ARCHAEO + MALACOLOGY GROUP NEWSLETTER

Issue 35, February 2021

Welcome to Issue 35 of the A+M Newsletter! My thanks to all have contributed. This issue. I would like to remind the AMWG community that we welcome any contributions related to archaeomalacology and are especially interested in member photos/images, news and updates.

About the Newsletter

The Archaeo + Malacology Newsletter warmly invites contributions related to archaeomalacology in its widest sense. Please email submissions and questions to the editor. **Annual deadlines are 31ˢᵗ January for circulation in February and 31ˢᵗ July for circulation in August**. Current and previous issues of the newsletter are available at archaeomalacology.wordpress.com

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RECENT PUBLICATIONS

News & Announcements

Free ICAZ Membership for New Members

"I am writing on behalf of the International Committee of the International Council for Archaeozoology (ICAZ) to extend to you an offer of a free one-year ICAZ membership. ICAZ promotes archaeozoological research and fosters communication among the international community of archaeozoologists. Its members number more than 500 individuals from 50 countries around the world, all with the common interest of understanding past relationships between humans and animals.

This year has been a particularly challenging one for everyone, and it promises ongoing and long-term economic impacts. In considering what ICAZ can do to support archaeozoologists around the world, our International Committee has agreed to reach out to potential new members with an offer of a free one-year membership (Jan-Dec 2021). We see this as something we can offer that can build community and collaborative ties, as well as include new voices to expand, diversify, and deepen our conversations.

We are especially interested in reaching out to possible new members in regions that are underrepresented in our current membership-- particularly Central and South America, many parts of Asia, and Africa. You can view the list of current members and find out more about ICAZ on our website.

Among other benefits, ICAZ members have the opportunity to contribute to two newsletters each year (news about their labs, research projects, and publications).

If you would like to take advantage of this offer, **please email sarahkansa@gmail.com with your name, email address, and country**. When we add you to the membership database, you will be invited to fill out your profile with more details.

Please also feel free to share this with colleagues and students of archaeozoology who work in "reduced rate" countries (defined by ICAZ as all countries *other than* Australia, Canada, EU countries, Japan, Iceland, New Zealand, Norway, Switzerland, USA).

Sincerely,

Sarah Kansa (ICAZ president 2018-2022) and the International Committee

International conference: Molluscs and Ancient Human Societies and meeting of the Archaeomalacology Working Group (AMWG).

Dates: 14-16 September 2021

Venue : Dept. of A.I.H.C. & Archaeology , Deccan College P.G.R.I. Pune 411006, Maharashtra, India

The international conference Molluscs and Ancient Human Societies and meeting of the Archaeomalacology Working Group (AMWG) which was postponed due to the severe pandemic crisis is now proposed to be held on September 14-16, 2021. However still considering the uncertainty of the covid situation further updates will be

made available only after April 2021. All those who had expressed their desire to participate are thanked for showing interest and those who would like to participate can contact amwg2020@gmail.com.

Short Reports & Papers

Building and maintaining an archaeomalacological reference collection

Fleur Dijkstra, Youri van den Hurk and Canan Çakırlar, *Groningen Institute of Archaeology*, *University of Groningen, The Netherlands*

Introduction

A mollusc reference collection aids the identification of molluscs found in archaeological sites. Identifications may allow important inferences about past environments, patterns of human food procurement, consumption, industry, and trade. This academic year (2019-2020), we decided to (finally) re-organize our mollusc collection, part of the zooarchaeology collections at the Groningen Institute of Archaeology (GIA), Faculty of Arts, University of Groningen (Çakırlar *et al.*, 2016). But how to do that? What are the scientific guidelines? Are there best practices to organize a mollusc reference collection for purposes of archaeomalacological research?

The first sources we consulted were of course the best known: the Cambridge Manuals, *Zooarchaeology* by E. Reitz and E. Wing (1999) and, *Shells* by Claassen (1998). Quite expectedly, we also found relevant information in sources that discuss managing natural history collections. At least six of the functions of a natural history collection as described by Winston (2007: 48-49) apply to archaeological reference collections, including cost-effectiveness, the physical heritage of the archaeological discipline, general aesthetics, taxonomic research, and educational purposes, in our case to aid in the training of new generations of archaeomalacologists (Winston 2007, 48-49). We were not, however, able to find out any specific guidelines to build and maintain a reference collection for purposes of archaeomalacological research, education, and ultimately public outreach.

A well-defined framework and clear guidelines are important for any curatorial project, so we thought we would write this short summary about our experience at the Groningen Institute of Archaeology, where we study and teach archaeomalacology.

Guidelines

Collections management in the 21st century requires the work to be structured into two components; the **physical** and the **digital** organization.

Physical organization

Collecting, Identification and **storage** are the key aspects of the physical reference collection, which will be outlined in this paragraph.

Mollusc guides, such as Sturm *et al.* (2006) provide detailed approaches to **collecting** molluscs. Collecting shells for a reference collection can be done through trading, purchasing, donations and collecting (Sturm *et al*. 2006a, 9). Similar to museum collections, extrinsic information regarding the collector, date and place of collecting are important to record (Pearce 2006, 190). Donors (most of whom will be amateurs) should also be asked to provide such information when new species or specimens are added to the reference collection (Pearce 2006, 189). Geographical information and the time collected are useful for research purposes beyond archaeology, such as the study of Pedales and Batomalaque (2014, 41-42) on the geographical occurrence of mollusc species. Pedales and Batomalaque illustrated the development of mollusc contributions of the University of the Philippines Biology Invertebrate Museum invertebrate collection from 1904 to 2007, and showed the distribution of sampling that has occurred on the islands to test how representative the collection specimens are for the landscape.

If specimens are collected alive, overexploitation and pollution should be considered (Reitz and Wing 1999, 379). Modern reference specimens are preferred over archaeological specimens, because molluscs colour patterns are regularly absent on old specimens (Reitz and Wing 1999, 378). Additionally, archaeological specimens should be labelled in a way that connects them to the archaeological context in which they were found.

Accurate taxonomic **identification** of the reference specimens is crucial and should be done, if possible, in consultation with more than one expert in the field. Taxonomic names should be up-to-date, following the most recent nomenclature (although this can, admittedly be difficult at times in the case of molluscs). For marine archaeomalacological collections the website World Register of Marine Species (WoRMS n.d.; or MolluscaBase for a freshwater and terrestrial mollusc inclusion) provides a solution to keep scientific names and synonyms up-to-date.

Identification of mollusc species is mostly based on the general shape, patterns of teeth and muscle scars in bivalves, and the features of the aperture and the spire in gastropods (Claassen 1998, 16). Intra-species size and shape variation in some species can be rather big (Claassen 1998, 26), one reason why it is relevant to have multiple specimens of each species within the reference collection. The more specimens a reference collection has the more chance the identifications of archaeological shellfish remains will be on species level rather than family or genus. To quote Reitz and Wing (1999, 378) "Identification and subsequent research is only as good as the reference collection". Nevertheless, lack of space and regional research foci are fair reasons to delimit the geographical and/or habitat ranges of reference collections.

Recognizing and identifying the causes of taphonomic traces on molluscs is of great importance in interpreting archaeological molluscs. The difficulties of distinguishing anthropogenic from natural and post-depositional factors in the formation of taphonomic traces are well-known (e.g., Çakırlar 2009). While some modifications to shells can only be identified through experimental archaeology, others can be documented using modern reference specimens. Therefore it is useful to set up a separate section in the reference collection for specimens with taphonomic traces identified by experts and/or created through experimental archaeology.

Designing the **storage** of the specimens should involve considerations of order, inventory numbers, labels, containers, and conservation. The order or structure of the reference collection is often taxonomic, while in some collections biogeographical distribution or (bone) elements might be more important selection criteria (Reitz and Wing 1999, 368). At the Natural History Museum of Rotterdam, which houses over 66,000 specimens of the phylum Mollusca, the malacological reference collection is categorized according to their general habitats (marine, freshwater and terrestrial), and then in taxonomic order. The museum houses a separate section for fossilised specimens. Considering that humans used fossil molluscs at least since the Neolithic (Bar-Yosef Mayer 2013), a section of relevant fossil molluscs is also useful in archaeomalacological reference collections. The molluscs of the GIA are ordered by family. Within these families, every genus and species is ordered alphabetically (Figure 1).

Archaeomalacologists interested in studying incremental patterns of growth and biochemistry should consider storing samples of known collection date together. If these are bivalves and one valve has been subject to destructive analysis, the other valves (consistently left or right) should be kept intact. If they are gastropods, at least a few individuals of each collection unit should be kept intact as a separate category in the reference collection.

Figure 1. Drawers with Bivalvia shells, taxonomically ordered. Family names are visible from the outside of the drawer to simplify identifications. By Fleur Dijkstra.

Preservation and containers are closely related. Previous studies on the long-term storage of mollusc shells have shown that keeping molluscs in oak cabinets and storage boxes can lead to efflorescence, which is the movement of internally present salt towards the shell surface, and is called Bynesian decay (Cavallari et al. 2014, 36). Bynesian decay is influenced by temperature, humidity and acid (Sturm 2006, 46, Cavallari et al. 2014, 36). The combination of acids from wooden cabinets with high temperatures and humidity increases the speed in which Bynesian Decay occurs (Sturm 2006, 46). Not only is the wood type of importance, but the adhesives of the cabinets, labels or paper can accelerate the conditions for this decay to occur as well (Sturm 2006, 46).

The use of hard plastic containers for shell storage does not pose the same hazards as wood and paper, at least not when minimum requirements for plastics are met (Williams 2019, 755). Over time, oxidation will weaken and possibly yellow the plastic container; fortunately this will not damage the product inside directly (Williams 2019, 760-761). Depending on the polymerization mechanism a plastic will or will not react to environmental conditions such as relative humidity (Williams 2019, 758). Hydrolysis of plastics, a chemical reaction to high humidity, is of more concern than yellowing plastic to zooarchaeological reference collections, because this process of degradation can lead to acid offgassing, which then causes Bynesian Decay to occur (Williams 2019, 761-764; Callomon 2019, 887).

Light levels in storage facilities should be kept low to decrease degradation speed of plastic containers (Williams 2019, 764). A list of suitable plastics for collection storage can be found in Williams (2019, 772-775).

A practical consideration is the size of the boxes; ideally boxes should have similar widths and are multipliable. Labels, which can contain harmful acids, should be put on the outside of the boxes to avoid contact with the shells. Inventory numbers, written on the specimens themselves, make the connection between the physical reference collection and the digital records, which contains additional information (Reitz and Wing 1999, 365, 368). These numbers, combined with labels with the species name, may also allow a convenient use for comparison and retracing the placement of the specimens within the storage facility. However, depending on the ink used, the numbers might be harmful to the shell, preventing its long-term use.

We color-coded the labels in the GIA molluscs reference collection to differentiate between biogeographical occurrences, which can contribute to the convenience of the users (Figure 2).

Figure 2. One of the drawers. Containing Glycymeridae and Mytilidae shells. The labels can be read easily and the coloured stickers tell whether a species occurs in the Mediterranean only (red), Atlantic (Northwest Europe; green) only or in both (no sticker). There is space left for future additions to the reference collection. By Fleur Dijkstra.

Digital organization

Every physical reference collection should have a corresponding **database** that contains metadata. The standard practice in zooarchaeology is to record the species name, element, number of specimens, name of the collector, age at death, date of acquisition, a description of the storage location and sometimes weight (Reitz and Wing 1999, 363). Standard biometric information can be a useful addition, as well as estimated or known age. Additional fields used in natural history collection databases include the name of the identifier, date of identification, whether it was collected dead or alive, its micro- or macrohabitat, and further specimen comments (Rosenberg 2006, 104). With a growing need for clarity of species identification within the field of zooarchaeology (Wolverton 2013, 381), details such as the geographic origin of the specimen and the information on the identifier are especially useful.

What can be useful to add is information regarding the environment of the species, for example whether they live in marine, terrestrial or freshwater conditions. Depending on the purpose and function of the reference collection, this

will make searching easier when marine, terrestrial and freshwater collections are all present in the collection. Specimens and specimen groups (e.g. specimens of the same taxon collected at the same location, dead or alive) received a single identifier (also called specimen number in GIA). Cohorts collected alive should ideally include a GIS location, date and time of the day, sea surface temperature, and if possible water and substrate samples. The soft tissue can also be preserved along with the shells for further research. Slow-drying in a simple oven might be the cheapest, most convenient way to preserve soft tissue.

The database of the GIA archaeomalacological reference collection includes the family name, common synonyms, geographical occurrence (i.e. for the GIA Mediterranean, Northwest Europe or Europe), information on body parts and if known, the name of the collector (Figure 3). Re-organizing the GIA reference collection highlighted the difficulty of gathering all the above-mentioned metadata for the specimens present, because over time some information had gone missing.

The importance of digital reference collections is increasing. Molluscan digital projects are not only used for identification, but also to study the molluscan ecology and environment by using 3D analysis (Scalici et al. 2016, 1, 4). Digital projects in zooarchaeology have been developed and have gained more attention over the last couple of years. Most recently, the Bonify project (Nobles et al. 2019; www.digitalbones.eu) focused on the scientific practicality of online and Virtual Reality reference collections for goat and sheep bones, testing the user-friendliness of an augmented reality app. It is accessibility that makes digital options attractive, because the physical handling of reference material remains the more sensible approach (Nobles et al. 2019).

The extensive digital database of the Natural History Museum of Rotterdam is an example of a useful online database (http://www.nmr-pics.nl/). Such online reference collections are especially useful for remote areas of research such as the Arctic, which has been developed by Virtual Zooarchaeology of the Arctic Project (VZAP) in an online format (Maschner et al. 2011, 41; www.vzap.iri.isu.edu). Despite the emerging 3D-models and online databases to enhance the identification of mollusc species, physical reference collections remain important for physical handling and teaching purposes. For the moment the archaeomalacological reference collection of GIA is searchable online (Çakırlar et al. 2016; https://dataverse.nl/), but access is physical. The collection is open to third parties outside the university for free. Funding for access by internationals can be requested from Iperion HS, a European Commission Research Infrastructure project for heritage science, which GIA is a part of.

Conclusions

With expert and student time investment, we were able to transform the archaeomalacological reference collection of the Groningen Institute of Archaeology. Labels and storage have become more user friendly and future proof. Figures 1, 2, and 3 show the cabinets with the reference material inside plastic boxes, including labels and show the database and some of the fields that are included to give an impression. Ideally every archaeomalacological reference collection would at least follow the guidelines that are proposed here, however, we realize that through time, new technologies and more funds will provide new opportunities.

Molluscs	M-number	Additional number	Species	Synonyms of species	Family	Class	Global Environment
M	1		Laevicardium crassum		Cardiidae	Bivalvia	marine
M	2		Acanthocardia tuberculata		Cardiidae	Bivalvia	marine
M	3		Cerastoderma edule		Cardiidae	Bivalvia	marine
M	3	f	Cerastoderma glaucum		Cardiidae	Bivalvia	marine/brackish
M	3	a	Cerastoderma edule		Cardiidae	Bivalvia	marine
M	3	b	Cerastoderma edule		Cardiidae	Bivalvia	marine
M	3	d	Cerastoderma glaucum	Cerastoderma lamarcki	Cardiidae	Bivalvia	marine/brackish
M	3	e	Cerastoderma glaucum	Cerastoderma lamarcki	Cardiidae	Bivalvia	marine/brackish
M	3	c	Cerastoderma glaucum	Cerastoderma lamarcki	Cardiidae	Bivalvia	marine/brackish
M	4		Scrobicularia plana		Semelidae	Bivalvia	marine
M	5		Acanthocardia echinata		Cardiidae	Bivalvia	marine
M	6		Mya arenaria		Myidae	Bivalvia	marine
M	7		Macomangulus tenuis	Tellina tenuis	Tellinidae	Bivalvia	marine
M	8		Fabulina fabula	Tellina fabula	Tellinidae	Bivalvia	marine
M	9		Mya truncata		Myidae	Bivalvia	marine
M	10		Arctica islandica		Arcticidae	Bivalvia	marine
M	11	a	Chamelea gallina/striatula		Veneridae	Bivalvia	marine
M	11		Chamelea striatula		Veneridae	Bivalvia	marine
M	12		Venus verrucosa		Veneridae	Bivalvia	marine
M	13		Ruditapes decussatus		Veneridae	Bivalvia	marine
M	13		Ruditapes decussatus		Veneridae	Bivalvia	marine
M	14		Limecola balthica	Macoma balthica	Tellinidae	Bivalvia	marine
M	15		Donax vittatus		Donacidae	Bivalvia	marine
M	16		Mactra stultorum		Mactridae	Bivalvia	marine
M	17		Eastonia rugosa		Mactridae	Bivalvia	marine
M	18		Zirfaea crispata		Pholadidae	Bivalvia	marine
M	19		Modiolus barbatus		Mytilidae	Bivalvia	marine
M	20		Mytilus galloprovincialis		Mytilidae	Bivalvia	marine
M	21		Mytilus edulis		Mytilidae	Bivalvia	marine
M	21	a	Mytilus edulis		Mytilidae	Bivalvia	marine
M	22		Aequipecten opercularis		Pectinidae	Bivalvia	marine
M	23		Pecten maximus		Pectinidae	Bivalvia	marine
M	24		Barnea candida		Pholadidae	Bivalvia	marine
M	25		Petricolaria pholadiformis		Veneridae	Bivalvia	marine
M	26		Arcopagia crassa		Tellinidae	Bivalvia	marine

Figure 3. Image of part of the new database, showing only the identification numbers, species names, synonyms, family, class and overall environment. The additional information is not shown here. This was an initial structure, changes may occur in a later phase. By Fleur Dijkstra. The archaeomalacological reference collection database can be found here: https://doi.org/10.34894/FIUY1Z

Through this brief study we learned the difficulty of fitting existing reference specimens into the new metadata standards, which is probably unavoidable. Furthermore we learned the importance of storage products, since wood or bad quality plastics can produce acids that can activate Bynesian Decay on shells in the long-term. Acquisition of new specimens should abide by the guidelines.

Increasingly more possibilities for shell identification arise online, though physical reference collections are of major significance still and therefore worth the investment. We hope that the guidelines we outlined here will serve as a starting point to make this investment a little easier.

Acknowledgements

References

Bar-Yosef Mayer, D.E., 2013. Mollusc Exploitation at Çatalhöyük. In Hodder, I. (Ed.), *Humans and Landscapes of Çatalhöyük, Reports from the 2000-2008 Seasons*, Çatalhöyük Research Project Series Volume 8. Ankara: British Institute at Ankara.

Çakırlar, C., 2009. Problems in determining the chain of production in shell "objects", Observations on shell assemblages from coastal sites in the Eastern Mediterranean. *BioArchaeologica* 45–50.

Çakirlar, C., Scheele, E., van den Hurk, Y., and Dijkstra, F., 2016, "Groningen Zooarchaeological Collections 2020: Vertebrates and Invertebrates", https://doi.org/10.34894/FIUY1Z, DataverseNL, V5.

Callomon, P., 2019. Shells and Corals. In Elkin, L., and Norris, C.A. (Eds.), *Preventive conservation: collection storage.* New York: Society for the Preservation of Natural History Collections.

Cavallari, D.C., Salvador, R.B., Cunha, B.R. da, 2014. Dangers to Malacological Collections: Bynesian Decay and Pyrite Decay. *Collection Forum* 28, 35–46.

Claassen, C., 1998. Shells, Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

Maschner, H.D.G., Betts, M.W., and Schou, C.D., 2011. Virtual zooarchaeology of the Arctic project (VZAP). *The SAA Archaeological Record*, (January), 41–43.

Nobles, G., Çakırlar, C., and Svetachov, P., 2019. Bonify 1.0: evaluating virtual reference collections in teaching and research, *Archaeological and Anthropological Sciences*, published online.

Pearce, T.A., 2006. Donating amateur collections to museums. In Sturm, C.F., Pearce, T.A., and Valdes, A., (Eds.), *The Mollusks: A Guide to Their Study, Collection, and Preservation.* American Malacological Society. Pittsburgh, PA, U.S.A.

Pedales, R. D. C., and Batomalaque, G. A., 2014. An account of the Accessioned Collections of the UP Biology Invertebrate Museum. *Science Diliman* 26 (2): 40-48.

Reitz, E.J., Wing, E.S., 1999. Zooarchaeology, Cambridge Manuals in Archaeology. 2nd Edition. Cambridge University Press, Cambridge.

Rosenberg, G., 2006. Computerizing Shell Collections. In Sturm, C.F., Pearce, T.A., and Valdes, A. (Eds.), *The Mollusks: A Guide to Their Study, Collection, and Preservation.* American Malacological Society. Pittsburgh, PA, U.S.A.

Scalici, M., Traversetti, L., Spani, F., Bravi, R., Malavoglia, V., Persichini, T., and Colasanti, M., 2016. Using 3D virtual surfaces to investigate molluscan shell shape, *Aquatic Living Resources*, 29, 207: 1-5.

Sturm, C.F., 2006. Archival and Curatorial Methods. In Sturm, C.F., Pearce, T.A., and Valdes, A. (Eds.), *The Mollusks: A Guide to Their Study, Collection, and Preservation.* American Malacological Society. Pittsburgh, PA, U.S.A.

Sturm, C.F., Pearce, T.A., and Valdes, A., 2006. *The Mollusks: A Guide to Their Study, Collection, and Preservation.* American Malacological Society. Pittsburgh, PA, U.S.A.

Sturm, C.F., Mayhew, R., and Bales, B.R., 2006a. Field and Laboratory Methods in Malacology. In Sturm, C.F., Pearce, T.A., and Valdes, A. (Eds.), *The Mollusks: A Guide to Their Study, Collection, and Preservation.* American Malacological Society. Pittsburgh, PA, U.S.A.

Williams, R.S., 2019. Plastic storage products. In Elkin, L., and Norris, C.A. (Eds.), *Preventive conservation: collection storage.* New York: Society for the Preservation of Natural History Collections.

Winston, J. E., 2007. Archives of a small planet: The significance of museum collections and museum-based research in invertebrate taxonomy. *Zootaxa* 1668: 47-54.

Wolverton, S., 2013. Data Quality in Zooarchaeological Faunal Identification. *Journal of Archaeological Method and Theory* 29, 381–396.

WoRMS, n.d. *An authoritative classification and catalogue of marine names*. World Register of Marine Species. [Last accessed 05-2020]: http://www.marinespecies.org/index.php.

NEW RESEARCH AT THE BUCKNER RANCH SITE (SOUTH TEXAS, USA) REVEALS HYDROCLIMATE AT THE TRANSITION TO THE HOLOCENE

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Abstract

New investigations at a South Texas archeological site excavated over 80 years ago help clarify the pace of environmental change as the Younger Dryas transitioned into the Early Holocene. Evidence from snails, sphaeriid clams, and sediments suggest groundwater-supported streamflow persisted into the early part of the Holocene, even as terrestrial habitats were beginning to reflect a warming and drying climate. Stored groundwater likely allowed well-watered riparian habitats to lag behind aridifying upland habitats.

Introduction

During the Depression yeas of the 1930s, the US federal government funded large-scale archeological and paleontological excavations in various parts of the United States through the Work Projects Administration. Field methods and documentation were primitive by today's standards, but some major excavations at important sites were undertaken. One of these was the Buckner Ranch site (sometimes also known as Berclair Terrace), situated on Blanco Creek, the border between Goliad County and Bee County in deep south Texas (Fig. 1). Extinct megafauna had been found here in 1936, and from February, 1938 through the spring of 1940, the Bureau of Economic Geology (University of Texas) and WPA sponsored excavations supervised by (in sequence) Glen Evans, Adolph Witte, and Nolan McWhirter. A report by E.H. Sellards (director of the Bureau) remains the only major published summary of the site (Sellards, Evans and Campbell 1940). A Rancholabrean fauna that includes bison, camel, extinct horse, glyptodont, pampathere, mammoth, mastodon, extinct tortoise (Moodie and Van Devender 1979) and extinct deer was recovered. Other fauna such as alligator, anurans, turtles, muskrat, and Eastern mole hint at well-watered conditions (the area receives about 76 cm of precipitation annually at present). Most of the effort at the site was devoted to finding and recovering large animals in plaster jackets, but artifacts were also found, including a small collection of Paleoindian projectile points (Clovis, Scottsbluff, Angostura, Midland, and Wilson-like). Bousman, Baker and Kerr (2004:Fig. 2.22) call the last Berclair points. This assemblage spans a period from about 13,000 to perhaps 7500 calendar years before present. Sabertoothed cat (*Smilodon fatalis*) remains have also been found in Berclair Terrace sediments on Medio Creek (Slaughter 1963:72-73).

The terrace deposit that the WPA crew cut into was reportedly about 4.6-5.2 m thick (although the deepest artifacts have a listed depth of about 5.5 m), with about 1.5 m of gravel and sand at the base, overlain by about 1.2 m of faintly laminated sand, then about 2.3 m of "silt" (actually, some silt and much fine sand). The "silt" layer was said to be sterile, producing no artifacts. Field measurements were made in feet and inches (converted for this report to the metric system).

Unfortunately, there are apparently no field notes, no journal, no intrasite plans or profiles (other than a schematic, Sellards, Evans and Campbell 1940:Fig. 4), and no topographic site map. Sellards says, "About 200 relics were obtained indicating the presence of man, including artifacts, partially worked flints, rejects, chips, flakes, burnt rocks, and hearths. Most of these came from the lower or basal part of the deposit" (Sellards, Evans and Campbell 1940:1638). This might seem to imply the presence of hearths in Paleoindian deposits, but Evans says "We also found seven fairly good artifacts including one spear head in a buried fire place in the terrace. The flints were 7.6 feet below the flood-plain surface, which is approximately the middle section of the terrace... I have recorded the location of the flints, but we dug out the fire-place — a small one — so as to continue work with the fresno" (letter of April 20, 1939 to Sellards). At least in this case, it is clear that the hearth was well above the Paleoindian deposit.
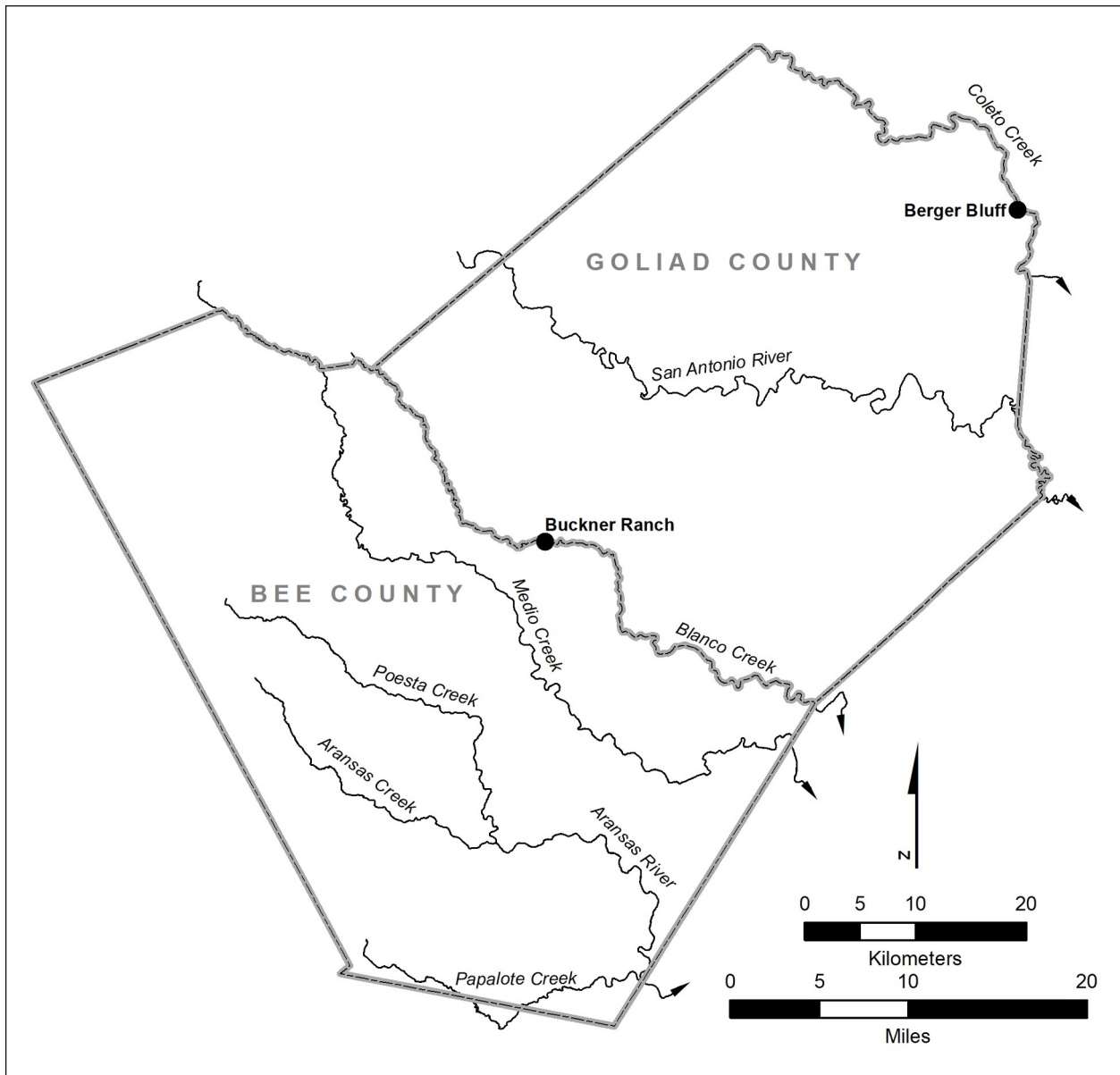
Figure 1: Location of Buckner Ranch and Berger Bluff sites.

Recognizing the importance of artifacts associated with extinct fauna, the field crew screened fill ("about 3700 cubic yards") from an area about 38 m by 14 m (Fig. 2) at a time when fill was almost never screened in archeological projects. The mesh size was not recorded. Although quarter-inch mesh is now the industry standard for archeological projects, larger sizes were used in past decades. Sellards says that "most" of the fill was screened, but photographs show overburden being removed with a tractor and fresno, and workers shoveling fill without screening. I suspect that in reality, only the basal deposits were screened.

Figure 2: Undated photo, circa 1939. Looking upstream (west) at excavation of Buckner Ranch. Blanco Creek is on the right. The lower group of workmen is probably in the megafauna-producing deposits. The area sampled in the present study is located somewhere to the left. This picture was taken at the end of the drought years of the Depression, and the valley is now much more heavily vegetated.

This was also one of the first (perhaps actually the first) archeological projects in Texas to recover and report snails. The taxa recovered, listed in terms of current taxonomy, includes three large or medium-bodied terrestrial snails (*Rabdotus dealbatus*, *Linisa texasiana*, and *Oligyra orbiculata*), two planorbids (*Planorbella trivolvis* and *Gyraulus parvus*), sphaeriid clams, and what were assessed as three species of *Physa* (*Physa conoidea*, *P. integra*, and *P. halei*). The last three would now probably all be classed as *Physa acuta*. No counts are given, nor is the recovery method described, but presumably these were all haphazardly uncovered while digging for fossils and artifacts. Specimens were identified by Horace G. Richards.

At some point (the date is not specified, perhaps in the early 1950s?) James and Barbara Conkin of the University of Louisville carried out geologic fieldwork on Berclair Terrace deposits exposed by Medio Creek, about 11-18 km south of the Buckner Ranch site. Recovery methods and specimen counts are unspecified. The result was another very limited laundry list of species. From their "Lower Unit," which should be approximately equivalent to the deposits of concern in this report, they listed seven taxa (Conkin and Conkin 1962:348). Below, their species list is given, along with suggested current taxonomy and my guesses as to the correct identity:

Conkin and Conkin (1962)	Suggested identification (KMB)
Terrestrial	
Bulimulus dealbatus	*Rabdotus dealbatus*
Praticolella berlandieriana	*P. berlandieriana* or *P. pachyloma*
Polygyra texasiana	*Linisa texasiana*

<u>Aquatic</u>

Amnicola sp.	*Cincinnatia integra?*
Helisoma antrosa	*Helisoma anceps*
Helisoma trivolvis	*Planorbella trivolvis*
Physa sp.	*Physa acuta*

New research

Although the plotted location of the site was known, after the WPA crew left the site almost no one revisited it for about the next 75 years. There has always been a certain degree of uncertainty about whether the findings represented an occupation site, a kill site, or redeposited material brought in by Blanco Creek from somewhere upstream. The bones were unarticulated, and the projectiles in the lower zone span a wide range of time. No absolute dates were available from the deposits. The site remained something of an enigma in the literature. Glen Evans had equated the deposits with the Beaumont Formation, but we now know that the Beaumont Formation is much older. The artifacts from this project now reside at the Texas Archeological Research Laboratory (except for a few key items that are missing), where they were examined by Sean Nash as part of his MA thesis research. Nash (2001) concluded that the artifacts were not streamworn. Along with Dr. Ernest Lundelius, he also examined the faunal material and found no evidence of either streamwear or human alteration.

Then, in 2016, archeologists David Calame and Glen Goode contacted the current landowner and were able to revisit the site, pinpointing the actual location of the now greatly eroded Depression-era excavations. They began digging test pits to assess what remained, and paleontologist Steven R. May also began excavations to investigate the Miocene Lapara Creek Fauna in the Goliad Formation bedrock (May 2019). Calame invited other researchers to visit the site, and soon a very informal (and unfunded) Buckner Ranch research consortium was assembled, as follows:

David Calame	archeology
Glen Goode	archeology
Dr. Vance Holliday	geoarcheology
Dr. Charles Frederick	geoarcheology
Chris Ringstaff	microdebitage
Dr. Barbara Winsborough	diatoms
Dr. Ken Brown	archeomalacology

Additional help has been furnished by members of the Southern Texas Archaeological Association, by Dr. Leslie Bush (wood charcoal identification), and by Arlo McKee (Texas Historical Commission, aerial drone photography). OSL assays were performed by Dr. Mark D. Bateman (University of Sheffield).

Sampling For Mollusks

The research reported here is aimed at reconstructing the moisture history of this part of South Texas during the transition from the Younger Dryas into the Holocene. Pollen generally is not preserved in the alkaline sediments of South Texas except in anoxic, persistently wet habitats. Pollen cores have been taken near Victoria (about 68 km away) and Corpus Christi (88 km away), but none of these extend far enough back in time to clarify the climatic

transition of interest. There are good climatic records from speleothems, but these are in karst topography north and northwest of San Antonio, even farther away.

My involvement with Buckner Ranch began in August, 2017, when I collected five irregularly spaced pilot samples of sediment from the south wall of Test Pit 1, previously dug by Calame and Goode. The five samples yielded 50.75 liters of sediment (almost 60 kg) which were wet-sieved through nested 2 mm, 1 mm, and 0.5 mm geologic sieves. The top two samples were nearly sterile; the middle sample, perhaps derived from the top of Sellards's "sand" zone, contained a small number of snails and some peaclams, while the lowest two samples, definitely derived from the sandy zone, yielded greater numbers, plus a few fingernail clams. The profile was heavily weathered, so I was not able to identify stratigraphic contacts.

For the five samples as a whole, only 38% of the snails were terrestrial, 34% were aquatic, and 27% were disarticulated peaclam valves or fragments of fingernail clams. This is a low proportion of terrestrial species for a floodplain setting, and large or medium-bodied taxa are scarce. An unusually large number of peaclams were recovered, and two of the aquatic species, *Cincinnatia integra* and *Valvata tricarinata*, suggested persistent, reliable, cool, clear streamflow (in this area, *Valvata* appears to be a good marker for Younger Dryas or older deposits). Although specimen density was somewhat low (3.23 specimens per liter) for the column as a whole, the results suggested it would be worthwhile to collect a complete, continuous sample column nearby.

Test pit 3 sample column

In March, 2018, I collected a sample column 79 inches (2.0 m) in vertical extent, anchored at the bottom at or just above Goliad Formation bedrock. Twenty samples, each four inches (10.16 cm) thick, were collected after a fresh exposure had been cut with a backhoe in the south profile of Test Pit 3 (Fig. 3). A small subsample was removed and set aside for diatom analysis, and then each sample was soaked overnight, then wet-sieved through nested 2 mm, 1 mm, and 0.5 mm sieves. No dispersant was necessary because the sandy sediment was essentially clay-free. The 0.5 mm fraction proved to be far too voluminous to pick, so only the 2 mm and 1 mm fractions have been examined. The top of this column, at about 2.5 m below the surface of the terrace, appears to correspond approximately to the contact between the "sand" and "silt" zones shown by Sellards, Evans and Campbell (1940:Fig. 4A). After the snails and small bivalves from this column were picked from the sieved residue, sorted, and identified, it became apparent that the assemblage was fairly uniform over the entire column. This meant that sampling had not begun high enough to detect major faunal changes in the Early Holocene. Consequently, I returned to the site on May 25, 2019, and collected an additional six samples from the top of the previous column. These additional samples extend well into the "silt" zone as described by Sellards.

The complete 2.62 m column now consists of 26 samples, extending from 76 inches (1.93 m) below the terrace surface to the base at bedrock; column width was about 30-45 cm. Mean sample volume is 14.48 ± 0.42 liters (range, 13.8-15.0). A total weight of 515 kg of sediment (1181 pounds, or over half a ton) was collected and processed. The new samples at the top of the column revealed specimen counts rapidly diminishing into the sterile zone represented by the "silt" layer. The faunal content, rather than altering, simply vanished.

Figure 3: Looking southwest at David Calame clearing a fresh face in the south profile of Test Pit 3.

Analysis of the samples shows that this deposit consists of fine sand, fining upward and enclosing carbonate concretions, iron-manganese pellets, animal bone (Quaternary and perhaps Miocene as well), mollusks, chert microdebitage, and occasionally baked clay, hackberry seeds or rare very small bits of wood charcoal. In profile, it looks rather homogeneous and I saw no obvious paleosols or stable surfaces, but Dr. Vance Holliday identified a moderately thick ABkb horizon at the top of the "sand" unit and an Awb horizon 68 cm below that, which implies that deposition paused long enough for at least a couple of weak soils to develop. The basal part of the profile contains large amounts of white, indurated caliche rubble derived from erosion of the Goliad Formation bedrock upstream.

Three separate pulses or spikes of included material were identified in the 2 mm fraction: levels 16-17, 10-12, and 5-6. These are characterized by an increase in Goliad Formation rubble caliber, chert pebble caliber, bone quantity, snail shell quantity, number of peaclams or fingernail clams, and especially by snail taxonomic diversity. Ferromanganese concretions tend to be more abundant and larger in the levels that have coarse-grained pulses and may be clastic in origin, rather than endogenous.

After the original 20-sample column was collected, sample tubes were driven into the fresh exposure near the top and bottom of the column, and two OSL samples were collected (Fig. 4). These effectively bracket the "sand" zone in this part of the site, although it is advisable to keep in mind that since the bedrock slopes somewhat downward and north toward the creek, the basal sediments where the WPA crew dug were probably deeper and older in that area.
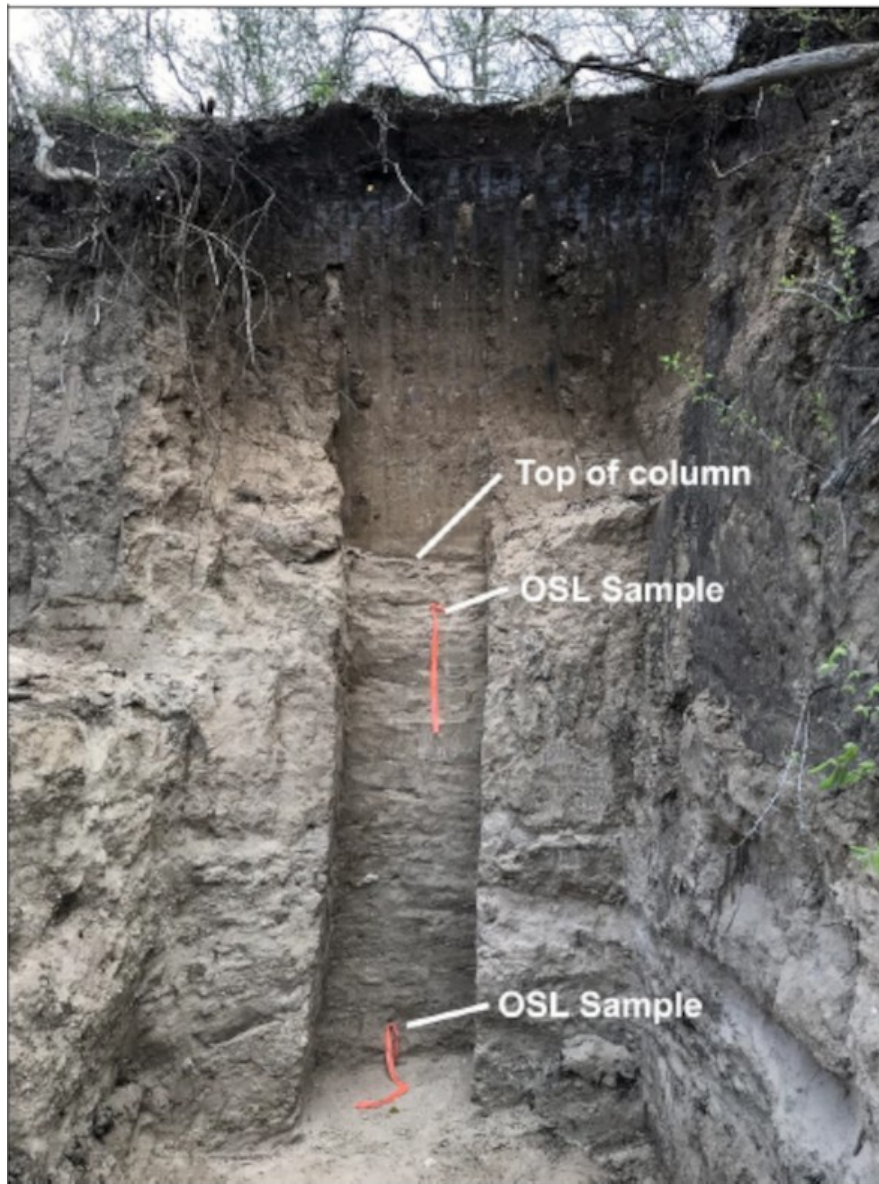
Figure 4: The 20-sample column removed from the south wall of Test Pit 3. Six additional samples were later removed above the point labeled "top of column."

The upper assay, just below the transition to the "silt" zone, produced an age estimate of 10, 800 ± 700 calendar years before present (Shfd 18025, where "present" is pinned at AD 2018). The lower sample, just above bedrock, is 10,900 ± 700 cal BP (Shfd 18026; these would be very roughly equivalent to uncalibrated radiocarbon dates of about 9000-9500 radiocarbon years before 1950). These estimates are reasonable and consistent with what we know about the archeology, and suggest rapid deposition, with the entire two meters of sediment accumulating in about a century. Large amounts of sand were evidently flushed from the Blanco Creek catchment upstream at the onset of the Holocene.

Large floods can occur in South Texas from two kinds of triggering events: hurricanes tracking inland from the Gulf of Mexico, or major rainfall events (usually in the spring or fall) triggered by Arctic airmasses sweeping southward down the South Plains. However, both of these triggers were apparently absent during the Younger Dryas. The Laurentide ice sheet blocked Arctic air masses from the central continent, and meltwater draining into the Mississippi River kept Gulf water temperatures too low to allow hurricane formation, until well into the Early Holocene.

The stratigraphic record of the "bench" deposits at Berger Bluff, located 53 km to the northeast (Fig. 1). illustrates these developments. Here, exceedingly slow cyclic vertical accretion of very fine-grained sediments was followed by massive accumulation of coarser-grained sand, punctuated initially by pulses of gravel. This change in depositional style cannot be dated precisely, but occurs sometime after a radiocarbon date of 9880 ± 90 RCYBP (AA 2831; Brown 2006:715). See also Brown (2006:556-560 and Fig. 4.20).

Analysis Of The Test Pit 3 Sample Column

An inventory of the column as a whole shows that it contains about 25% terrestrial snails, 46% aquatic snails, and 25% sphaeriid clam valves (here counting individual, not paired valves), for a total of 3205 specimens. Even if the number of paired valves is estimated by halving the valve count, sphaeriid clams and freshwater snails together still account for 67% of the specimens. Compared to other sites (of various ages and in various regions) in Texas where similar recovery methods have been used, specimen density is fairly low (about 8.5 specimens per liter), although still lower recovery rates are found in the arid western parts of the state, or in deeply buried strata with active groundwater throughflow. Recovery rates of anywhere from roughly 10 to 60 specimens per liter might usually be expected from deposits of varying age and location in Texas.

For Texas archeological sites experiencing modest alluviation, a ratio of about 70% terrestrial species to 30% freshwater species might be typical, but in the present study, these proportions are reversed. What accounts for the high proportion of aquatic fauna but rather low specimen density in Test Pit 3? Several relevant factors come to mind:
1. The area where the sample column was collected was probably fairly close to the creek channel.
2. Water quality at the onset of the Holocene was still quite good, supporting a robust aquatic fauna.
3. Specimen counts were partly diluted by rapid vertical accretion of sediments.
4. Rapid accretion of sandy, clay-free sediments produced an organic-poor, rapidly drying substrate that was poorly suited for colonizing by plants and terrestrial snail species. The side-attached sandbars at Berger Bluff might be a good analog (Fig. 5).

From both a geological and a faunal viewpoint, the "sand" zone seems to resemble a thick sandbar, yet vintage photos of the WPA excavations (Fig. 2) suggest this sand deposit was more extensive than a point bar or lateral sandbar. The aquatic taxa clearly arrived in this sand deposit as clastic particles, but it is also plausible that the terrestrial species were mostly clastic in origin as well, not resident on the surface, if that surface was as unvegetated as the circumstances suggest.

Because of taxonomic uncertainty about a few of the species, it is difficult to be precise about species richness, but it appears there are at least 23 terrestrial taxa (and perhaps one or two more) and at least 13 or so freshwater snails, giving a minimum species richness of three dozen taxa. The sphaeriids are not identified, but there appears to be only one species each of peaclams and fingernail clams. Three dozen taxa is comparable to recovery at Berger Bluff, and is fairly speciose compared to other similarly investigated sites.

Figure 5: Looking upstream (northwest) at lateral sandbar on Coleto Creek overflow chute, opposite the Berger Bluff site (November, 1979). Is this a good analog for the sandy deposits sampled at Buckner Ranch?

Terrestrial Fauna

Terrestrial snails include substantial numbers of *Lucilla singleyana*, *Oligyra orbiculata*, *Rabdotus* sp. (mostly juveniles) and modest numbers of *Praticolella* sp., *Strobilops texasiana*, and *Linisa texasiana*. These are all common species in later arid phases of the Holocene, as well as today. However, there are also some taxa that suggest somewhat wetter conditions or more deciduous cover. There are a number of slug plates (unidentified, but not the giant extinct slug *Deroceras aenigma*). Slugs are usually good indicators of damp conditions. There are many juvenile succineids, also perhaps damp ground indicators, and a single example of *Pomatiopsis lapidaria*. Two large-bodied genera prominent at Berger Bluff, *Mesomphix* and *Mesodon*, appear to be entirely absent at Buckner Ranch. A single snail is logged as *Vallonia* cf. *V. parvula*. According to Fullington and Pratt (1974:28), in the Pleistocene the genus is "indicative of a somewhat cooler and wetter climate," but most other sources record it in dry, grassy habitats. Contemporary living populations are known mostly from the Panhandle. A small number of juvenile (but no adults) *Anguispira strongylodes* suggests deciduous tree cover. Living populations today occur mostly in East Texas and north of Seguin, but were recovered from early deposits at Berger Bluff, Pavo Real, and the San Antonio Mammoth Site.

Aquatic Fauna

There are fewer aquatic taxa, but more individuals, even if the peaclam count is halved. Peaclams and fingernail clams appear to represent only one species each. The most abundant freshwater snails are *Valvata tricarinata* juveniles, followed by *Cincinnatia integra* juveniles, *Gyraulus parvus*, and *Physa* cf. *P. acuta*. The *Valvata*, *Cincinnatia*, *Probythinella*, and some unidentified high-spired hydrobiids are all prosobranch taxa indicative of perennial, cool, clear, well-oxygenated running water. Living populations of *Valvata tricarinata* occur extensively in Canada and the

northern US, particularly New York and the Great Lakes region, but are not found south of Oklahoma and Arkansas. They are often found in lakes, often associated with aquatic vegetation. The species is apparently extirpated in Texas, but is somewhat widespread as a Pleistocene fossil, occurring at Berger Bluff, the Aubrey site, and in the Panhandle at Lubbock Lake, Rex Rodger and the Snail Bed site (see discussion in Brown 2006:1141-1150). Hubricht (1962:1) reports large numbers from an undated locality on Palo Blanco Creek in Brooks County. In Texas, *Probythinella emarginata* is not reported south of the Brazos River and San Saba River (Hershler 1996:140). A study of the species in Kansas found that it may be threatened and is susceptible to desiccation and loss of dissolved oxygen (Sowards 2012). A study of cold water spring snails in Germany suggests that desiccation, low oxygen, and low pH are the principal threats to such species (Klockmann *et al.* 2016).

Somewhat less numerous than these species are a number of *Physa* and several kinds of planorbids: *Gyraulus parvus*, *Helisoma anceps* juveniles, *Planorbella trivolvis* juveniles, *Planorbella scalaris* juveniles, *Micromenetus dilatatus*, some unidentified or fragmentary planorbids, and possibly a couple of unidentified lymnaeids. These are pulmonate species that are more likely to be tolerant of stagnant, poorly oxygenated, hot, perhaps algae-choked water. They are also species that are commonly found in South Texas creeks and rivers today.

The presence of *Planorbella scalaris* is remarkable. This freshwater snail is native to Florida, and its current native range does not extend much beyond the state boundaries except for occurrences in the Caribbean and Costa Rica, but it also occurs as an introduced invasive in Colorado, Wyoming, and in Europe. In Florida, it has been recovered from the Paleoindian Page-Ladson site as well as various later Archaic shell middens. The USGS BISON online mapping system lists two specimens in Texas, one in Matagorda County and one at San Marcos. Details and validity of these are unknown. The species can be confused with the similar-appearing *Planorbella duryi*. The Buckner Ranch specimens all have flat apices and are not turreted. The mean diameter is 3.44 ± 1.49 mm, which is far less than the 7-11 mm diameter quoted by Pilsbry (1934:33), so these are obviously juveniles. Buckner Ranch is only the second site in Texas where these have been reported; the other site, in the Panhandle, is Late Holocene. There is also a known paleontological occurrence in Coahuila.

It is worth mentioning that although the freshwater snails from Buckner Ranch are dominated by juveniles, this is a common finding whenever alluvial sediments are sampled for snails, regardless of region or age. Discussing possible reasons is beyond the scope of this report. And while the Younger Dryas-aged deposits at the Berger Bluff site contained examples of an apparently healthy, long-lived freshwater mussel population (Brown 2006:Chapter 9), no mussels have been found yet at Buckner Ranch except in the upper deposits dug by the WPA.

When rainfall diminished in South Texas at the end of the Younger Dryas, small drainages like Blanco Creek changed from groundwater-supported to runoff-supported streams. When continuous flow ceases and the drainage becomes a string of isolated pools, those pools become semi-toxic environments for aquatic fauna. As pools dry and become stagnant, they contract, solute levels increase, water temperature increases in hot weather, and oxygen content plummets. Aquatic snails in shrinking pools migrate to the deepest part, where aggregates of snails compete with one another for scarce resources (although some taxa like *Gyraulus* can live for a time in damp mud or under algal mats). Hypoxia limits heat tolerance (Koopman *et al*. 2016) as well. These conditions favored pulmonate snails over prosobranch snails, and the prosobranch species responded with range retraction or even extirpation, Major flood waves ,which began with the arrival of triggering events (Arctic airmasses or Gulf hurricanes) in the Holocene would also have disrupted aquatic communities. The importance of new research at Buckner Ranch is that it helps pinpoint when this groundwater- to- runoff transition began to have an impact on small streams in South Texas. Major rivers like the Guadalupe and the Nueces were buffered by their much larger catchment areas, headed far to the west and spanned different ecological zones.

Assessing Contemporary Snail Populations

The reach of Blanco Creek from Buckner Ranch upstream is variable. At times it has running water, at times it has isolated pools, and at times it is completely dry (Fig. 6). An attempt was made to sample aquatic fauna in March, 2020, when the reach upstream contained only damp mud (Fig.6), but it failed because the channel bed could not be reached. In future visits, perhaps a second try will yield better results.

Fig. 6: Looking upstream at dry bed of Blanco Creek near the Buckner Ranch site (March, 2020). Bee County is on the left, Goliad County on the right. In the Early Holocene, this probably would have been continuously flowing.

In order to sample terrestrial habitats, three 1x1 m square litter samples were collected in March, 2020. Two were located on the floodplain opposite the site (in Goliad County; Fig. 7) and one was located on the Berclair Terrace surface above and to the southeast of the site. Surface litter and sediment to a depth of no more than 3 cm were collected. Sample volumes varied approximately from 29.4 to 93.5 liters. As of this date, only one of the floodplain samples has been picked. It yielded about 10 or more terrestrial species (a subset of those found in the Early Holocene column) and 4-5 aquatic species (including *Biomphalaria* and *Drepanotrema*, tropical genera not seen in the sample column; Fig. 8). Fewer than 5% by count of the Litter Sample 1 snails are aquatic. Specimen density is about 41 specimens per liter, considerably higher than in the column sample, but with markedly less taxonomic diversity. Species richness in the Test Pit 3 sample column is roughly two and a half times the species richness of Litter Sample 1 (Fig. 9). This may be partly due to time-averaging: the column documents accumulated diversity over about a century of time, while the litter sample presumably documents only a year or two of shell accumulation (no live specimens were recovered). However, it also probably illustrates the thinning out of the regional snail fauna as more a stressful Holocene climatic regime took hold.

Figure 7: Looking north at David Calame collecting Litter Sample 1 from one-meter quadrat on the contemporary floodplain of Blanco Creek (March, 2020). Surface litter is grass and leaves from fairly extensive tree canopy. This sample produced over 1200 specimens.
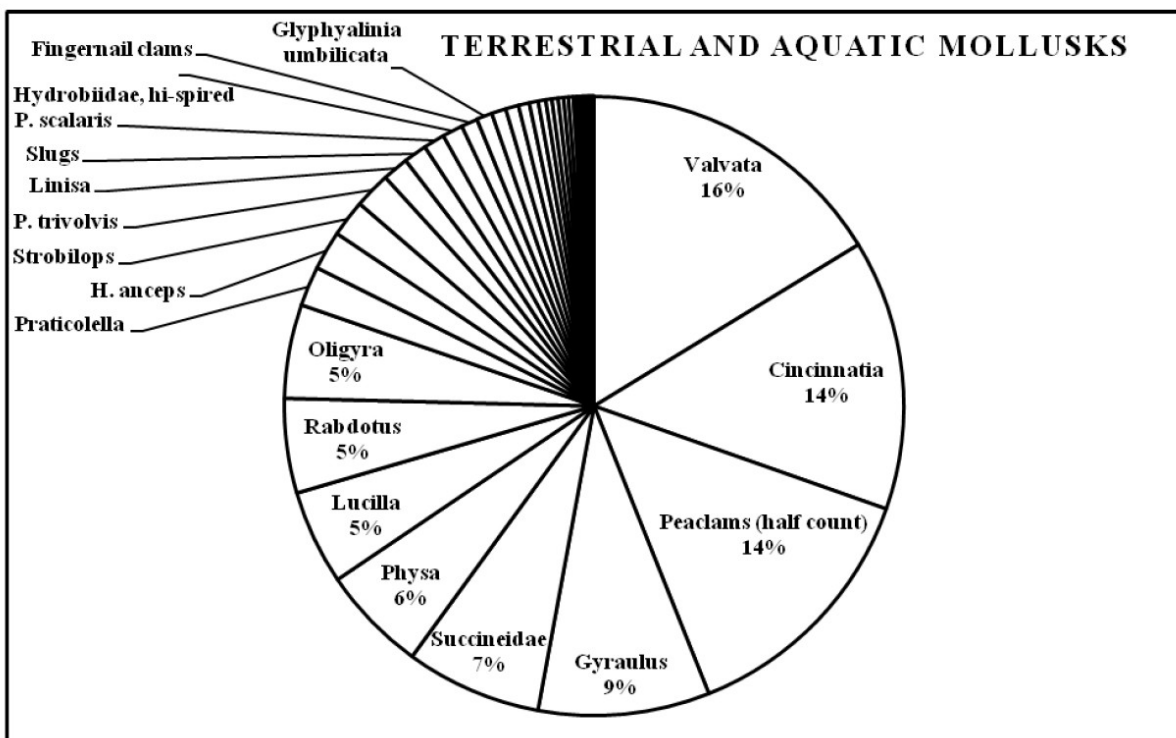
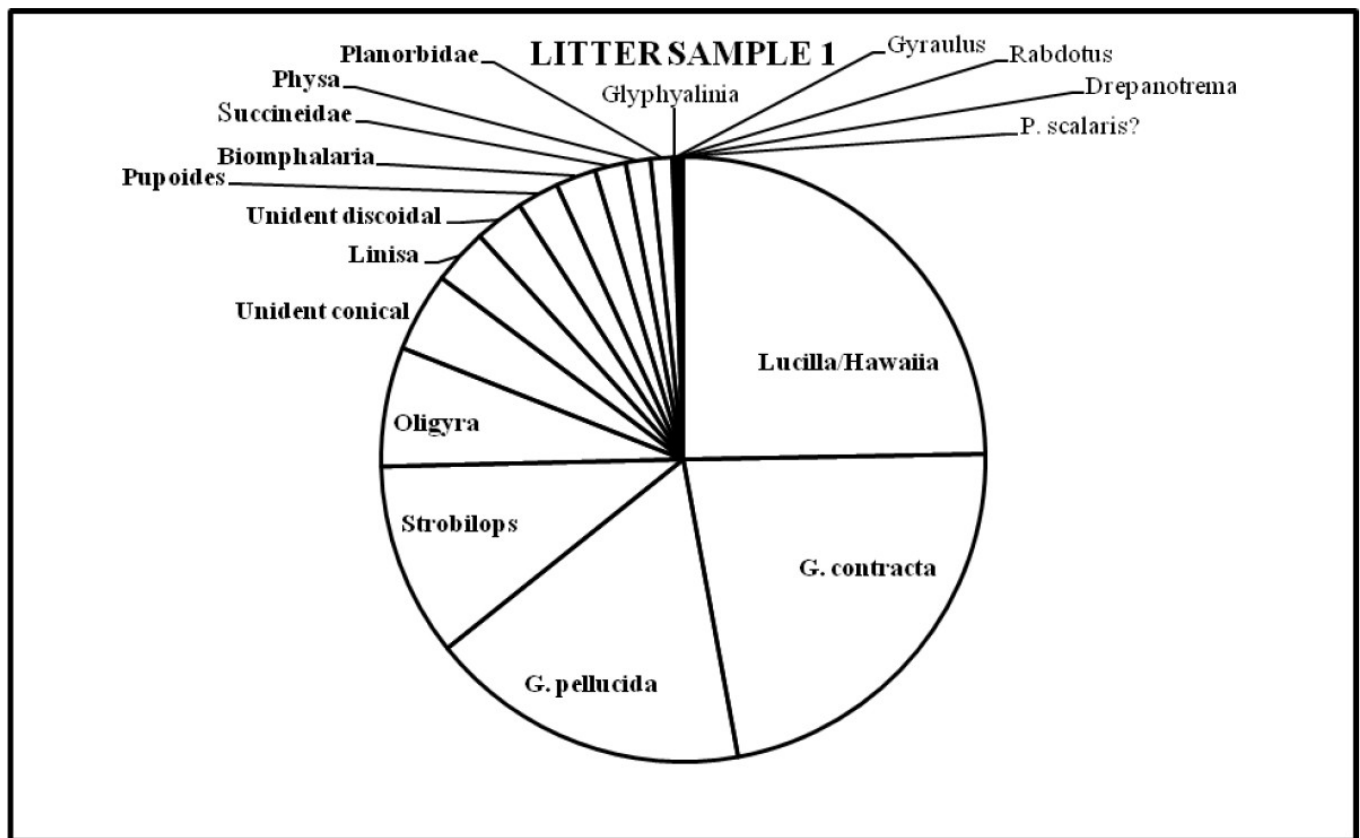*Figure 8: Preliminary inventory of entire Test Pit 3 column.*

Figure 9: Preliminary inventory of Litter Sample 1.

Summary: Evolving Hydroclimate

The area sampled in this study consists of rapidly accumulating, thick, sandy deposits with a robust aquatic snail and sphaeriid fauna and little evidence of stable or vegetated surfaces. The aquatic component has a sizable proportion of prosobranch species, suggesting streamflow was reliable, clear, and well-oxygenated. Species like *Valvata tricarinata* (thought to be extirpated now from Texas) and *Cincinnatia integra* (still present, but with range retracted to the north) are markers of former hydroclimate.

The Younger Dryas-aged "bench" deposits at Berger Bluff (estimated at perhaps about 9500-12,900 cal BP) furnished data from vertebrates, freshwater mussels, sediments, and biosilica, as well as a diverse assemblage of terrestrial and aquatic snails. There are differences compared to Buckner Ranch (Berger Bluff has large-bodied woodland taxa such as *Mesomphix*, *Mesodon*, and adult *Anguispira*, but fewer sphaeriid clams), but there is very substantial overlap between the assemblages from the two sites. The similarity between the two, with the sample column at Buckner Ranch evidently dating somewhat later, illustrates how well-watered riparian habitats along small creeks in this part of South Texas persisted into the Early Holocene, until major flood events began to strip out and rearrange these bottomland corridors as Holocene hydroclimate evolved.

Acknowledgements

References

Bousman, C. B., B. W. Baker and A. C. Kerr, 2004. Paleoindian Archeology in Texas. Pages 15-97 in Timothy K. Perttula*, The Prehistory of Texas*. Texas A&M University Press.

Brown, K. M., 2006. The Bench Deposits at Berger Bluff: Early Holocene — Late Pleistocene Depositional and Climatic History. Unpublished PhD dissertation (distributed on CD-RM), University of Texas at Austin.

Conkin, J. E. and B. M. Conkin, 1962. Pleistocene Berclair Terrace of Medio Creek, Bee County, Texas. *Bulletin of the American Association of Petroleum Geologists* 46(3):344-353.

Fullington, R. W. and W. L. Pratt, Jr., 1974. *The Aquatic and Land Mollusca of Texas*. Dallas Museum of Natural History, *Bulletin* 1. Part Three: The Helicinidae, Carychiidae, Achatinidae, Bradybaenidae, Bulimulidae, Cionellidae, Haplotrematidae, Helicidae, Oreohelicidae, Spiraxidae, Streptaxidae, Strobilopsidae, Thysanophoridae, Valloniidae (Gastropoda) in Texas.

Hershler, R., 1996. Review of the North American Aquatic Snail Genus *Probythinella* (Rissoidea: Hydrobiidae). *Invertebrate Biology* 115(2):120-144.

Hubricht, L., 1962 Land Snails From the Pleistocene of Southern Texas. *Sterkiana* 7:1-3.

Klockmann, M., M. Scharre, M. Haase and K. Fischer, 2016. Does Narrow Niche Space in a "Cold-Stenothermic" Spring Snail Indicate High Vulnerability to Environmental Change? *Hydrobiologia* 765:71-83.

Koopman, K. R., F. P. L. Collas, G. van der Velde and W. C. E. P. Verberk, 2016. Oxygen Can Limit Heat Tolerance in Freshwater Gastropods: Differences Between Gill and Lung Breathers. *Hydrobiologia*763:301-312.

May, S. R., 2019. The Lapara Creek Fauna: Early Clarendonian of South Texas, USA. *Paleontologia Electronica* 22.1.15A:1-129.

Moodie, K.B. and van Devender, T.R., 1979. Extinction and Extirpation in the Herpetofauna of the Southern High Plains with Emphasis on *Geochelone wilsoni* (Testudinidae). *Herpetologica* 35(3):198-206.

Nash, S.R., 2001. The Buckner Ranch Site (41 BE 2): A Re-Examination of the Data from the 1938-1941 Texas Memorial Museum Excavations. Unpublished MA Thesis, University of Texas at Austin.

Pilsbry, H. A., 1934. Review of the Planorbidae of Florida, with Notes on Other Members of the Family. *Proceedings of the Academy of Natural Sciences of Philadelphia* 86:29-66.

Sellards, E. H. (with T.N. Campbell and G. L. Evans), 1940. Pleistocene Artifacts and Associated Fossils from Bee County, Texas. *Bulletin of the Geological Society of America* 51:1627-1657.

Slaughter, B. M., 1963. Some Observations Concerning the Genus *Smilodon*, With Special Reference to *Smilodon fatalis*. *Texas Journal of Science* 15(1):68-81.

Sowards, B., 2012. *Survey of the Freshwater Gastropods of Southeastern Kansas with Emphasis on the Distribution and Habitat Use of the Delta Hydrobe (*Probythnella emarginata*).* Unpublished MS thesis, Fort Hays State University.

Abstracts

García-Argudo, G., Fernández-Marchena, J.L., Vergès, J.M., Fullola, J.M., 2020. Contributions of microscopy to the study of the Upper Paleolithic *Homalopoma sanguineum* shell beads. *Quaternary International* 569-570, 23-38. https://doi.org/10.1016/j.quaint.2020.08.049

Recently, there has been a proliferation of studies focused on traceological analyses of shell tools, most of which have been carried out using high magnifications. In contrast, wear patterns identified in other types of shell objects, such as ornaments, are usually analyzed at low magnifications. A new approach to the technological and functional analysis of Paleolithic *Homalopoma sanguineum* shell beads is proposed here. This taxon has been considered especially problematic in archaeomalacology for several reasons. First, it is a very rare species on current coasts, so conducting perforation and suspension experiments is logistically difficult. This leaves two unique routes for the acquisition of data: analogous experiments on other seashells, which is not recommended based on the characteristics of the internal structure of this species, or directly through the study of archaeological specimens. Secondly, it has been considered impossible to successfully perform use-wear analyses due to the physical characteristics of this species. Lastly, the high reflective capacity of the species' inner nacreous layer can make its study via optical microscopy difficult. Given these issues, the goal of this study is to compare the advantages and disadvantages of the microscopy equipment conventionally used for use-wear analysis. By comparing multiple microscopes' accuracy in identifying polishing, striation, and micro-chipping patterns, a set of criteria has been generated which can be used not only in analyses of *H. saguineum*, but in a wide range of nacreous ornaments.

Kozuch, L., 2021. Cahokia's Mound 72 Shell Artifacts. *Southeastern Archaeology,* 39 (1), in press.

Around AD 1050 at Cahokia, a sudden coalescence of peoples with new ceremonials and Mound 72's commemorative human interments provide evidence of long-distance contacts and finely-crafted artifacts. Beads from the famous Mound 72 Beaded Burial have remained unstudied since they were unearthed—a strange situation given the importance of the Beaded Burial. This article presents results from my re-examination of all shell artifacts from Mound 72, including some new artifact identifications, bead counts and measurements. Artifacts previously called gorgets are shell cups. One of them was remarkably large, and the source for most marine shells was probably the eastern Gulf of Mexico. I present a new method of examining bead drill holes using the frustum formula, supporting that porcupine quills or biological materials were used as drill tips for columella beads. This method can be used on stone and bone beads as well. I hypothesize a general decline in bead crafting through time. Paired shell artifact emplacements throughout Mound 72 echo the paired male/female human interments from the Beaded Burial, adding to evidence that Mound 72's burials were part of a ritual theater. My analysis supports the contention that marine shell artifacts were symbolic conduits of human spirits and power.

Kozuch, L., 2020. Shell Bead Crafting at Greater Cahokia. *Illinois Archaeology,* 32, in press.

Shell beads were important to Mississippians, so much so that tens of thousands were made, most of which were found associated with human burials. Here I present information on shell bead crafting from the American Bottom, most particularly Cahokia, along with crafting techniques. Different shell parts and bead types require different methods and tools, based on the shape and toughness of different shell parts. Columella versus disk bead workshops are thus differentiated. I describe these tools and hypothesize that chert microdrills were used mainly to drill disk beads, while biological materials, such as porcupine quills and river cane, were primary drill tips for columella beads. I distinguish bead standardization from craft specialization, and this helps to engender more precise discussions of crafting. Bead crafting time estimates, large workshop areas, and the preciousness of shell materials, indicate full-time bead crafting specialists.

<div style="background:#c00;color:#fff;text-align:center;font-weight:bold;">Book Review</div>

Review of García-Escárzaga, Asier, 2020. *Paleoclima y aprovechamiento de recursos costeros durante el Mesolítico en la región cantábrica (N de Iberia)*. BAR International Series 2977. Oxford: British Archaeological Reports. ISBN 978-1-4073-5672-3. 245pp + Additional Material Online.

Reviewed by Matt Law, Bath Spa University, UK

The coasts of the Iberian Peninsula have been a rich source of material for research into pre-Neolithic hunter-fisher-forager subsistence, and this book, largely based on Asier García-Escárzaga's doctoral thesis (from the University of Cantabria) into the cave site of El Mazo in Asturias does much to enrich our knowledge, with a thorough application of analytical techniques.

Across 14 chapters, the book efficiently brings the reader up to speed with the Mesolithic maritime economy of northern Iberia before setting out the objectives of the study, discussing the methods and results, situating them in their regional context, and reflecting on the value of shells as palaeoclimatic indicators.

A prologue (in English) by Lawrence Guy Strauss briefly outlines the context for the work and the history of study of the Mesolithic *concheros* (shell middens) of the Iberian Peninsula, before Chapter 1 (in Spanish, as are subsequent chapters except for an English language summary at the end) discusses the *concheros* in more detail, noting that unlike other shell middens of the Atlantic façade, those in northern Iberia are almost exclusively found in caves and shelters, which gives rise to a particular phenomenon less commonly seen in middens elsewhere: cementation. A helpful table lists radiocarbon dates (recalibrated for this study using IntCal 3) from the Mesolithic and Neolithic of the region. Chapter 2 summarises current knowledge of early Holocene palaeoclimate and palaeoenvironment in the study region. Chapter 3 introduces the aims and objectives of the study, and Chapter 4 the site itself, discovered in 2008, and excavated between 2009 and 2017 by a team led by Igor Gutiérrez Zugasti. An impressive 24 radiocarbon and 7 amino acid racemization dates from the stratigraphic sequence are presented, suggesting that the midden material began to be deposited from between c.9, 000 and c.7, 500 cal BP. The study focuses on samples collected in the 2012 fieldwork campaign.

Methods are detailed in Chapter 5, which includes helpful illustrations of the fragmentation categories for bivalves and spired and non-spired (for example, Patellidae) gastropods (as well as echinoids and the goose barnacle *Pollicipes pollicipes*) used in the study (originally framed by Gutiérrez Zugasti 2009a, 2011b). For palaeoclimatic analysis, oxygen isotope analysis was carried out on *Patella vulgata* and *Phorcus lineatus* from the samples (*Patella* spp. and *P. lineatus* account for c.90% of MNI at the site), while for seasonality studies, analysis of oxygen isotopes from 120 *P. lineatus* samples was performed, as well as on four modern specimens of *P. lineatus* from Playa de Langre, to the north east of Santander (two of these were collected in October 2012, the other two in April 2012). The chronology of the archaeological samples encompasses the 8.2ka cold event, and results suggest a decrease in summer and winter sea surface temperature, although some important unknowns are highlighted.

Analysis of Mg/Ca and Sr/Ca ratios was also carried out (using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) and Laser Induced Breakdown Spectroscopy (LIBS), the latter a relatively novel technique for archaeomalacology), again with a necessary study of modern specimens of *P. lineatus*, *P. vulgata* and *Patella depressa*, with the important finding that LIBS compares favourably with ICP-OES for the measurement of Mg/Ca ratios.

The impressive array of methods allows García-Escárzaga to draw some significant conclusions about changing environmental conditions through the study period, in particular the 8.2 ka cold event and its implications for human resource exploitation; as well as key insights into the seasonality of shellfish collection, which tend to suggest an awareness among the Mesolithic hunter-fisher-foragers of Cantabria of the relative meat yield of *Phorcus lineatus* at times throughout the year.

Recent Publications

PAPERS

Amesbury, J.R., Walth, C.K. & Bayman, J.M., 2020.Marine shell ornaments and the political economy of gendered power in the Mariana Islands. *The Journal of Island and Coastal Archaeology*, DOI: 10.1080/15564894.2020.1838972

Klishko O.K., Kovychev E.V., Vinarski M.V., Bogan A.E., Jurgenson G.A. 2020. The Pleistocene-Holocene freshwater molluscs as indicators of the past ecosystem changes in Transbaikalia (Eastern Siberia, Russia). *PLOS One* 15(9) (Published: September 18, 2020) DOI: 10.1371/journal.pone.0235588

Kurzawska, A., and Sobkowiak-Tabaka, I. 2020. *Spondylus* shells at prehistoric sites in Poland. *Sprawozdania Archeologiczne* 72 (2). pp. 41-66. DOI: 10.23858/SA/72.2020.2.1713