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Paper Presented in the symposium *Subsistence, Settlement, History, and Identity: Current Approaches to the Investigation of Shell Middens, Mounds, and Rings of the Southeastern United States*, organized by Thaddeus G. Bissett and Stephen Carmody.
70th Annual Meeting of the Southeastern Archaeological Conference,
Tampa, FL, 6-10 November.

Presentation slides can be found at the end of the document

Design over space and time: an analysis of the Atlantic and Gulf Coast shell rings of North America

The Late Archaic shell rings of the Atlantic and Gulf coasts of the southeastern United States have been a part of the archaeological understanding of North American prehistory since their initial discovery in the early 1800's (Drayton 1803). Through the years, as information has been gathered and added to our understanding of the rings, different regional discussions and analyses of the rings have been conducted, beginning with C.B. Moore (SLIDE) in the 1890's through the publications of his findings from his travels along the Atlantic Coast (1897, 1898a, 1898b). Since then there have been various analyses using the rings and each has included the rings in different ways (Russo 2006; Sassaman 1993; Trinkley 1980, 1985) and each have added to and furthered our understanding of the rings, and more broadly, the southeastern Late Archaic. To date, however, there has been one element of the rings that has yet to be examined regionally or chronologically and, interestingly, it is the one feature of the rings that makes them unique, namely their elliptical designs. One of the main reasons for this lack of analysis of individual shell ring designs is that there has been no easy and reliable way to separate out the individual ring designs into meaningful and comparable metrics that could be used within an analysis. It is now possible, however, through the use of elliptical mathematics and the standardization of shell ring measurements, to individualize shell ring design and thus to investigate changes in shell ring design at the individual ring level both geographically and chronologically.

As noted, one of the main reasons for the lack of regional analysis of ring designs is because, as Dr. Russo has stated, "no uniformly recognized nomenclature exists for the variety of shapes and site features found at ring sites aside from descriptive terms" (Russo 2004:31). The most commonly used terms for the description of the shell rings are as (SLIDE)follows: C-shaped, U-shaped, horseshoe-shaped, or closed circle. The first obvious issue with these descriptive terms is that, in regards to comparative analyses, they are categorical in nature. There are over 50 identified Late Archaic shell rings with only the four aforementioned major categories that are used to describe their designs. Thus, any regional analysis of designs using these categories would be coarse grained and limited by their use. What is needed instead, is a set of metrics that generate interval data, rather than categorical, and thus can be individualized and comparable.

The second issue with the use of these categories, and the issue of greater concern with regards to comparative analyses, is that the four descriptive terms are vague and ill-defined. At what point does a ring become C-shaped rather than U-shaped? What is the difference (if any) between U-shaped rings and Horseshoe-shaped rings? How big does the opening of a shell ring need to be in order to be classified as a C-shaped versus a closed-circle, and in this scenario are we considering possible erosion when describing its shape? Though pedantic, these questions do highlight the fact that any analysis of the designs of shell rings that uses these categories would fall prey to varying levels of bias, from initial recording bias to the researcher's own interpretations of what the categories represent. Furthermore, with shell rings playing an active role in discussions regarding social complexity within foraging peoples, it is important that we are able to accurately describe and compare the differences in designs of the rings.

Thus, the first step towards any comparative analysis of design, is being able to accurately describe the designs of the shell rings through a nomenclature (or set of metrics) for these designs that works at the individual level and that generates interval data. No matter how one interprets the shell rings and their possible uses, one thing does remain a (SLIDE) constant: shell rings, as their name implies, are constructions of shell that form an elliptical pattern with a marked shell-free interior plaza (Russo and Heide 2003; Russo 2004; Sassaman 1993; Trinkley 1980). Therefore, the solution for creating the necessary metrics to describe shell ring design should be found within elliptical mathematics.

A recent (SLIDE) attempt at creating a standardized nomenclature for the rings was the mapping of the Sewee shell ring by Russo and Heide (2003). In their report they call for a standardization of ring measurements and descriptions, and the creation of a glossary of ring terms (Russo and Heide 2003:48) that are both descriptive and accurate, and indeed many of the terms suggested should become more standardized within future shell ring literature, especially within discussions of ring design (Table 1). However, even with these proposed terms, there were still too many dimensions needed to describe the rings, with no one or two that, by themselves, might characterize or describe the design of the rings. Building off of this attempt, new metrics were created that combine those recommended terms into a single set of metrics that are both uniquely descriptive and that generate the necessary interval data for comparative analyses. These metrics are: *shell ring eccentricity*, to examine the shape of the rings, and *major diameter*, to represent the size of the rings. Eccentricity, when combined with major ring diameter, can fully describe the design and size of the shell rings at the individual level.

Before describing the analysis of shell ring design, a brief discussion of elliptical mathematics, and the validity of these metrics, is necessary. Ellipses (SLIDE) are conic sections that result from a plane intersecting a cone at an arbitrary angle and creating a closed curve. Within elliptical (SLIDE) geometry, circles represent special situations where the plane intersects the cone perpendicular to the cone's central axis. Both ellipses and circles are vertically and horizontally symmetrical about their major and minor axes and this symmetry results in relatively straightforward descriptive mathematics that are the same for both shapes, thus ensuring that the mathematics being used covers these two design situations. While most of the shell rings being analyzed are not perfectly symmetrical ellipses they will be treated as such for the purposes of this analysis in order to not complicate the mathematics. Every (SLIDE) ellipse has a major axis (A^{I}-A) and a minor axis (B^{I}-B), mirroring Russo and Heide's (2003) Major Diameter and Minor Diameter, as well as two foci (F_1 and F_2). The (SLIDE) foci (F_1 and F_2) for perfectly symmetrical ellipses are always equidistant from the center point, which is represented by the value *f*. In this equation, *a* equals half the value of the major axis and *b* equals half the value of the minor axis which means that all one needs to calculate f for a shell ring are the Major and Minor axes.

Once *f* has (SLIDE) been calculated it is then possible to calculate the eccentricity of the ellipse. The eccentricity of an ellipse (ε) is the ratio of the distance between the two foci to the length of half of the major axis (Figure 5), put more simply eccentricity represents the degree to which an ellipse is circular. Eccentricity values have no units, and range between values of 0 and 1, with the value 0 representing a perfect circle and the value 1 representing a straight line or fully flattened ellipse. Thus, (SLIDE) by being able to assign each shell ring an eccentricity value it is possible to have an interval scale metric that represents either the elliptical or circular nature of the ring without having to use the categorical terms as described earlier. Furthermore, as we have seen, to calculate the eccentricity all one needs are the values of the major and minor axes which is something that should be a part of any data collected at a shell ring. The eccentricity, however, does not provide a measure of size of the rings. For a size metric, the major axis dimension was chosen due to this metric always being the larger dimension of shell rings.

The data for this initial analysis was gathered from the current shell ring literature. Specifically, site maps, recorded dimensions, and chronological data were collected for this analysis with all other data being entered into a central shell ring database. In order to ensure that the eccentricity calculations and maximum diameters were consistent, all of the site maps that could be collected from the literature were scanned and uploaded into AutoCAD (2013) where all of the measurements were standardized as per Russo and Heide (2003) and the major and minor diameters were measured. All of these data, as well as the additional data from the literature, have been entered into a single Late Archaic Shell Ring Database. In those instances where site maps could not be located, published dimensions were used for the calculations. There were a few shell rings that were excluded from this analysis (n=10), namely those that have no site map or published dimension, and those that have either yet to be defined as a shell ring or those that, due to erosion, do not have enough of the ring present to allow for any reliable diameter measurements.

To ensure (SLIDE) that both eccentricity and major diameter could be used simultaneously within an analysis a test for covariance was conducted. A scatter plot of the data and a Pearson (SLIDE) product-moment correlation were created and both (SLIDE) indicated that there was a weak positive relationship between the metrics but still allowing for the use of both variables as unique metrics for analyzing the shell rings.

All eccentricity, major axis, and published chronological data were entered into ArcGIS examined chronologically and regionally. Due to this analysis being based around the examination of design elements of the shell rings (shape and size) it was felt that using the earliest (SLIDE) recorded date would be the most accurate. While later dates may represent the final, and thus more completed stages of the designs of the rings, the general size of the rings would have been defined earlier rather than later, as would to a lesser extent, the general layouts. Furthermore, while it has been noted (Sanger 2010) that the nature of the chronology of these rings can be a bit "quixotic", it was felt that this being an initial analysis using a new descriptive method, and that the purpose of this analysis is to highlight the utility of the new metrics, that the use of more of the dates rather than eliminating them would allow for a larger and more regional perspective.

As noted, the main data for this analysis are the chronological data, the two metrics of eccentricity and major axis, and the general locations of the rings. When one initially begins to look at the data either only chronologically or geographically, these new metrics do not seem to illustrate any patterns. However, when one can overlay the chronologies with the design elements and plot them all geographically, a potential pattern does emerge. The nature of this pattern, biased in part on the choice of using early dates for the rings, takes the form of the possible movement of the initial use of shell rings along the coasts. What (SLIDE) we see is a possible three or four stage movement of shell ring use, with four core areas of use, where upon establishment of the tradition, there is an eventual increase in the eccentricity of the rings within that region as well as a change in ring sizes. Also if, as social space theory suggests (Gron 1991; Kelly 1995), an increase in the elliptical nature of a site (or in this case an increase in eccentricity) is a possible indication of an increase in social inequality and/or complexity, then what is being illustrated by the changes in ring design over space and time, is that as shell ring use is established there is an increase in social complexity or social inequality within that region.

The initial use of shell rings is of course partly clouded by the nature of the chronological data that exists within the literature; at present there appear to be two possible interpretations for the location of the initial use of shell rings. The first of these interpretations is that the initial use of shell rings occurs around the head of the St. Johns River with the creation of the Oxeye and Cannons Point shell rings (Figure 8). After this initial anchor is placed, there is an almost immediate spread of the tradition to the Gulf coast as well as up the Atlantic coast. This initial interpretation, however, is possibly tied in part, to our bias of combining developments together with the aim of attempting to define causal relationships. This is especially the case with the initial development of a technology such as the first creation and use of pottery in the southeast. When such events occur we find ourselves looking for related factors, and in this instance the initial development of pottery does indeed coincide with the use of shell rings, but, as has already been demonstrated (Sassaman 1993), the initial use of pottery does not occur in all places that shell rings are used. Furthermore, the development of pottery, and its intentional use or not-use, is also an indicator that, while shell rings and pottery may be related, the initial use of the one does not define the initial creation of the other, but rather, the initial creation of pottery, and the subsequent changes of the wares, may be a result of the eventual cultural separations that occur with the movement of the ring tradition.

The alternate (SLIDE) interpretation of the initial use of shell rings is based around the array of dates found at Horr's Island (Russo 1994) combined with the amount of architecture, in the form of mounds, which are also present. These dates, duration, and intensity of occupation at Horr's island, suggests that the initial use of shell rings may have indeed occurred along an earlier occupied Gulf Coast and then made its way through the interior of the panhandle up to the head of the St. Johns, (Figure 9) at which point we then see the aforementioned move up the Atlantic Coast. In either of these two interpretations, as will be shown, the overall patterns seen with size and eccentricity remain the same.

No matter where the use of shell rings has its start, the move along the Atlantic coast does begin at the head of the St. Johns River. After this core is established we see a push both northwards and southwards. The push (SLIDE) southwards is characterized by both a significant increase in shell ring size and an increase in eccentricity. Interestingly, (SLIDE) the initial, and possibly core, ring of this region, the Oxeye shell ring, is one of the first rings in the region to be abandoned (Sanger 2010). However, the two subsequent rings in the move south remain until Sanger's (2010) postulated final abandonment. If the eventually use and non-use of pottery is an indication of some level of separation of shell ring using groups then it is possible that the head of the St. John's becomes a buffer zone between those that choose to use pottery and those that don't, and thus being in a buffer zone the ring itself may have been ill-placed.

The move (SLIDE) northward is defined by a general push towards the Savannah River that eventually settles back to a possible core being established on Sapelo Island, defined both by its unique clustering of a significantly larger ring and persistence of habitation, accompanied by the construction of smaller rings. This first wave of movement up the coast sees a decrease in general size of the rings from the original Atlantic ring, Oxeye. There is also a decrease in the eccentricity of the rings the more northward the tradition reaches. However, once the shell ring using tradition is established we see the shift back towards an increase in eccentricity with the most marked increase on Sapelo. Furthermore, this core also becomes the heart of what eventually becomes the Stallings fiber temper wares. It is interesting to note, however, that the initial core area at the St. Johns, as well as initial push north are both well-established before we see the first use of pottery in the area. This pattern will be seen again within the next push northward.

This next (SLIDE) move northward of the shell ring using tradition moves up towards the Grand Strand and eventually settles to forms a core at Fig Island, again with the creation of a much larger ring with a persistence of place and the building of accompanying smaller rings. As with the first wave, this second wave of movement of the tradition see that once the tradition is established, locally there is a shift towards higher eccentricity if not always size. And again, as with the initial drive up the coast, we see that after the core, and the initial outlying rings are established, there is a development of a new ceramic ware, the Thoms Creek wares. Another pattern of note is that the shell rings that are built outwards from each of these cores are clusterings of more standardized smaller rings that have less eccentricity than the original core ring of the region.

The final movement of the shell ring tradition is almost as poorly defined as the initial use of the rings, but in this case it is a general lack of data from the shell rings in the region that is to blame. The final push appears to be less of moving the tradition to a newer area but instead filling in the gap between the two regions. This final move is southwards back to the head of the Savannah River, which may have initially been a kind of transition zone between the first two movements. Many of the dates from this region are later and the wares that are found at these rings are usually more mixed than within the core regions of the first two movements. Furthermore, the design elements of these rings are more variable and may represent different design influences within this new mixture zone.

In conclusion, it would appear that design, as represented by eccentricity and size, is a local construct and changes locally and does not follow any set design at any regional level. The movement up the Atlantic coast appears to have development between major water headways and after an initial establishment of the tradition a core becomes visible with a ring grouping that has a larger more eccentric ring. We then see a continued use and in some cases a subtle expansion outward from these cores. Furthermore, after a wave of shell rings becomes established, we see that there is a change in the situation of the pottery technology as well as an increase in the eccentricities of the subsequent rings, all of which indicate a very dynamic and developing Late Archaic coastline.

On a final note, (SLIDE) all of these data, as well as all of the recorded data from the literature, have been entered into a single Late Archaic Shell Ring Database. This database is currently being expanded upon with the addition of data from the Woodland period rings and shell bearing sites in Florida as well as defining the region at the head of the Savannah river that would both fill in the data gap from that region as well as, if the chronologies are any indication, help to better examine the transition from what we have defined as the Late Archaic to Woodland period.

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Figures and Tables

Table 1: Shell Ring Description Nomenclature from Russo and Heide 2003

Ring Description Nomenclature
Greatest Ring Diameter (Major Diameter)
Least Ring Diameter (Minor Diameter)
Greatest Plaza Diameter
Least Plaza Diameter
Greatest Wall Width
Least Wall Width

Apex

Figure 1: Ellipses are conic sections resulting in a plane intersecting a cone

Figure 2: Circles are a special situation within elliptical mathematics where the two foci are on top of one another making the focal distance equal to zero

Figure 3: The parts of the ellipse: Major Axis (Diameter) ($A^{\prime}$-A), Minor Axis (Diameter) ($B^{\prime}$-B), Focal Distance *f*

Figure 4: The equation for the focal distance of an ellipse where *a* is half the measure of the Major Diameter and *b* is half the measure of the Minor Diameter

Figure 5: The equation for calculating the eccentricity (ε) of an ellipse where *f* is the focal distance and *a* is half the measure of the major diameter

Table 2: Shell ring site maps were uploaded into AutoCAD (2013) and all dimensions were standardized and re-measured to increase consistency amongst the dimensions

Shell Ring	**Eccentricity**	**Major Diameter**
Horr's Island	0.857675	150
Cannon's Point	0.743704	71
Oxeye	0.396714	165
Hill Cottage	0.478877	150
St. Catherines	0.08444	70
West Ring	0.803183	69
Bonita Bay	0.858364	230
Sapelo 1	0.260937	93
Auld	0.45034	56
Rollins	0.57386	190
Sewee Mound	0.581798	75
Fig Island 2	0.273965	72
McQueen	0.167244	71
Meig's Pasture	0.688724	88
Fig Island 3	0.208442	56
Claiborne	0.484123	200
Sapelo 2	0.6	75
Fig Island 1	0.541949	89
Skull Creek Small	0.586843	40
Guana	0.744904	222
Patent Point	0.296015	47
Coosaw 3	0.295246	34
Sea Pines	0.313499	51
Coosaw 2	0.45108	36
Coosaw 1	0.321187	36
A. Busch Krick	0.60418	40
Skull Creek Large	0.346071	55
Sapelo 3	0.686349	55
Barrows	0.603568	38
Joseph Reed	0.736722	293
Lighthouse Point	0.161687	76
Cedarland	0.109929	165

Figure 6: Scatter plot of the Eccentricity data and Major Diameter data to identify possible correlations within the two data sets. A weak positive correlation can be seen

Figure 7: Pearson product-moment correlation coefficient was calculated. The lower the value the weaker the relationship, thus the value of positive 0.2629 also indicates a weak positive relationship

Figure 8: One interpretation for the location of the initial use of shell rings, based upon both geography and chronology, places this initial use around the head of the St. Johns River with a diffusion outwards

Figure 9: An alternate interpretation for the location of the initial use of the shell rings has the first uses of shell rings occur along the Gulf coast and then spread up through the interior along the St. John's River

Table 3: As soon as shell rings are established in and around the St. Johns River, there is a move both north and south along the Atlantic coast

Shell Ring	Eccentricity	Major Diameter
Oxeye	0.396714	165
Rollins	0.57386	190

Guana	0.744904	222

Table 4: The move north is different from the move south especially in that eventually these rings are where pottery is first utilized in the southeast

Shell Ring	Eccentricity	Major Diameter
Oxeye	0.396714	165
Cannon's Point	0.743704	71
West Ring	0.803183	69
St. Catherines	0.08444	70
McQueen	0.167244	71
Sapelo 1	0.260937	93
Sapelo 2	0.6	75
Sapelo 3	0.686349	55

Table 5: The second wave of movement northward along the Atlantic coast reaches all the way to the central coastal region of what is now South Carolina

Shell Ring	Eccentricity	Major Diameter
Auld	0.45034	56
Sewee Mound	0.581798	75
Fig Island 2	0.273965	72
Fig Island 3	0.208442	56
Fig Island 1	0.541949	89
Coosaw 3	0.295246	34
Coosaw 2	0.45108	36
Coosaw 1	0.321187	36


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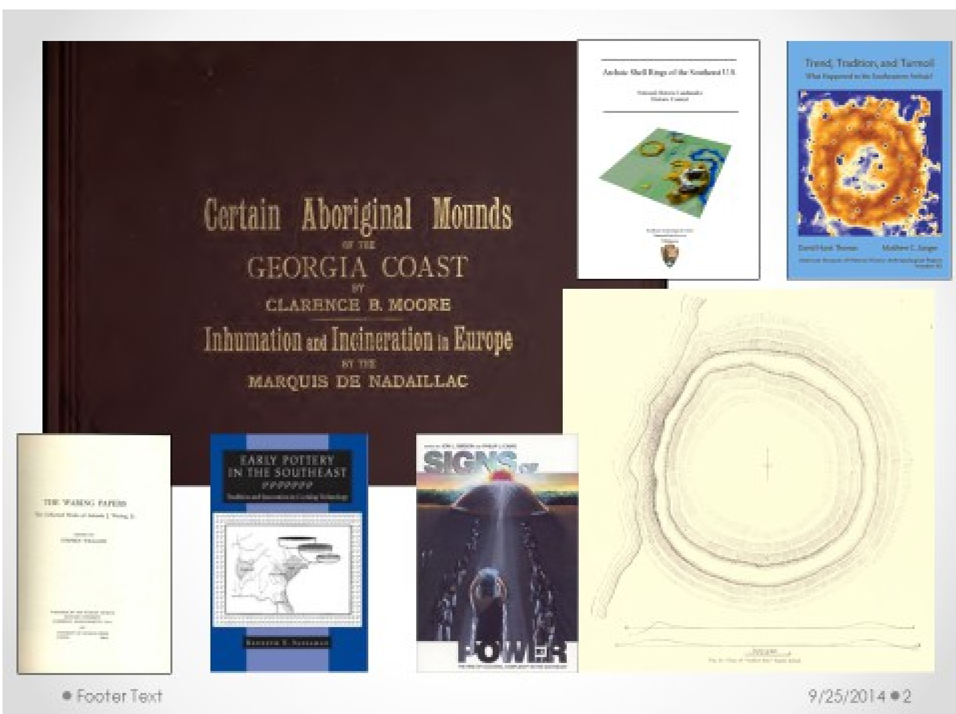
9/25/2014 • 1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by
CLARENCE B. MOORE
Inhumation and Incineration in Europe
by the
MARQUIS DE NADAILLAC
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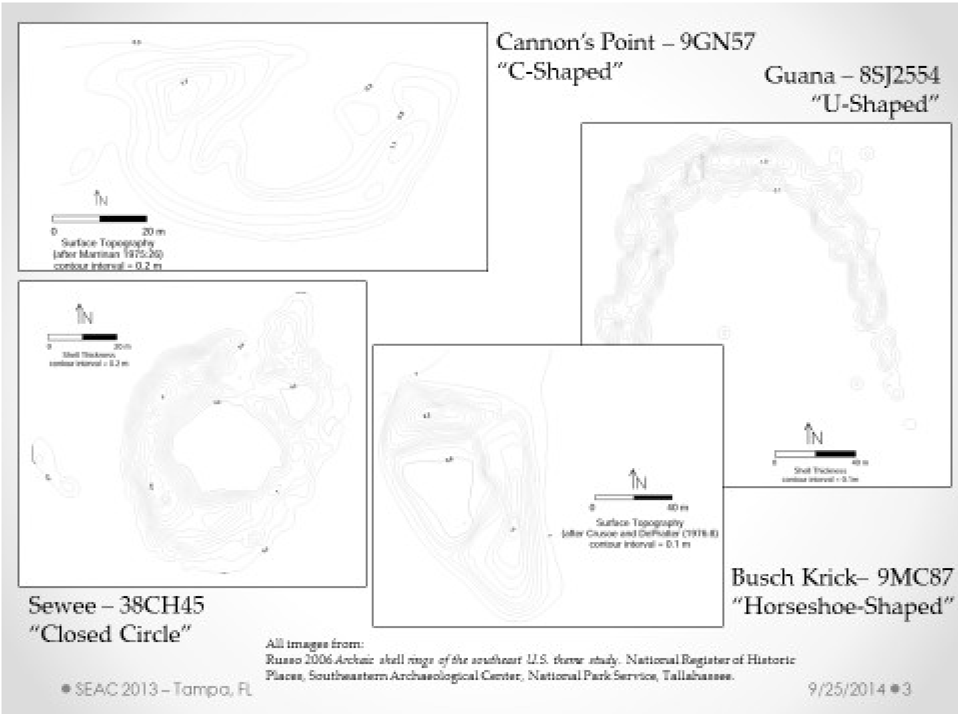
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"C-Shaped"
Guana – 8SJ2554
"U-Shaped"
Busch Krick– 9MC87
"Horseshoe-Shaped"
Sewee – 38CH45
"Closed Circle"
All images from:
Russo 2006 *Archaic shell rings of the southeast U.S. theme study*. National Register of Historic Places, Southeastern Archaeological Center, National Park Service, Tallahassee.
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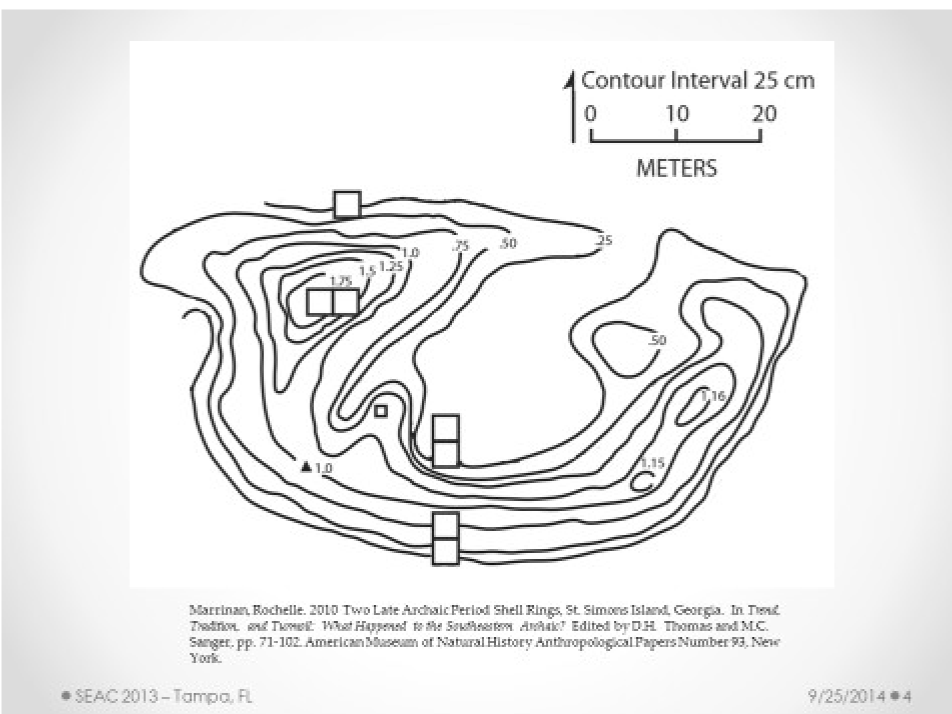
9/25/2014 3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9/25/2014 4

Table 1: Shell Ring Description Nomenclature from Russo and Heide 2003

Ring Description Nomenclature

Greatest Ring Diameter (Major Diameter)
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Greatest Plaza Diameter
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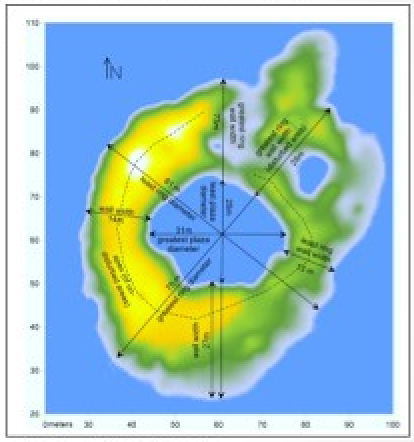


Russo, Michael and Gregory Heide. 2003 *Mapping the Sewee Shell Ring*. The Southeastern Archaeological Center, National Parks Service, Tallahassee.

• SEAC 2013 – Tampa, FL 9/25/2014 • 6

Ellipses are conic sections resulting from a plane intersecting a cone

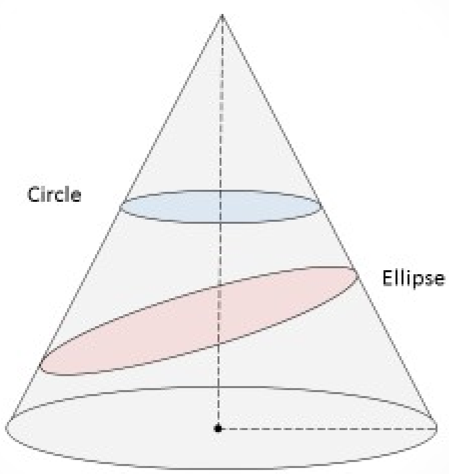
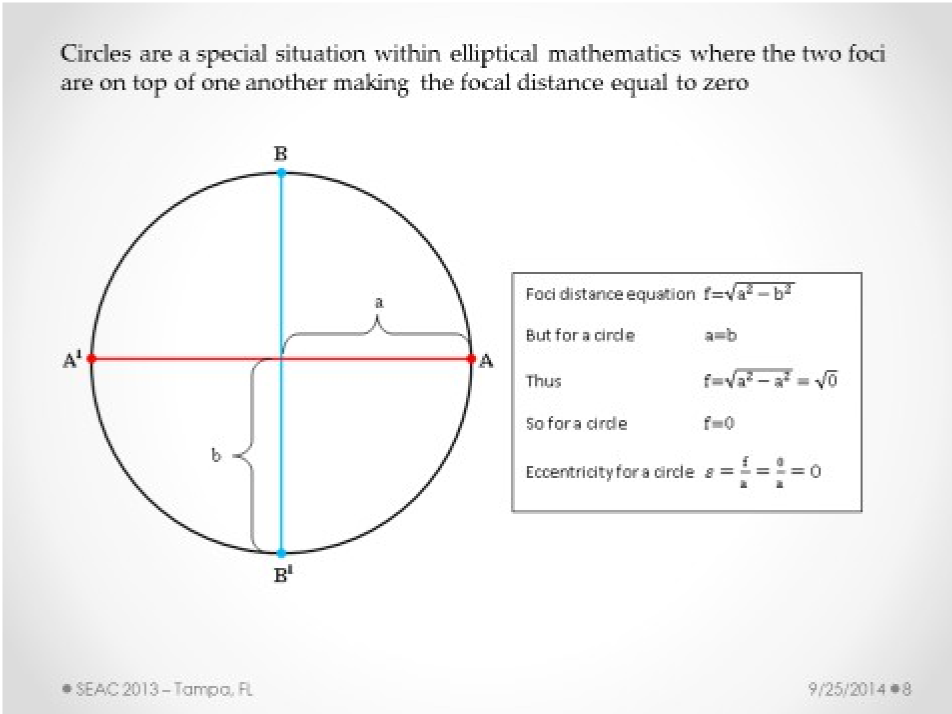


Figure: Ellipses form as a plane intersects with a three-dimensional cone. Circles are ellipses formed when the plane intersects perpendicular to the central axis of the cone.

• SEAC 2013 – Tampa, FL 9/25/2014 • 7


Circles are a special situation within elliptical mathematics where the two foci are on top of one another making the focal distance equal to zero
B
a
A^1
A
b
B^1
Foci distance equation $f=\sqrt{a^2-b^2}$
But for a circle $a=b$
Thus $f=\sqrt{a^2-a^2}=\sqrt{0}$
So for a circle $f=0$
Eccentricity for a circle $\varepsilon=\frac{f}{a}=\frac{0}{a}=0$
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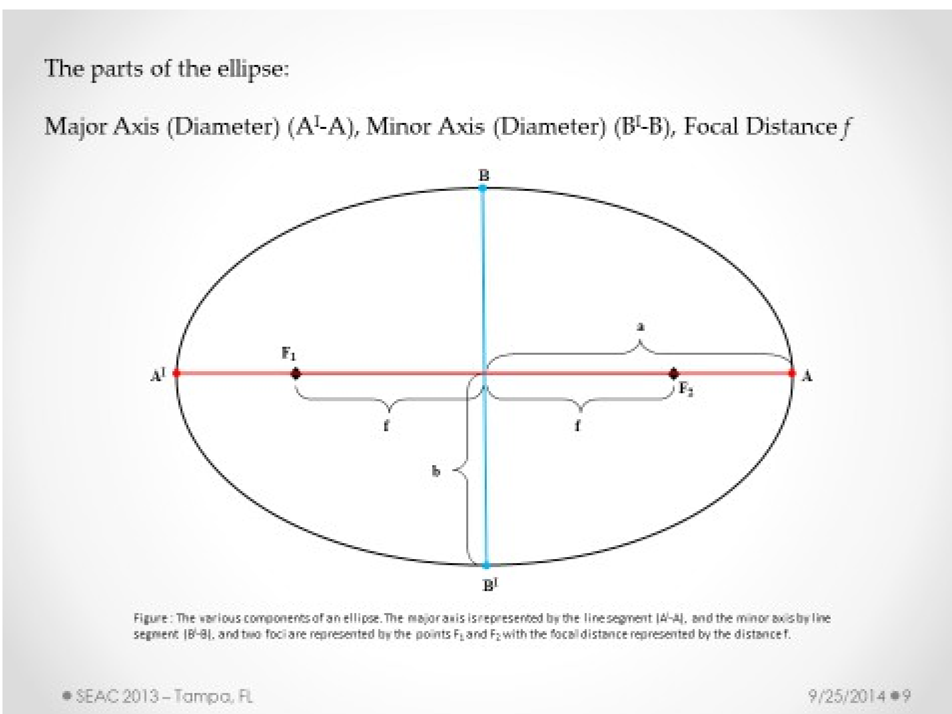
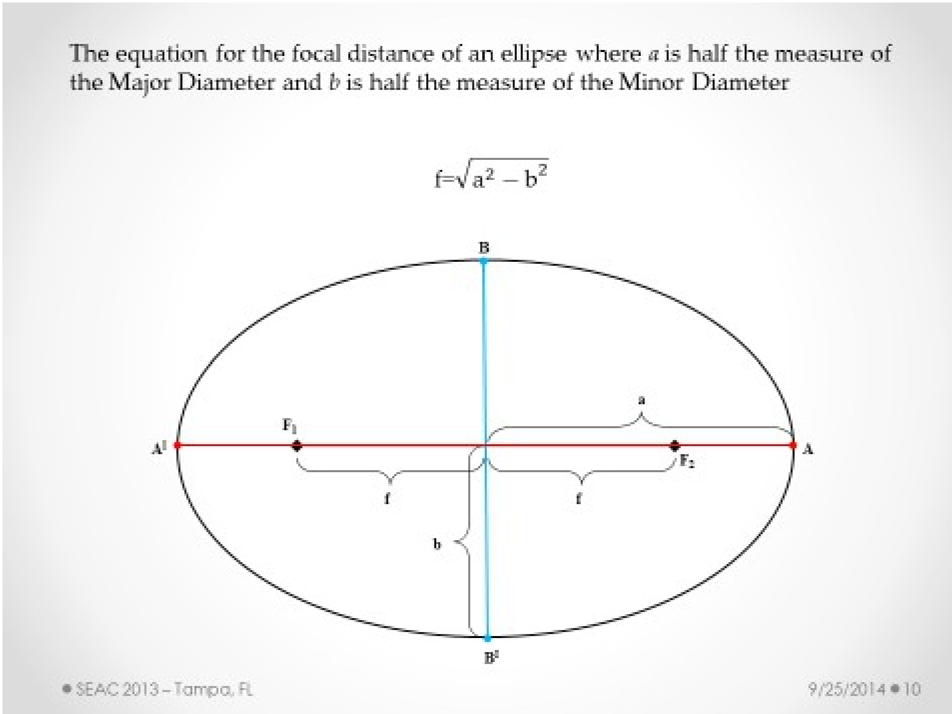
9/25/2014 8


The parts of the ellipse:
Major Axis (Diameter) (A^I-A), Minor Axis (Diameter) (B^I-B), Focal Distance *f*
B
a
F_1
A^I
A
F_2
f
f
b
B^I
Figure : The various components of an ellipse. The major axis is represented by the line segment (A^I-A), and the minor axis by line segment (B^I-B), and two foci are represented by the points F_1 and F_2 with the focal distance represented by the distance f.
SEAC 2013 – Tampa, FL
9/25/2014 9


The equation for the focal distance of an ellipse where *a* is half the measure of the Major Diameter and *b* is half the measure of the Minor Diameter
$f=\sqrt{a^2 - b^2}$
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F_1
A^1
A
F_2
f
f
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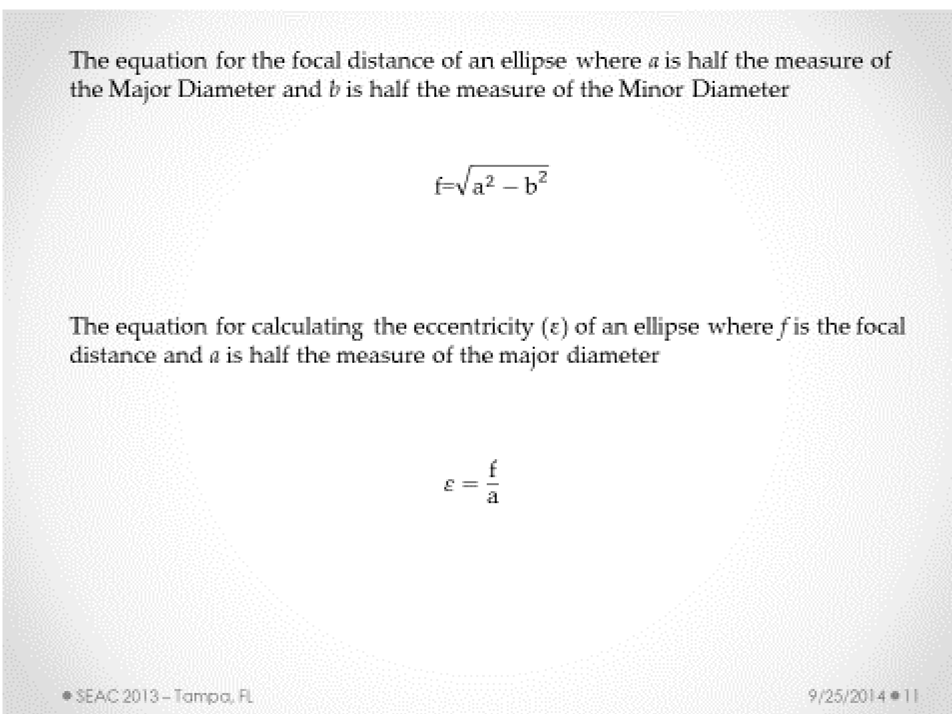
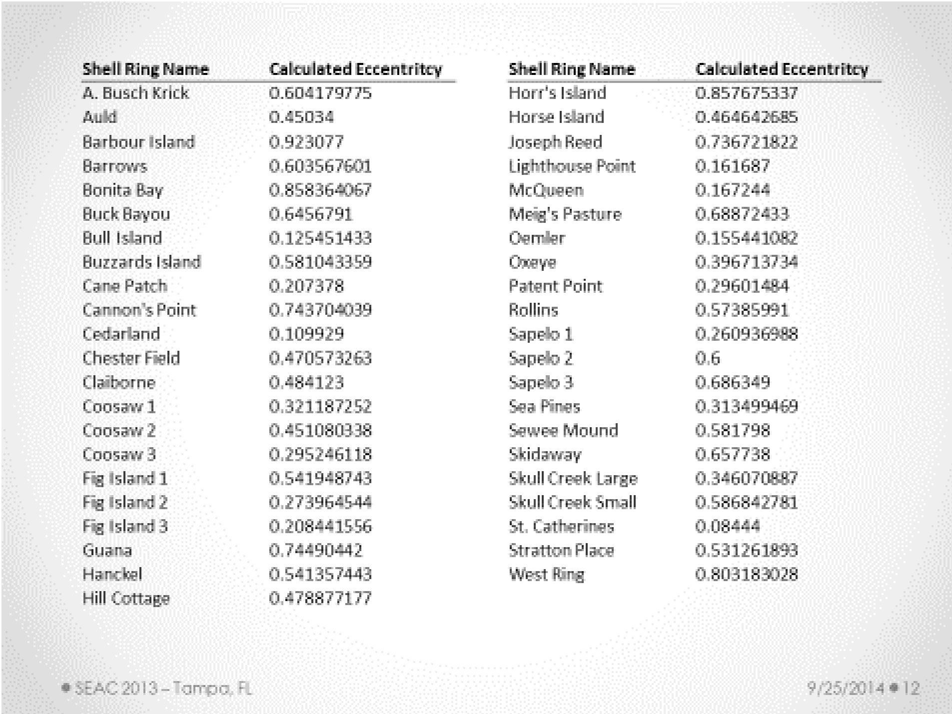
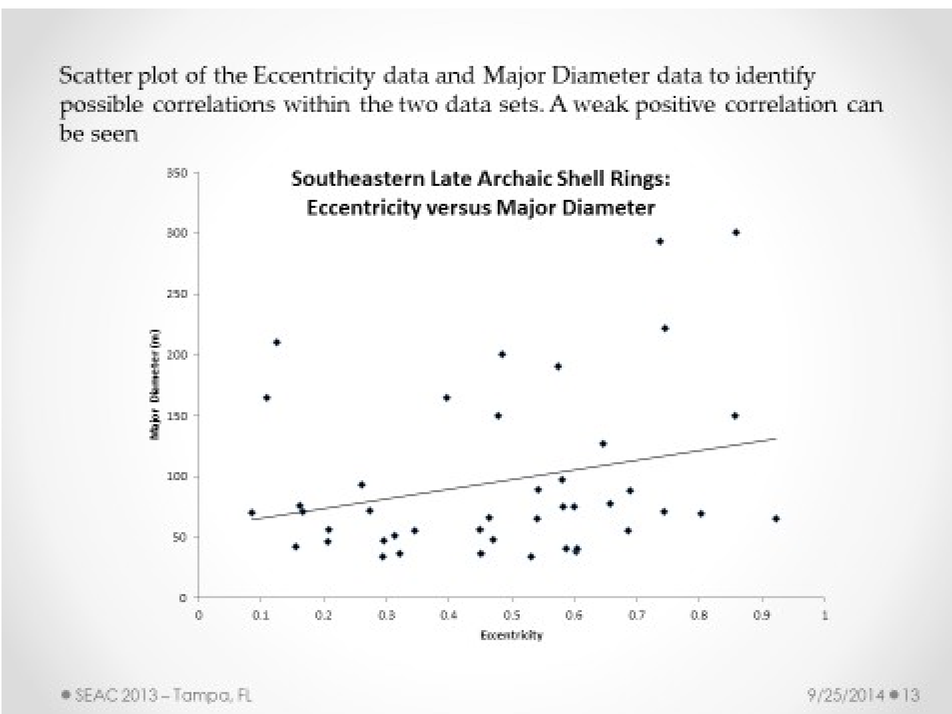
SEAC 2013 – Tampa, FL
9/25/2014 • 10


The equation for the focal distance of an ellipse where *a* is half the measure of the Major Diameter and *b* is half the measure of the Minor Diameter
$f=\sqrt{a^2 - b^2}$
The equation for calculating the eccentricity (ε) of an ellipse where *f* is the focal distance and *a* is half the measure of the major diameter
$\varepsilon = \frac{f}{a}$
SEAC 2013 – Tampa, FL
9/25/2014 • 11



Shell Ring Name	Calculated Eccentritcy
A. Busch Krick	0.604179775
Auld	0.45034
Barbour Island	0.923077
Barrows	0.603567601
Bonita Bay	0.858364067
Buck Bayou	0.6456791
Bull Island	0.125451433
Buzzards Island	0.581043359
Cane Patch	0.207378
Cannon's Point	0.743704039
Cedarland	0.109929
Chester Field	0.470573263
Claiborne	0.484123
Coosaw 1	0.321187252
Coosaw 2	0.451080338
Coosaw 3	0.295246118
Fig Island 1	0.541948743
Fig Island 2	0.273964544
Fig Island 3	0.208441556
Guana	0.74490442
Hanckel	0.541357443
Hill Cottage	0.478877177
Horr's Island	0.857675337
Horse Island	0.464642685
Joseph Reed	0.736721822
Lighthouse Point	0.161687
McQueen	0.167244
Meig's Pasture	0.68872433
Oemler	0.155441082
Oxeye	0.396713734
Patent Point	0.29601484
Rollins	0.57385991
Sapelo 1	0.260936988
Sapelo 2	0.6
Sapelo 3	0.686349
Sea Pines	0.313499469
Sewee Mound	0.581798
Skidaway	0.657738
Skull Creek Large	0.346070887
Skull Creek Small	0.586842781
St. Catherines	0.08444
Stratton Place	0.531261893
West Ring	0.803183028



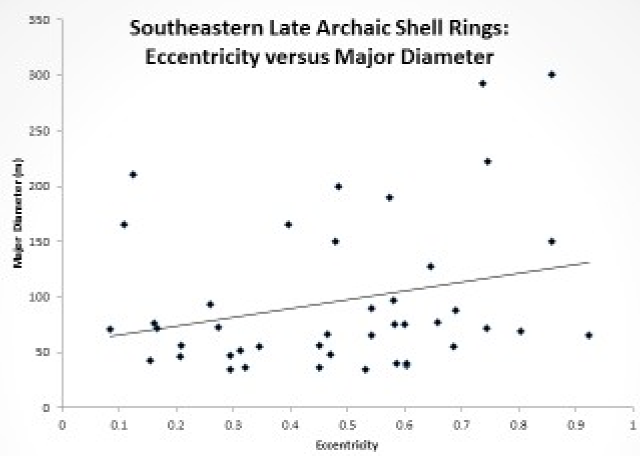
Pearson product-moment correlation coefficient was calculated. The lower the value the weaker the relationship, thus the value of positive 0.2629 also indicates a weak positive relationship

Pearson Product Moment Correlation

$$r=\frac{n\sum XY-\sum X\sum Y}{\sqrt{(n\sum X^2-(\sum X)^2)(n\sum Y^2-(\sum Y)^2)}}$$

r=0.2629

● SEAC 2013 – Tampa, FL 9/25/2014 ● 14



Pearson Product Moment Correlation

$$r=\frac{n\sum XY-\sum X\sum Y}{\sqrt{(n\sum X^2-(\sum X)^2)(n\sum Y^2-(\sum Y)^2)}}$$

r=0.2629

● SEAC 2013 – Tampa, FL 9/25/2014 ● 15

Shell Ring Name	Earliest Excavated Date	Shell Ring Name	Earliest Excavated Date
A. Busch Krick	3625 BP	Joseph Reed	3455 BP
Auld	4180 BP	Lighthouse Point	3345 BP
Barrows	3550 BP	McQueen	4100 BP
Bonita Bay	4260 BP	Meig's Pasture	4100 BP
Cannon's Point	4600 BP	Oxeye	4580 BP
Cedarland	3200 BP	Patent Point	3850 BP
Claiborne	3990 BP	Rollins	4150 BP
Coosaw 1	3790 BP	Sapelo 1	4210 BP
Coosaw 2	3800 BP	Sapelo 2	3955 BP
Coosaw 3	3810 BP	Sapelo 3	3560 BP
Fig Island 1	3953 BP	Sea Pines	3810 BP
Fig Island 2	4112 BP	Sewee Mound	4120 BP
Fig Island 3	4074 BP	Skull Creek Large	3585 BP
Guana	3860 BP	Skull Creek Small	3890 BP
Hill Cottage	4500 BP	St. Catherines	4390 BP
Horr's Island	4660 BP	West Ring	4270 BP

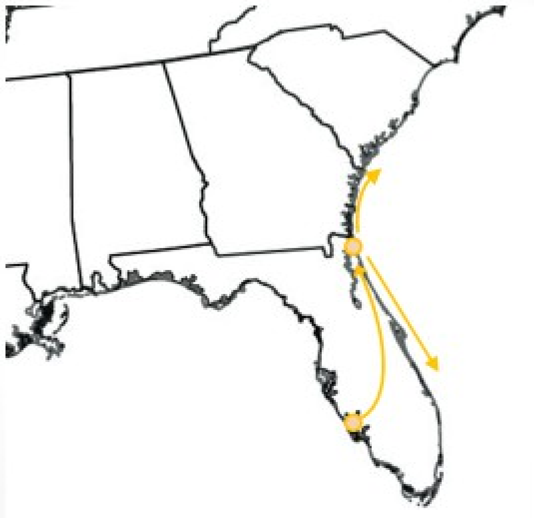
Most dates recorded from the following sources but were checked against the cited literature within these sources:
Russo 2006 *Archaic shell rings of the southeast U.S. theme study*. National Register of Historic Places, Southeastern Archaeological Center, National Park Service, Tallahassee.
Thomas, David H. 2010. "The Two Rings of St. Catherines Island: Some Preliminary Results from the St. Catherines and McQueen Shell Rings." In *Trend, Tradition, and Turmoil: What Happened to the Southeastern Archaic?*, David Hurst Thomas and Matthew C. Sanger (eds), pp. 45-70. American Museum of Natural History Anthropological Papers Number 93, New York.

SEAC 2013 – Tampa, FL 9/25/2014 16

One possible interpretation for the location of the initial use of shell rings, based upon both geography and chronology, places this initial use around the head of the St. Johns River with a diffusion outwards

SEAC 2013 – Tampa, FL 9/25/2014 17

Alternatively, based upon chronological data, and the size and scope of the Horr's Island site, the initial use of shell rings, may have occurred along the Gulf Coast of Florida from an already present population and then spread northward.



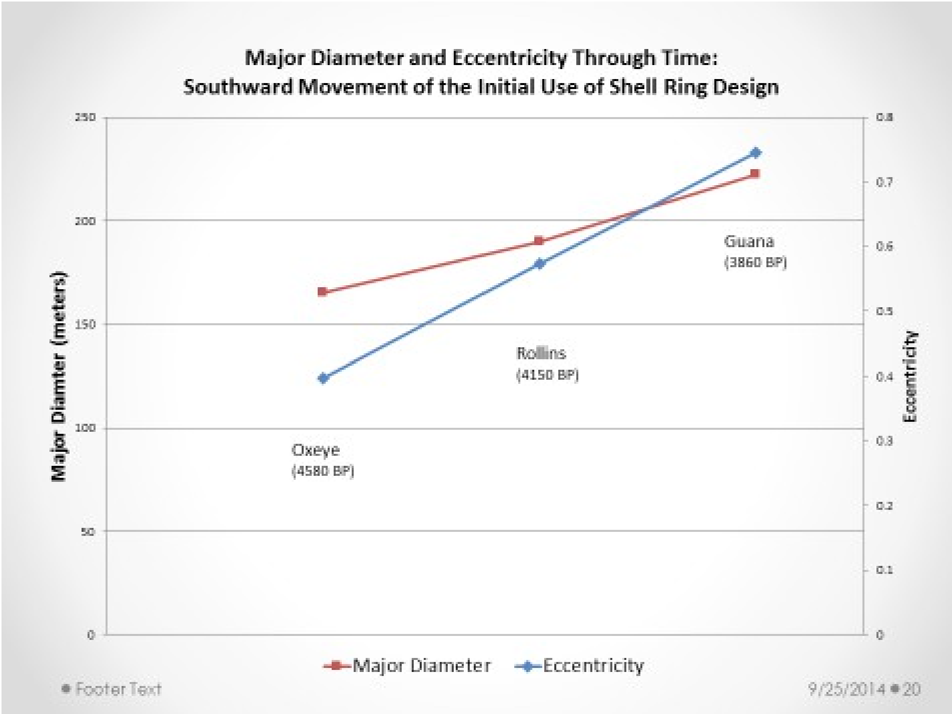
• SEAC 2013 – Tampa, FL 9/25/2014 • 18

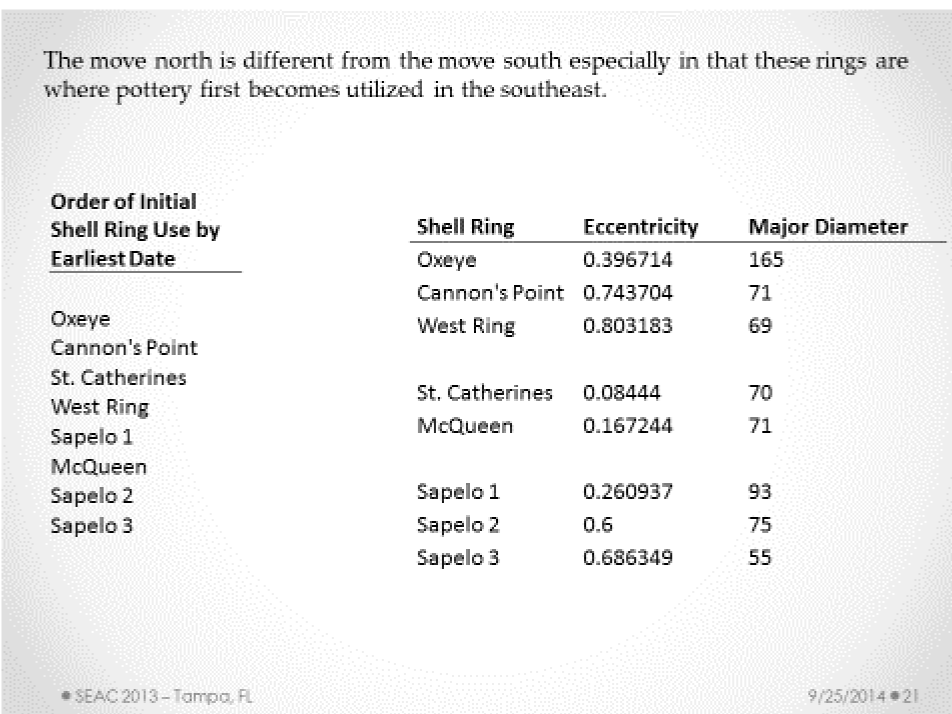
As soon as shell rings are established in and around the St. Johns River, there is a move both north and south along the Atlantic coast. The southward trend is described with both increasing eccentricity and size through time .

Shell Ring	Eccentricity	Major Diameter
Oxeye	0.396714	165
Rollins	0.57386	190
Guana	0.744904	222

Table of eccentricity values and major diameter values for the Oxeye, Rollins, and Guana shell rings. Entries are arranged *chronologically* based upon earliest date excavated from top (oldest) to bottom (youngest).

• SEAC 2013 – Tampa, FL 9/25/2014 • 19





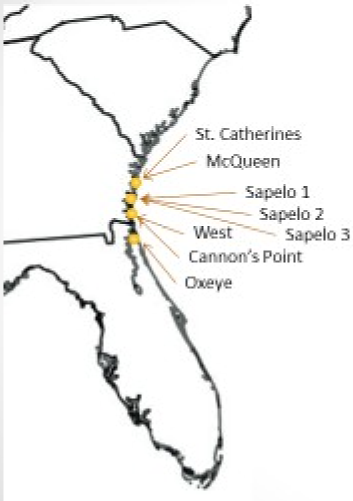
The move north is different from the move south especially in that these rings are where pottery first becomes utilized in the southeast.

Order of Initial Shell Ring Use by Earliest Date
Oxeye
Cannon's Point
St. Catherines
West Ring
Sapelo 1
McQueen
Sapelo 2
Sapelo 3

Shell Ring	Eccentricity	Major Diameter
Oxeye	0.396714	165
Cannon's Point	0.743704	71
West Ring	0.803183	69
St. Catherines	0.08444	70
McQueen	0.167244	71
Sapelo 1	0.260937	93
Sapelo 2	0.6	75
Sapelo 3	0.686349	55

SEAC 2013 – Tampa, FL 9/25/2014 21

The move north is different from the move south especially in that these rings are where pottery first becomes utilized in the southeast.

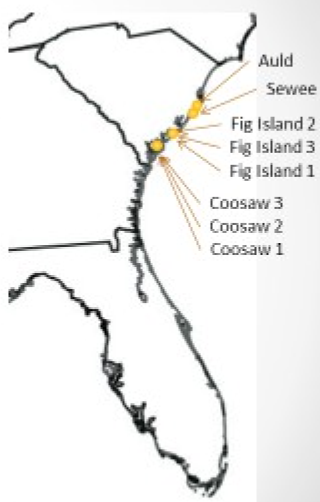


Shell Ring	Eccentricity	Major Diameter
Oxeye	0.396714	165
Cannon's Point	0.743704	71
West Ring	0.803183	69
St. Catherines	0.08444	70
McQueen	0.167244	71
Sapelo 1	0.260937	93
Sapelo 2	0.6	75
Sapelo 3	0.686349	55

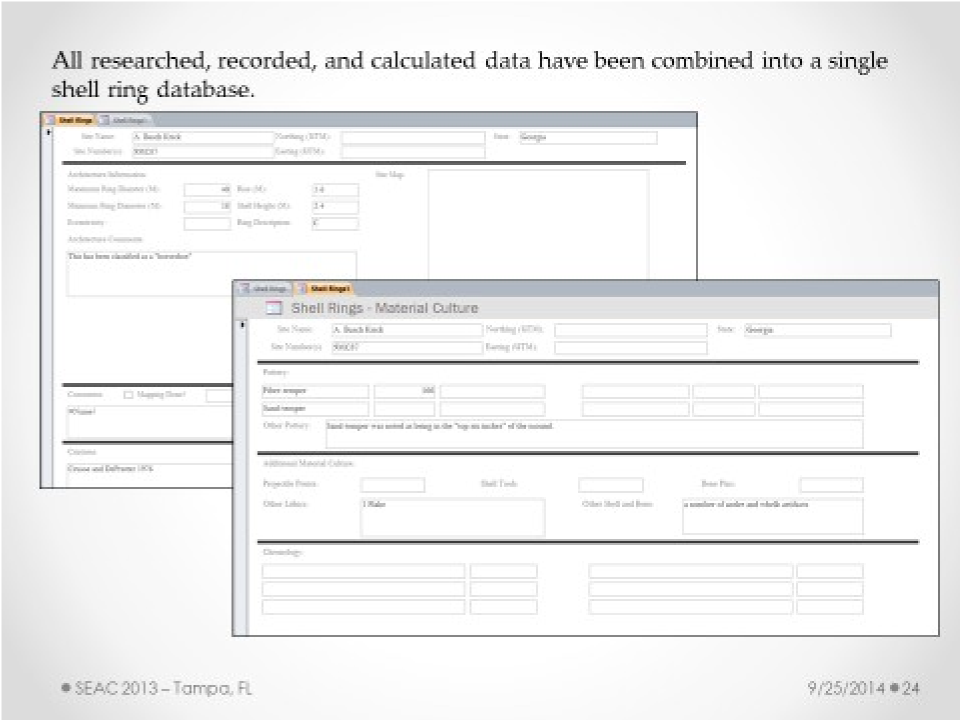
• SEAC 2013 – Tampa, FL 9/25/2014 • 22

The second wave of movement northward along the Atlantic coast reaches all the way to the central coastal region of what is now South Carolina.

Shell Ring	Eccentricity	Major Diameter
Auld	0.45034	56
Sewee Mound	0.581798	75
Fig Island 2	0.273965	72
Fig Island 3	0.208442	56
Fig Island 1	0.541949	89
Coosaw 3	0.295246	34
Coosaw 2	0.45108	36
Coosaw 1	0.321187	36



• SEAC 2013 – Tampa, FL 9/25/2014 • 23


All researched, recorded, and calculated data have been combined into a single shell ring database.
Shell Rings - Material Culture
SEAC 2013 – Tampa, FL
9/25/2014 24


Acknowledgements
Dr. David Anderson, University of Tennessee, Knoxville
Dr. Phillip Li, University of Tennessee, Knoxville
Dr. Michael Russo, Southeast Archaeological Center, NPS
Dr. David Hurst Thomas, American Museum of Natural History
Thaddeus Bissett, Stephen Carmody, University of Tennessee, Knoxville
Matthew Sanger, American Museum of Natural History and Columbia University
Lori Pendelton Thomas and the AMNH staff and interns
Southeastern Archaeology Graduate Seminar classmates at UTK
All those that have managed to slip my mind (sorry)
Jenny Chin for her constant support
SEAC 2013 – Tampa, FL
9/25/2014 25