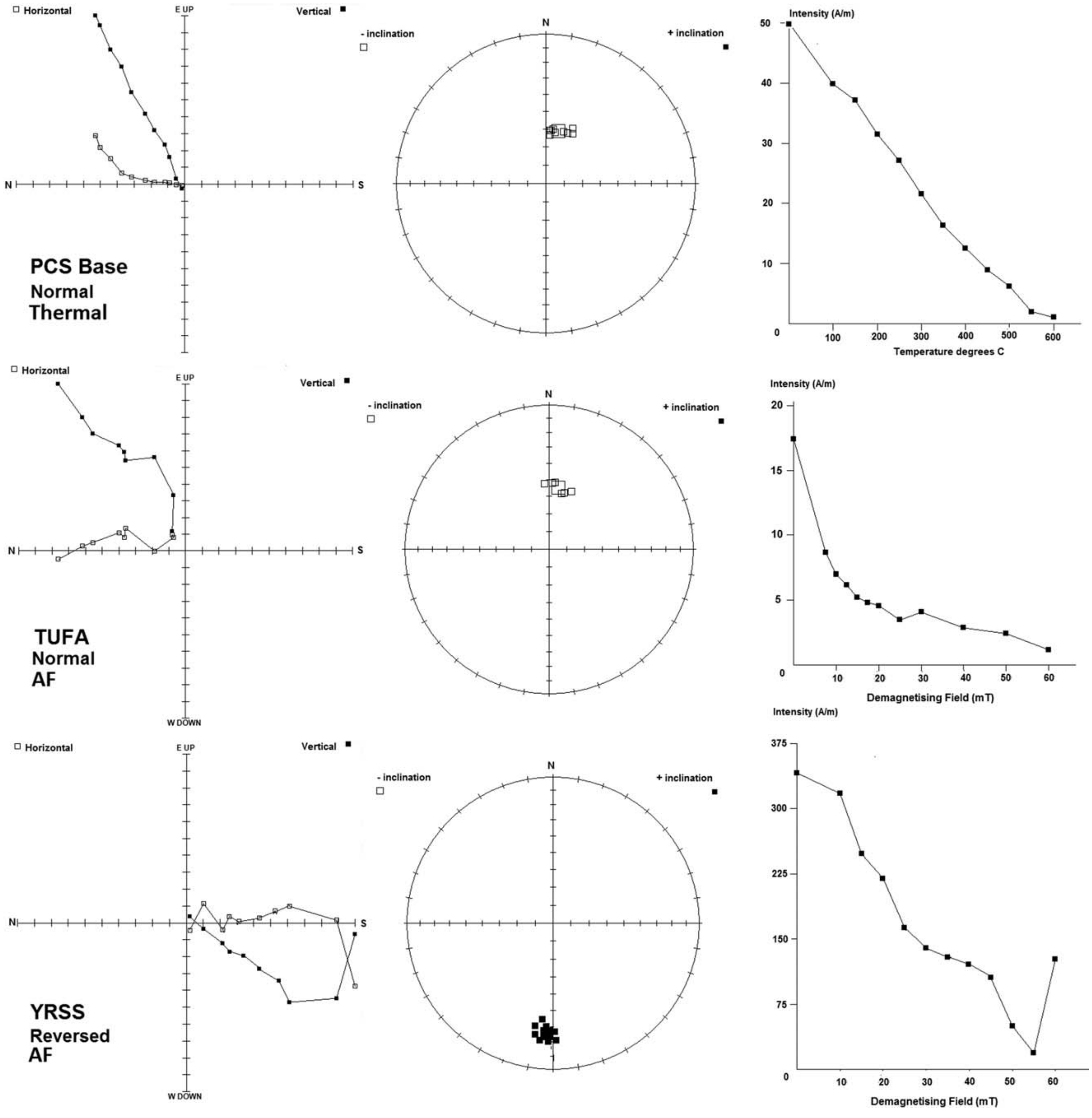

Fig. 5. Paleomagnetic vector plots for normal polarity PCS and Thabaseek Tufa and reversed polarity YRSS samples collected from the Dart and Hrdlička Pinnacles using both thermal and alternating field (AF) demagnetization.

that the "Taung Child"-bearing PCS deposit is older than the nonhuman primate rich YRSS fissure deposits that infill solution tubes formed through the interbedded Thabaseek tufa and PCS.

Pedogenic origin of the PCS "Pink carbonate"

The sediments of the Dart and Hrdlička Pinnacles have proven difficult to interpret since mining first exposed them in 1924. Much of the Buxton-Norlim quarry was blanketed by up to 1 m of lime kiln dust that covered (or obscured) the underlying deposits. In addition, the Thabaseek Tufa exposed on the southern face of the Dart Pinnacle has been subjected to numerous episodes of karstic erosion and sedimentation since its initial deposition, obscuring much of the original deposit. Given the presence of younger cave deposits at the Buxton-Norlim Limeworks and the discovery of hominin-bearing paleokarst at Sterkfontein in the 1930s, it is of little surprise that the "Pink Carbonate" of the Dart and Hrdlička Pinnacles was assigned a speleogenetic origin (Fig. 6a,b). Moreover, much of the early work concentrated on the Hrdlička Pinnacle, where bone-bearing cave fissure fills do occur. Exposure of the PCS deposits was greatly improved during the University of the Witwatersrand excavations (McKee, 1994) which cleared parts of the pinnacles of miners rubble, exposed the quarry floor between the two pinnacles, and

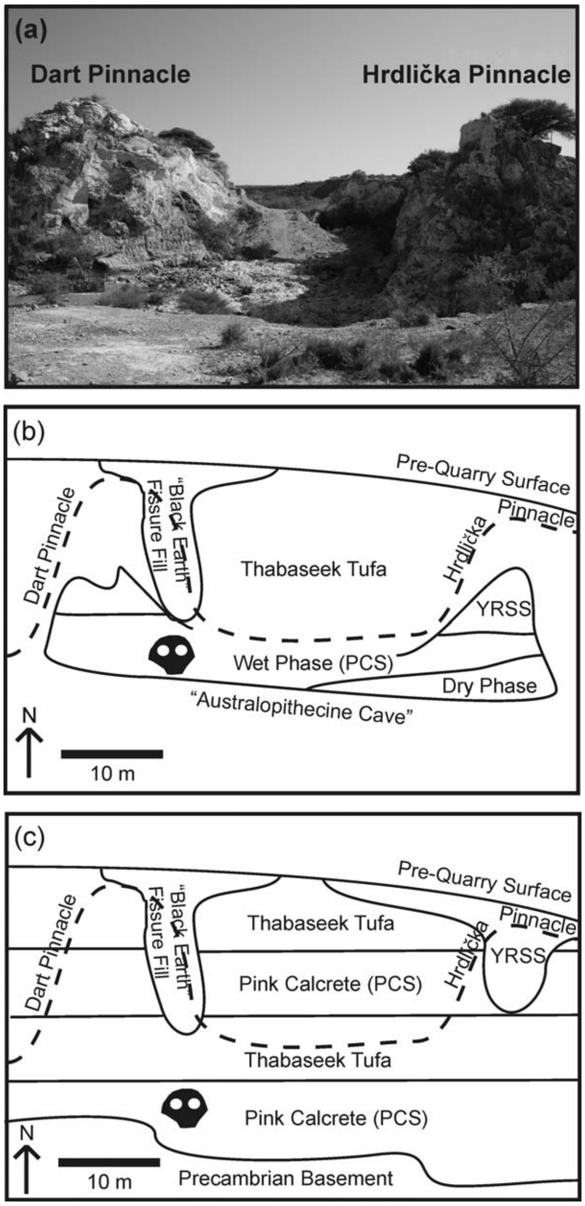

Fig. 6. (**a**) North-facing photograph of the area surrounding the Dart and Hrdlička Pinnacles. The spot identified as the location of the "Taung Child" by Peabody (1954) is indicated by the pyramid to the east of the Dart Pinnacle. Field of view is 55 m wide. (**b**) An illustration of the tufa cave model of the stratigraphic relationships at the Dart and Hrdlička Pinnacles. Modified from Peabody (1954). (**c**) A reinterpretation of the stratigraphic relationships at the Dart and Hrdlička Pinnacles in light of the lithological and stratigraphic evidence presented in this study.

excavated a >2 m deep pit at the base of the Dart Pinnacle and some smaller trenches in the Hrdlička Pinnacle. However, subsequent authors (Partridge, 2000; McKee, 2010) continued to uphold the tufa cave hypothesis despite the lack of clear evidence for the subterranean nature of the PCS deposit.

The outcrops of PCS are characterized by rhizoconcretions, *Coprinisphaera* sp., *Celliforma* sp., and fragments of fossil eggshell (Figs. 1c and 4). This association of plant and animal trace fossils is characteristic of the *Coprinisphaera* ichnofacies and represents calcrete growth in a semi-arid environment. *Coprinisphaera* and *Celliforma* are nesting traces (calichnia) constructed in the soil by adult insects (dung beetles and solitary bees, respectively) for breeding purposes (Genise et al., 2000). The larvae are confined to cells provisioned with different kinds of organic matter, such as pollen, dung, and plant material. Unlike some social insects (e.g., ants and termites), most solitary insects cannot transport their eggs or larvae to more favorable sites when conditions become unfavorable, nor they can construct nests to produce a favorable microclimate. Instead, they construct their nests at ideal sites where larval physiological requirements match the local soil microenvironment (Genise et al., 2000). Excessive moisture inside the cells leads to the decay of provisions, whereas insufficient moisture results in dehydration of the larvae, which are not protected by a water-resistant cuticle like adults. The *Celliforma* tracemaker, solitary bees (Hymenoptera), construct their nests on bare, light, and dry soil exposed to sun with access to angiosperms which provide pollen for the bees.

The *Coprinisphaera* ichnogenus is strongly associated with terrestrial herbaceous communities such as savannahs, grasslands, and prairies (Sánchez et al., 2010). As the *Coprinisphaera* tracemaker, Scarabaeinae, provision their nests with the excrement of vertebrate herbivores, it is common to find their trace fossils in association with herbaceous trace fossils such as rhizoliths (Genise et al., 2000). The *Coprinisphaera* ichnofacies has been observed at a number of African early hominin paleosol localities in Tanzania, Kenya, and Chad (Thackray, 1994; Duringer et al., 2007; Krell and Schawaller, 2011) and is indicative of savannah grassland environments.

Toward the top of the PCS, particularly in the Hrdlička Pinnacle, calcified root mats form discontinuous cream-colored sheets up to 10 cm thick (Fig. 4d), punctuated by 1 mm diameter holes, which housed the roots prior to their decay. In thin section, the highly contorted spar-filled cylindrical structures and microlaminar micrite fabric (Fig. 4f) is typical of the biogenic laminar calcretes described by Wright et al. (1988). Similar sedimentary structures have been described and figured in the early Pleistocene Koobi Fora Formation, Kenya (Cohen, 1982; Mount and Cohen, 1984). In arid environments, water availability is a dominant factor in root morphology. Plants growing near ephemeral streams or on floodplains send out long vertical taproots to exploit deeper phreatic water. In contrast, plants living in areas where phreatic water is shallow, such as pan margins, are able to extend their roots laterally in thin mats over large areas. The laminar calcretes exposed in the Hrdlička Pinnacle are indicative of the lateral root growth that typically forms in seasonally waterlogged palustrine and floodplain environments (Wright et al., 1995, 1988).

It is possible that this represents the migration of the paleo-river channel close to this locality, prior to the inundation of the area with the Thabaseek riverine tufa deposits. Based on the preliminary evidence collected from the environs surrounding the Dart and Hrdlička Pinnacles, the sedimentary sequence is characterized by >1 m thick beds of interbedded calcrete and tufa (Fig. 3), indicative of a semi-arid land surface that was repeatedly inundated by a tufa-forming river and associated freshwater lakes that periodically dried out, reverting to calcrete development. Further sedimentological work is required to determine the location of the paleo-

Thabaseek river channel and its proximity to the calcrete deposits, and geological mapping is required to determine the full lateral extent of the pink calcrete (PCS).

Implications for the relative age of the fossil deposits at Taung

A faunal age estimate of 2.8–2.3 Ma has been produced for the primate assemblage of the Hrdlička Pinnacle, based on a combination of fossils collected from the YRSS and the PCS (Delson, 1988; McKee, 1993a). However, there has been uncertainty as to whether the YRSS is contemporaneous with (Partridge et al., 1991) or younger than (McKee, 1993a) the hominin-bearing PCS deposit, with implications for the age of the "Taung Child" relative to the faunal age estimate. In addition, reclassification of the taxonomy of some of the primate specimens (Gilbert, 2007; Williams et al., 2007) and changes in the age of other sites on which the biochronology was based (Herries et al., 2010), has reduced the reliability of the existing age estimate.

The paleomagnetic data shown in Figure 5 show that the YRSS deposits have a reversed polarity, whereas the PCS and Thabaseek Tufa have a predominantly normal polarity, indicating that the fossil assemblages of the YRSS and PCS are not contemporaneous. In conjunction with the stratigraphic evidence for the crosscutting relationship between the YRSS and the interbedded PCS and Thabaseek Tufa sequence (Fig. 6c), it is clear that the hominin-bearing PCS deposit is older than the primate-bearing YRSS fissure-fill. This indicates that the faunal age estimate of 2.8–2.3 Ma (McKee, 1993a) is most likely a minimum age estimate for the "Taung Child."

Additional dating evidence is required to further constrain the age of the normal polarity PCS deposit and by inference the age of the "Taung Child," through correlation to the Global Polarity TimeScale (GPTS). We are in the process of collecting further dating evidence through uranium–lead dating of carbonate material (Pickering and Kramers, 2010), more detailed paleomagnetic studies, and an improved understanding of the stratigraphy of the site.

CONCLUSIONS AND FUTURE RESEARCH

The evidence presented in this study demonstrates that the pink hominin-bearing deposits of the Dart and Hrdlička Pinnacles were not sedimentary infills of a tufa cave. Instead, we have demonstrated that the hominin-bearing pink carbonate deposit is a calcrete that formed on the Plio–Pleistocene land surface. This appears to be the earliest hominin-bearing land surface deposit to be recognized from southern Africa; hominin fossils from the Elandsfontein calcrete and dune system and the Cornelia fluvial system date to <1.1 Ma (Herries and Shaw, 2011; Brink et al., 2012). We have demonstrated that the pink deposits share a number of sedimentological characteristics with the hominin-bearing paleosols of eastern and central Africa (Hay and Reeder, 1978; Cohen, 1982).

The low abundance of vertebrate fossils within the PCS deposit of the Dart Pinnacle, especially when compared with the primate-rich deposits of the Hrdlička Pinnacle, is highly suggestive of differing taphonomic processes. The low rate and low-abundance passive accumulation of bones on a land surface contrasts greatly with a rapid and high-abundance predatory accumulation or a primate sleeping site, the two most likely scenarios of bone accumulation within the YRSS of the Hrdlička Pinnacle (Simons, 1966; Brain, 1981; McGrew et al., 2003; Barrett et al., 2004). Berger and Clarke (1995) introduced the Bird of Prey Hypothesis to explain the unusual elemental composition and bone modification characteristics of the "Taung Child" cranium and numerous other primate fossils from the associated PCS deposits. Raptor-modified bones will either enter the sedimentary record at the kill site or will be transported to the nest. As some large raptors preferentially select nesting platforms on sheer cliff faces above either a seasonal or permanent water source (Brain, 1981; Steyn, 1982; Ginn et al., 1989; Gargett, 1990; Berger and Clarke, 1995), bone debris dropped from the nest can accumulate on the land surface below, or be transported downstream before accumulation in a lag or flood deposit (Brain, 1981; Berger and Clarke, 1995; McKee, 2010). Although the evidence for raptor modification of the land surface PCS fossil assemblage is compelling, the full taphonomic history of the bone accumulation is currently uncertain.

Under the previous tufa cave depositional model (Fig. 6b), it seemed unlikely that there were significant in situ Plio–Pleistocene fossil deposits remaining to be discovered at the Dart and Hrdlička Pinnacles, as they had been largely destroyed by the combination of mining activities and paleontological investigations. To the contrary, we have shown that the pink calcrete extends 100 s of meters laterally beyond the Dart and Hrdlička Pinnacles (Figs. 2 and 3). This observation is at odds with a cave formation model for the earliest hominin-bearing deposits, and instead reflects an extensive calcretized land surface in the vicinity of a carbonate-rich river system. Despite the apparent low-fossil abundance, with such a large area of exposure, the likelihood of finding further primate fossils from the PCS deposit at Taung is high.

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