Shell Middens of Lower Casamance and Problems of Diola Protohistory

by

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SUMMARY

Excavations in the Casamance River delta of southern Senegal have yielded a cultural sequence spanning periods from the end of the Neolithic phase (200 B.C.) to the Early Iron Age and until after the European arrival. Eight shell middens were investigated, and their contents—potsherds, mollusk remains, animal bones, and iron artifacts—have been classified into four periods dated by thirteen radiocarbon samples.

After proposing a chronology, inferences are made about the use of micro-environments, and changes in subsistence, through time. Starting with Period II (A.D. 200) a series of pottery types links the inhabitants of the ancient middens with the Diola, actual occupants of Lower Casamance.

Besides offering one of the few detailed protohistoric chronologies for Senegal that is based on extensive stratified excavations of habitation sites, this article illustrates the use of an ecological, micro-environmental approach to problems of West African protohistory.

Introduction

On the broad delta of the Casamance River in the south-western corner of Senegal known as Lower Casamance, between Gambia and Portuguese Guinea, there are a number of archaeological sites consisting of artificial shell middens found in or near Diola villages. The Diola who occupy the entire Lower Casamance number today 210,000 and are well known for their intensive wet-rice agriculture in the alluvial valleys and reclaimed mangrove swamps (Pélissier, 1966; Linares de Sapir, 1970). A sequence of pottery types links the ancient middens with pottery from modern Diola household middens.

Fieldwork was carried out in this area from December 1965 to May 1966. Before then very little was known about the Lower Casamance shell middens. They had been mentioned briefly (Mauny, 1961, p. 162) and a few photographs filed in the archives of IFAN. In this paper I offer an analysis of pottery, mollusks, bone remains, and iron artifacts found in eight middens from six sites. (For the analysis of the iron specimens...
Micro-environments of the Casamance Delta

The entire Lower Casamance is an alluvial plain with irregular flat raised areas of sandstone and a sub-Guinean vegetation. I shall deal only with the 30 x 36 km. of delta at the mouth of the Casamance River where the shell middens are located (Fig. 1). At first, the delta appears as an undifferentiated tidal estuary with an extensive network of mangroves, but there are actually several micro-environments, or biotopes, which offer special resources for human support. Adaptations to and modifications of these micro-environments through time is thought to be more important for cultural development than the influence of marked geologic or climatic changes. The following micro-environments within the delta have exercised an important role in the development of Diola society. (For a good discussion of micro-environments in prehistory see Coe & Flannery, 1964; much of the geographical information that follows comes from Pellissier, 1966, Chapt. 13, Livre III.)

1. Forests: Lower Casamance is the only part of Senegal with a sub-Guinean environment. With a yearly rainfall averaging 1800 to 2000 mm. (at the Ziguinchor latitude), in contrast to the 600 mm. average for the rest of Senegal north of Gambia, this area once supported a dense forest of large trees such as Mampato (Parinari excelsa) and Tali (Erythrophleum guineense). Forests once covered most of the raised areas of Lower Casamance from Marrassoum almost to the coast (Aubréville, 1948, nos. 1-2, pp. 25-52). Of these there only remain small areas protected by the government. The clearance of the forests by fire has resulted in a secondary growth dominated by bushes and Prosopis africana, Cassia sieberiana and the important oil palm (Elaeis guineense) resistant to fire and protected by man. Pellissier (1966, p. 640) is of the opinion that this change to a secondary forest with species characteristic of the Sudan has been going on for centuries and has not been caused by accidental fires, or the subguinean forest would have regenerated itself. It has been man-induced by the established practice of clearing land for cultivation. A sparser type of forest, consisting mostly of the well-known fromager (Ceiba pentandra; kapok or silk-cotton tree), the x'taba (Cola cordifolia) and kossito (Dialium guineense) exists today in or around Diola villages.

Forests provide lumber, firewood and medicinal plants, game ranging from rodents to antelopes, and also sacred places for ceremonies and shade for houses.

2. Low sandy ridges: these are long, flat arid areas 12 to 18 km. long and up to 2 km. wide, surrounded by alluvial valleys. Millennia preceding the archaeological occupations, during the Flandrian transgression, the sea probably covered the entire triangular area between Kafountine, the Djougout and Oussouye plateaus and the limestone protrusions at Cap Skirring. When the sea retreated it left behind these low ridges of well-drained ground which are now covered by short grasses with scattered bushes and baba'bab (Adansonia digitata) trees. They offer land on which to build the villages, and pasture for cattle, sheep and goats.

3. Swampy alluvial valleys: these surround the sandy ridges and are characterized by a heavy clayey soil with a rich humus content. They were formed by alluvium brought down from the forested plateaux east of the delta by streams flowing into the sea at a time when the mouth of the Casamance was south of its present location.
postulated to have had a wetter climate. Valleys are of two types: inland valleys fed only by rainfall during the rainy season, and those fed in addition by the marigots (tidal rivers) during the dry season from November to June. Both valleys are used today, as probably in the past, for wet-rice agriculture. In the dry season the rice straw serves as forage.

4. Streams and Marigots: on both sides of the Casamance River there are 2000 sq. km. of low delta which has been described as an 'amphibious landscape'. Hundreds of small streams drain the plateaus and join meandering brackish rivers flowing into the Casamance River. The slow-moving waters of the marigots harbor a rich fauna and connect inland areas with the sea, an even greater source of edible fish.

5. Mangrove Channels: joining the marigots are smaller muddy secondary channels flanked by a thick stand of mangroves of two species: the common palétuvier (Rhizophora racemosa) forms a maze of prop roots and grows near the mouth of the estuary; further inland is found the 'palétuvier blanc' (Avicennia nitida) which grows in better drained, more sandy soils.

It is important to stress the usefulness of the mangrove in protecting and reclaiming land from the sea. Stilt or prop roots and pneumatophores catch mud and debris at high tide, forming dry land as the mangroves grow old. Younger plants at the water edge extend their roots ever forward. This natural process has been going on through the ages and has been used by the Diola to reclaim additional land for their rice fields. Mangrove also serves today for firewood and the framework of Diola houses. Patches of what were probably decomposed palétuvier were common in our excavations.

The mangrove channels teem with mollusks, the most common edible species being the mangrove oyster (Gryphea gasar or Ostrea tulipa), which adheres to the aerial roots of the mangrove, and the mud-living clam or Area senilis. Furthermore, ancient as well as modern Diola eat small quantities of the pointed univalve Tympanotonus fuscatus, burn the shells for temper, and roll them over the surface of vessels for decoration. The punctuated type of pottery made in the recent periods is decorated in the lower two-thirds with Tympanotonus punctations.

Besides mollusks, crabs and even crocodiles live in estuaries and both are eaten today.

Archaeological sites and their location

The Lower Casamance sites are clustered in an area 22 km. by 6 km. in or near what are now important Diola villages (Fig. 1). Location of the general area where the sites are found is 12° 26' to 12° 38' north latitude and 16° 36' to 16° 44' west longitude. From near villages of these names on the southern portion of the Île de la Grolette; b) the Pi, 4-8; and c) the Diakite Diola sites (Lo-Oul-1, souye. Sites were assigned a letter-number combination, with the letters standing for (the Dioloulou) and Lo-Oul (Loudia Ouolof).
To summarize, the Niomoune sites participated in two micro-environments that are closely related, the alluvial valleys and the area immediate to the mangrove. Forests were sparse, high ground was rare, and accessibility to the mouth of the Casamance River was only via the two marigots that border Niomoune.

2. The Samatite-Kagnout (Lo-Oul-1, 4-8) sites: these are smaller (average 10 x 25 m.) than those of Niomoune and more numerous; Lo-Oul-1 middens number 35 in an area 410 x 440 m. which was surveyed and mapped (Fig. 1). Distances between them range from 25 to over 100 m. Of nine middens here which have escaped destruction by road builders, five were excavated. They average one to three meters in height and are roughly ovoidal in shape.

Only a part of the site appears in Fig. 3, but there were middens all the way from Samatite to Kagnout and beyond both villages. A rough population estimate for the half-kilometer strip mapped for Period III was made by an analogy with the modern nearby village of Samatite where we have a complete census of all households. Each household in Samatite consists of a patrilocal extended family headed by a male agnate; though the size of the family varies, the average number of persons is six, which includes a man, his wife (or at most two wives) and their unmarried children. Since each household today usually has a separate trash heap, and assuming that such was the case in the past, a reasonable population estimate for the middens in the mapped portion of Lo-Oul-1 during Period III would be around 200 persons.

All of the Lo-Oul-1 middens are on sandy ridges covered by herbaceous vegetation; the topsoil is shallow, over a thin layer of light-colored clay, which covers a deep substratum of yellow sand. Contiguous to the ridges begins another micro-environment, the alluvial valley covered with rain-fed rice fields. These gradually join the deep, irrigated paddy fields to the east, while towards the west the rice fields are only of the rain-fed type. Abandonment of Lo-Oul-1 could not have been because of the encroachment of the rice fields, since the ridge itself has no trace of either ancient or modern rice fields. Other reasons will be proposed later.

Other sites (not illustrated) in the Samatite-Kagnout vicinity are a short distance from the Lo-Oul-1 cluster described above: Lo-Oul-5 is about one and a half kilometers north of Mound D and Lo-Oul-7 is about 600 meters directly southeast of Mound E. Both of these are nevertheless in the same micro-environment as Lo-Oul-1, only on different ridges. Lo-Oul-5, consisting of only one mound, is north of the Ebrui compound in the modern town of Kagnout. Completely surrounded by rain-fed rice fields, it measures 25 x 30 m. and is close to two meters high. The area where Lo-Oul-7 is located, however, is dotted with numerous shell middens, all of which are on the deforested ridges surrounded by rice fields belonging to the Ujoho quartier of the town of Kagnout. Only one mound was excavated here.
Fig. 4. Plan of site Lo-Oul-6, Samatite-Kagnout.

Forested areas enclose Lo-Oul-4. Being in the middle of the Bouhibane quartier of the town of Kagnout, it served as our modern ‘control’.

Site Lo-Oul-6 (Fig. 4) was in the palm tree grove that the Bouhibane quartier tapers for palm wine. No modern houses are on this spot, but several other middens are easily spotted because of the tall fromagers growing on them. Old middens are still occasionally used for sitting under the trees to drink palm wine collected from the groves.

Explored last was Lo-Oul-8 (Fig. 5) in the village of Samatite near the Hubinkan-Bassen compound. A waterhole lies roughly 25 m. directly north of the only midden here, surrounded by a dense grove of palms. Although the mound was chosen to represent a ‘modern occupation’, it turned out to date back at least three generations since informants say that even their grandparents did not recall the midden in use. Nonetheless, its contents showed little difference from a surface collection from a nearby dump now in use.

Fig. 5. Plan of site Lo-Oul-8, Samatite-Kagnout.
Excavations and depositional history

Twenty-two separate test pits and trenches were made in the 1965 season, in seven separate sites. Varying in size from 1 x 2 m., to 2 x 8 m., the cuts were placed at random points on several mounds to test for intra-mound and intra-site differences. Their maximum depth before reaching sterile was seldom over 2 m. As cultural strata were often impossible to distinguish during excavation in loose shell deposits, levels were usually made either ten or twenty centimeters thick, except when adjustment for stratification was possible. Levels followed the incline or slant of the deposits, and natural features such as fire-hearth, caches, etc., were excavated as units. With these precautions in mind metrical stratigraphy can offer certain advantages when excavating shell middens. If we had used 'natural strata' alone, the strata we could have distinguished during excavation would have been one to several meters in thickness (Pls. VIII, IX), eliminating the possibility of classifying the contents into several chronological periods.

In order to illustrate the stratigraphy of the Lower Casamance sites I have chosen to discuss below only the three sites yielding radiocarbon dates; their general depositional histories are typical of the other Lower Casamance sites excavated.

1. Depositional history of the Loudia-Ouolof middens: middens excavated at Lo-Oul-1,2, 5,7 have a common depositional history. In spite of variations in ash lenses and hearths, they show generally the same occupational stages, illustrated by the stratification of Lo-Oul-1, Mound C (Fig. 7).

The lower levels (150—200 cm.) contain a pure orange sand devoid of all mollusk remains. A few charcoal specks, plus a handful of potsherds, deteriorated mammal bones, and a chunk of bog iron ore are the only signs of human activity. A radiocarbon date of 200 ± 70 B.C. (Si—496) places this part of the deposit in Period I, after which Mound C was abandoned, to be re-used many centuries later.

Levels belonging to the next occupational stage (100—140 cm.) show signs of intensified cultural activity. The soil is gray-black from abundant ash and charcoal, and throughout the deposit are found patches of a white unburned material that may be either rotted wood or decomposed bone. Although not as abundant as in subsequent levels, shell makes up roughly 10—15% of the deposit by bulk, and most of it is Area. Pottery averages 150 sherds per 20 cm. level, and there are a few animal bones. Two overlapping radiocarbon dates (St—492-3) give an average date of A.D. 1410 ± 92 for this part of the occupation, placing it in Period III.
Fig. 7. Section of Lo-Oul-1, Mound C.

In the upper one meter of the Loudia-Ouolof mounds shell makes up between 90 and 94% of the deposit, the rest being a loose, windblown gray-black dust. Numerous firepits, ash lenses, bones and charcoal are found throughout. Pottery averages 345 sherds per level, and in decorative techniques is similar to Period HI ceramics. Two radiocarbon dates, A.D. 1630 ± 100 (Si—491) and A.D. 1570 ± 70 (Si—489) give a terminal date in the 16th—17th centuries, within our Period IV.

2. Depositional history of the Nioraoune mounds: the mounds at Niomoune (Di-3) are all lacking the shell-less levels of the oldest occupation at Loudia-Ouolof. The deposits throughout contain a mixture of mollusks and pottery, as can be shown by the excavations in Mound C, located directly south of the Essanholou quarter. Three different cuts were made in this mound, but only Cut 2, measuring 2 x 4 m., will be discussed here (Fig. 8) since it yielded the most complete of the Di-3 sequences.

The oldest part of the deposit (levels 80—140 cm.) contain a loose, gray, sandy soil mixed with charred and decomposed shell fragments. A slight amount of whole shell, mostly Arca, amounting to 2 kg. in level 120—140 cm., increases rapidly to over 40 kg. by weight in each of the subsequent 20 cm. levels of this unit. There are almost no signs of other cultural activity such as cooking, except for a few specks of charcoal, but neither fire hearths, nor ash lenses of any sort. The soil is sandy, gray in colour and containing a large amount of crushed shell. Ceramic material is extremely scanty (from 2 to 13 sherds per level) and there are no animal bones or iron. A radiocarbon date of A.D. 270 ± 80 (Si—499) places this stage at the beginning of Period II.

A band of dark soil at 80—110 cm. divides the older from the more recent occupation. The latter is marked by a compact light-brown to gray soil. Over 50 kg. of mollusks are found in each level and Gryphaea gasar or Ostrea tulipa, amounting to about 10%, make their first appearance. Ostrea increases until it becomes dominant in the top level. Likewise the amount of ceramic material increases markedly from 70 sherds per level at the beginning of this stage to 500, then over 1000 at the end of the stage. There are some animal bones and a few fragments of artifacts at the top. This stage is dated at A.D. 1620 ± 50 (Si—497) and fits into Period IV. It should be noted here that the test-pit (Cut 1) which we made on another section of the same mound has only this second stage (Period IV) represented.

3. Depositional history of Lo-Oul-6, Mound A: the 4 x 2 m. cut (Fig. 9) in this mound shows only slight variations in stratigraphy between the bottom 30 cm. of the deposit and the upper 150 cm. The lower three levels have a very hard, light buff, clayey compact soil, similar to the adjacent forest soil and quite different from the sandy fraction of the Lo-Oul-1 lower levels. Shell makes up about 10% of the deposit (about 15 kg. per 10 cm. level). Abundant charcoal and pottery are found in these levels, but there are no animal bones. A radiocarbon date of A.D. 295 ± 52 (P—1483), from the bottom level, places this part of the deposit in the beginning of our Period II.

Above 160 cm. the soil continued to be clayey and hard, but somewhat less compacted, due in part to the abundant shell, making up between 40 and 60% of the deposit (between 50 and 150 kg. per 10 cm. level): the clam Arca senilis is at first predominant, then decreases in favor of Ostrea in the middle levels. In the upper 60 cm. the soil is light gray in color, loose and powdery, without forming clots. Shell is abundant, and equally divided between Arca and Ostrea, except for the top level where the first predominates. Unidentified mammal bones, cow and a shark vertebra were found in these levels, as well as abundant pottery. Free overlapping radiocarbon dates from above 150 cm. (P—1478-82) average to A.D. 652 ± 50 and place this part of the deposit at the end of Period II.
In hundreds of kilograms of excavated material (mollusks, pottery, animal bones) not a single stone or shell tool was found. A few chunks of bog iron ore were present. This means, technologically speaking, that our entire sequence falls within the Early Iron Age, with the oldest period possibly belonging to a terminal Neolithic phase. However, a classification of periods into technological stages (Neolithic, Iron Age, etc.), obscures, rather than clarifies, important changes in subsistence (food-getting activities) through time.

The short description included here is divided into two parts: first a description of the decorative modes, then a short discussion of the time/place distribution of two other attributes, red slip and the kind of temper.

1. Decorative modes (from oldest to most recent):
   A. Grid-stamping (Pl. X, a-e): parallel rows of rectangular depressions divided by raised ridges and covering the entire exterior of the vessel. Unidirectional over small areas, suggesting that they were made by pressing a stamp with a raised grid design on the soft surface of the vessel.
   B. Wavy-line (Pl. X, f-k): close parallel wavy-line incisions made with some sort of comb; occasionally the lines are straight, rather than curved. They are placed in bands varying in width between 2 and 4 cm. and are combined at some sites with braid impressions on the same sherd. Wavy-line incisions occur usually around the neck and rim.
   C. Braid impressions (Pl. XI, a-d): these were apparently made by rolling this braided 'string' over the surface when wet. They are of two kinds, thin and thick. The thick were probably made the same way, but flattened (accidentally?) before firing. Braid impressions cover the entire vessel, except where combined with wavy line. On several sites, braid impressions occur without any wavy-line incision.
   D. Punctations (Pl. XI, g-i): oblong, elongated punctations roughly aligned, closely spaced, covering large areas. Made, not by sinking a many-toothed comb, but by dragging a spiked object over the surface. Comparisons with modern Diola pottery suggests the instrument rolled over the surface was a Tympantowon, or small pointed univalve with long spikes. Punctations are often combined with what appears as rolled (not braided) cord impressions and shallow line incisions.

2. Red slip and temper: their time and place distribution is as follows:
   A. The Niomoune Di-3 ceramics were shell-tempered and non-slipped, except for small amounts of these techniques occurring in the top two levels of Dr-3, Mound C, Cut 2.
   B. At Lo-Oul-6 and 7 the ceramics throughout the entire occupation were predominantly sherd-tempered and non-slipped, except for tiny percentages of shell temper and red slip in the top levels.
   C. The ceramics from Lo-Oul-1, 2 and 5 show a marked difference in the incidence of these two techniques between bottom and top levels. In these cuts shell temper and red slip increase markedly towards the top levels, while sherd temper is popular at the bottom and decreases towards the top.

The decorative techniques (i.e. modes) were plotted in terms of popularity (percentage frequencies per level), and the resultant bar graphs used to divide the sequence into time periods. These were correlated with changes in the stratification; cultural interpretations based on this relative chronology are discussed in the last section. Thirteen radiocarbon
dates from charcoal samples fit the different periods into an absolute chronology. In so
far as there are at least two, and usually several, dates from different levels of the same cut,
there is good internal control for their accuracy. Furthermore, the dates were processed
by two different laboratories (University of Pennsylvania and Smithsonian Institution);
the samples is indicated in the profiles for the three cuts included under the depositional
history (Figs. 7-9). Ceramic differences between the periods can be summarized briefly:
(a) Period I is defined by the presence of high percentages of two decorative techniques,
both of which continue in Period II but practically disappear in Periods III and IV. Braid impression is also a popular technique in this period.
(b) Period II is characterized by a predominance of the braid-impressed technique. Although small percentages of punctations, characteristic of the following period are present, this period can be isolated at Di-3, Mound D, Cut I.
(c) Period III is marked by a substantial increase in popularity of the punctated pottery type, which is also shell-tempered and slipped.
(d) The punctated type occurs almost alone in levels belonging to Period IV. Modern Diola pottery is exactly like that of this period, except that in some areas such as Niomoune it is being imported from the Fagny where sherd and not shell is being used for temper. The percentage frequencies of the ceramic techniques are summarized in Tables I—IV.

Changes in subsistence and their cultural interpretations

The Lower Casamance sites yielded abundant remains besides pottery (mollusk, animal bones and occasionally iron) that permit the reconstruction of subsistence practices in each of the periods. Unfortunately, the absence of tools and plant remains (the latter should be possible to recover in the future by flotation methods) make inferences about agriculture only tentative. Those offered here are based on indirect evidence, such as location of the sites in reference to the surrounding environment. Where appropriate, analogies with modern Diola, whose culture I studied for a year (Linares de Sapir, 1970) are used in the interpretation. The discussion is facilitated by Tables I—IV.

Period I

From the depositional history, it is safe to assume that the first inhabitants of the
Loudia-Ouolof sites were few, sparsely settled in small encampments on what were at the
time low sandy ridges, probably covered by grass and shrubs, and surrounded by forests. Shellfish gathering was not practised. Just what they did for subsistence is hard to tell since remains of animal bones are scarce. This is to be expected in high rainfall areas when shell deposits are not present to neutralize acids in the soil. The few bones found in this period were unidentifiable beyond being mammal remains.
Thus several lines of evidence suggest that these first colonists were not adapted to coastal life: the complete absence of mollusk remains (from four sites in about 400 years of occupation), the absence of any fish bones, and the sherd-, rather than shell-, tempered
Plate VII
View of Niomoune (Di-3) shell midden D, showing large baobabs and *frangipani* growing on it; modern rice field in foreground.
Plate IX
View of the test pit at Lo-Out[1], showing the two depositional stages characteristic of this site.

Plate X
Potsherds illustrating two ceramic techniques of the oldest periods:
a-e—Grid-stamping. f-k—Wavy-line incision.
Plate XI
Potsherds illustrating two ceramic techniques of the most recent periods:

a-d—Braid impressions.  e-f—Braid impressions combined with wavy-line incisions.
g-h—Puncations.  j—Incisions with punctations.

Plate XII
Microstructure of iron spear fragment (x 100 magnification).
Table I DISTRIBUTION OF CULTURAL REMAINS IN PERIOD I: 200 B.C. — A.D. 200

<table>
<thead>
<tr>
<th>MOUND AND CUT</th>
<th>LEVELS (cm.)</th>
<th>CERAMIC TECHNIQUES (%)**</th>
<th>MOLLUSK SPECIES (%)**</th>
<th>ANIMAL BONES</th>
<th>IRON</th>
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<tr>
<td></td>
<td></td>
<td>grid stamped</td>
<td>wavy-line</td>
<td>braid impressed</td>
<td>puncts.</td>
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<td>LO-OUL-2 Md. B, C.1</td>
<td>60-80</td>
<td>.136</td>
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<td></td>
<td>80-100</td>
<td>.338</td>
<td>.046</td>
<td>.338</td>
<td>.000</td>
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<tr>
<td></td>
<td>100-120</td>
<td>***</td>
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<td>***</td>
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<tr>
<td>LO-OUL-5 Md. A, C.1</td>
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<td>.011</td>
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<td></td>
<td>160-180</td>
<td>.088</td>
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<td>.550</td>
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<td>140-160</td>
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<td>LO-OUL-1 Md. C, C.2</td>
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</table>

* The percentage frequencies of plain sherds (not listed) make up the rest of the sample.
** Only the percentage frequencies of the most common species are listed. Calculations are based on weight.
*** Samples smaller than 50 sherds; percentage frequencies not calculated for these.
pottery. Perhaps their immediate provenience was to the east, and they moved into this area following the rich alluvial lands along the Casamance River and its tributaries.

If Aubréville (1948) is correct in assuming that thick forests once covered all the area surrounding the Oussouye Plateau until decimated by fire and converted into open paddies, then it is possible to suggest that these new colonists were agriculturalists, perhaps of mountain, or dry, rice. It seems unlikely that they had reclaimed the mangrove's wetlands, for, in cutting down the mangrove, they would have known and hated the Gryphaea gasar and the A. senilis which abound in this micro-environment. Mangrove swamp reclamation came later, I believe, as a result of new migrations, population pressures and the need to intensify cultivation.

Other economic activities remain unknown. Perhaps they pastured animals on the sandy ridges; most likely they hunted, though no direct evidence such as bones or hunting implements have been found.

Nodules of bog iron ore were common in our excavations in levels from the oldest to the most recent, and may indicate the use of iron. 'Bog iron is a hydrated ferric oxide ore, containing a high proportion of sandy or earthy impurities, which forms by sedimentation. It can be reduced to a solid spongy mass of iron by chemical reaction with the carbon in a charcoal fire, the maximum temperature of which would be around 900°C. Sponge iron can then be hammered into artifacts.' (Dr. David R. Gaskell, School of Metallurgy and Materials Science, University of Pennsylvania: personal communication.)

### Period II

Some time between A.D. 200 and A.D. 300 the inhabitants of the area began gathering mollusks in the adjacent mud-flats and mangrove channels, mostly A. senilis, a bivalve which Diola women today wade for at low-tide in 40 to 50 cm. of muddy water. Only A. senilis was found in Di-3 while at Lo-Oul-6, noticeable quantities of G. gasar (or O. tulipa) were also present. G. gasar is a small conical oyster that grows attached to the prop roots of the mangrove. To a lesser extent, the univalve Tympanotonus was also gathered, and all archaeological specimens have their tips broken. Most likely the flesh was removed by sucking, in the manner of those Diola who still eat them.

It is interesting to note that the A. senilis we found in the lower levels were much larger and heavier than those from more recent levels, indicating that as the supply became depleted, people were forced to collect smaller ones. Since the quantity of shell gathered was much less at the beginning of the period than at the end, apparently it took time to utilize it fully as food. As site Lo-Oul-6 represents 400 years of occupation, so the increase in the use of mollusks could have been caused by population growth and consequent pressure on resources.

Because of the shell concentration, animal bones, though not abundant, were preserved at sites of this period. At Lo-Oul-6, located inland, the archaeological fauna is almost entirely terrestrial, excepting a shark vertebra found in the top level. All identifiable mammals here are cattle, but it is fair to assume that sheep and/or goat may have been present. In the coastal site of Di-3, Mound D, fish bones were found and also small decomposed mammal fragments.
The suggestion that bog iron ore indicates the use of iron is reinforced by a find of iron shaft fragments, possibly from a spear, at Di-3, Mound D. That artifacts were forged locally is not certain, however.

Although plant evidence is missing, there is little reason to doubt that people of this period were fully agricultural, as the shellfish and the few animals hunted could hardly suffice to feed the substantial population suggested by the dozens of middens belonging to this period in the vicinity of Loudia-Ouolof. Furthermore, an occupation at one spot lasting more than 400 years (at Lo-Oul-6) implies sedentary agriculture, perhaps of wet rice. The use, then, of heretofore unexploited biotopes such as the mangrove channels and the alluvial valleys represents a new and radical adaptation, one which, in fact, may have been introduced by new settlers into the area coming from the south, probably the Diola who displaced the sparse original inhabitants of Period I.

Period III

The transition between Period II and III is not marked by the appearance of new subsistence activities, but by secondary additions within the established economic systems. By this time, sheep and/or goat are definitely present, as well as cattle previously noted. Fish vertebrae are common, some from a species of Pagurus, which, like all fish remains from this period, is of marine origin. Skull fragments of a large unidentified ocean fish were also present. All three species of mollusks were gathered, but the use of Gyrphaea gasus, the mangrove oyster, increases so that at the end of this period it makes up by weight 30 to 80% of the deposit, and at Lo-Oul-1, Tympanotonus makes up a noticeable part of the diet (3 to 12% by weight).

The appearance of pottery types similar to those from the Gandoul-Bandiala area to the north implies connections with the Niominka Serer (see discussion on pp. 45-47). They, like the Diola, are today wet rice cultivators, but their agronomic practices are only a poor reflection of their neighbours', since they neither irrigate, nor transplant, and cultivate for only six months of the year. The tool which they use for land preparation, the saug, is a simpler version of the Diola kayando. During the six months of the long dry season when the Niominka do not cultivate, these excellent sailors migrate, fishing offshore all the way north to the Cayor and south to the Casamance and even beyond to Portuguese Guinea. There are villages in the vicinity of our sites, such as Elinkine, where Serer immigrants come to live each year, trading dried fish for surplus rice from the Diola, who are definitely not seafarers. Such interchange probably accounts for the introduction of new pottery forms into Lower Casamance at the time, and for the large marine fish in our deposits.

Period IV

Deposits of this period consist of clayey soils mixed with some Arca and abundant Ostrea. Two new animal domesticates appear in this period: the pig, and the dog. Whether this late appearance is a matter of incomplete sampling, or these two animals were introduced with the first European contacts in Casamance, is yet to be established. Although in general appearance the pottery is similar to that from the preceding period, the small lidded bowl was no longer made by the Diola then, and they do not make it today.
Some time after the early 1700s, site Lo-Oul-I was abandoned, and the inhabitants moved a short way to the villages now known as Samatite and Kagnout. In the same period the compounds that existed adjacent to Mound C at Niomoune were moved away from the mangrove 250 meters to their present location in the Saangor quartier. The reason for these movements cannot be ascertained, but data we obtained concerning present Diola social organization, and oral traditions, give us some clues. Samatite and Kagnout were once a single village located where the abandoned middens are, but due to conflicts between compounds they separated, in accordance with a continuous process of fissioning by which new quarters have and are being formed. Besides social factors, environmental factors may have expedited these movements, such as becoming encircled by rice fields. The Di-3, Mound C abandonment was with reasonable certainty caused by the encroachment of rice fields. A glance at Fig. 2 shows that adjacent to the middens are rice fields that have encroached into the midden itself.

Some aspects of Diola culture were securely established at this time. In the excavations of Di-3, Mound C (Cut 1, levels 100—120 cm.) we uncovered ten small round cups with holes in the bottoms, together with a large shell (Cymbium sp.). These were readily identified by local Diola as the discarded instruments used in divining by a former priest of the buwinko spirit. The cups were placed on the ground and palm wine ladled into them with the large shell during a divining seance. Upon the death of the priest, the entire lot was discarded, and whoever inherited the spirit patrilinearly must use a new set. Proof of this is that in the Saangor quartier close to Mound C two buwinko spirits are propitiated today in the same manner.

Comparisons of the Casamance Sites with other Senegalese Shell Middens

As a general rule, wherever an estuary system offered ancient Senegalese groups additional subsistence potential in mollusks and other fauna, besides rich alluvial valleys for agriculture, villages or encampments were formed with the resulting shell middens. Areas offering these conditions are the mouth of the Senegal River near St. Louis, the Sine-Saloum delta (Gandou and Bandiala) and the Casamance River delta. Although some middens found here may be terminal Neolithic, most date from the Early Iron Age and some were occupied when the Europeans arrived. In Gandou and Casamance, people gather today large numbers of mollusks for food and trade, forming shell heaps outside their compounds.

Relationships between our Casamance sequence and materials from other Senegalese sites are difficult to establish. Except for a few reports, most other Senegalese shell middens have been only hastily described, with only a cursory treatment of their stratigraphy and chronology. An excellent summary is presented by Mauny (1961, pp. 150-62), whereas Davies (1967, pp. 270-7) confines the Sine-Saloum (Gandou and Bandiala areas) with Casamance.

My discussion of the relevant sites will follow the Senegalese coast from north to south. As much ecological data as possible will be sifted from the site reports, but comparisons will necessarily center on the pottery which is the most abundant material in the Casamance middens and has been described to some extent in other Senegalese reports.

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### Table IV DISTRIBUTION OF CULTURAL REMAINS IN PERIOD IV: A.D. 1500 — 1700

<table>
<thead>
<tr>
<th>MOUND AND CUT</th>
<th>LEVELS (cm)</th>
<th>CERAMIC TECHNIQUES (%)*</th>
<th>MOLLUSK SPECIES (%)**</th>
<th>ANIMAL BONES</th>
<th>IRON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-20</td>
<td>grid stamped</td>
<td>0.00</td>
<td>large ocean fish; small freshwater fish; sheep/goat; fragments of tool (?)</td>
<td></td>
</tr>
<tr>
<td>DI-3 Md. C, C.2</td>
<td>20-40</td>
<td>.000</td>
<td>.000</td>
<td>cow; sheep/goat; pig; dog; sheep/goat; lamb; calf; fish; crabs; small tubular fragments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40-60</td>
<td>.000</td>
<td>.000</td>
<td>pig; cow; calf; pig</td>
<td></td>
</tr>
<tr>
<td>DI-3 Md. C, C.1</td>
<td>60-80</td>
<td>.000</td>
<td>.000</td>
<td>cow; sheep/goat; pig; cow; calf; pig</td>
<td></td>
</tr>
<tr>
<td></td>
<td>80-100</td>
<td>.000</td>
<td>.000</td>
<td>cow; sheep/goat; pig</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100-120</td>
<td>.000</td>
<td>.000</td>
<td>cow; sheep/goat; pig</td>
<td></td>
</tr>
<tr>
<td></td>
<td>120-140</td>
<td>.000</td>
<td>.000</td>
<td>cow; sheep/goat; pig</td>
<td></td>
</tr>
<tr>
<td>LG-01-1 Md. C, C.1</td>
<td>40-60</td>
<td>.000</td>
<td>.005</td>
<td>fish; immature sheep/goat; cow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60-80</td>
<td>.000</td>
<td>.000</td>
<td>fish; immature sheep/goat; cow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>80-100</td>
<td>.000</td>
<td>.000</td>
<td>fish; immature sheep/goat; cow</td>
<td></td>
</tr>
</tbody>
</table>

* The percentage frequencies of plain sherds (not listed) make up the rest of the sample.
** Only the percentage frequencies of the most common species are listed. Calculations are based on weight.
Shell middens at the Senegal River delta have been described carefully by Joire (1947) and lengthy discussions have followed as to their nature, whether artificial or natural. The evidence is that they are mostly man-made middens, since they contain habitation refuse, but a few low mounds appear to have been formed by wave action. Natural shell heaps are not, to my knowledge, found anywhere in Lower Casamanace, although the general ecology of both areas is similar, the Saint Louis middens being near the shore dunes which are adequate for the encampment of fishermen (Joire, 1947, p. 190), while the Sambaite-Kagnou middens are on sandy ridges beside the estuary.

Objects such as those found in the Saint Louis middens (a ring of copper and iron and a bone axe) were not found in Casamanace, yet there are general ceramic parallels between the two areas worth mentioning. Cord impressions (i.e., braid impressions) and comb punctuations occur in Saint Louis, on the same vessels, while braid impressions without punctuations occur predominantly in Period I of Casamanace. Punctuations which are definitely recent occur mostly in Period III and IV in our Casamanace sites. It is somewhat puzzling, however, that at Saint Louis an "herminette polie en os" (polished bone axe), exactly like those from Kharoutou dated in the 4th millennium B.C., was found together with pottery known to be much more recent, from the Middle Ages to the eighteenth century (Mauny, 1961, pp. 156-7).

The so-called Neolithic pottery of Cap Vert, though not from shell middens, has been found together with shell lenses. Description of the Cap Vert pottery is precise (Mauny, 1951) but it should be noted that both in Casamanace and in Cap Vert, decorative techniques assigned to the Neolithic also continue into the Early Iron Age—another case of the thorny problem of just how to define the Neolithic epoch in West Africa. ‘De ce côté-ci du Sahara, Ton ne sais même pas à quelle époque s’est terminée le néolithique’ (Mauny, 1951, p. 166).

Both these areas show vague similarities in the shapes of vessels, which are spherical and oval and of various sizes and middle-sized jars with flaring necks. Being such universally common forms, they could have been duplicated independently at any time anywhere. Decorative techniques are in some ways more indicative of historical relationship. In Casamanace, wavy-line incisions like those at Cap Vert appear only in the bottom of the cuts and help define Period I, suggesting that this period corresponds to the terminal Neolithic phase, a supposition reinforced by the absence of mollusk collecting in both areas at this time. A close historical relationship is questionable, however, as in the Cap Vert Neolithic assemblage stone tools (mostly flint) are frequent, while completely absent in Lower Casamanace. Of the areas under discussion, Siné-Saloum shows the oldest relationship to Lower Casamanace, partly explainable by its proximity and similar physiography. Extensive shell middens, both ancient and modern, have been found at Joal-Fadiout, Gandoul, and Bandiala, all showing close parallels in ceramic technologies to our materials.

Joal and Fadiout are located near each other in the Saloum delta, approximately 20 km. north of the Saloum river. Large archaeological shell middens occur here, some more than 100 m. in length, composed mainly of Arca antilia, with only occasional lenses of Gryphaea gaudensis (Ostrea tulipa), and with burial tumuli on top (Mauny, 1957). Outwardly they differ from those in Casamanace in being considerably larger (the largest Casamanace midden is not over 40 m. along its longest axis), in having more Arca (95% as compared to percentages of Arca in Table II), and in the burial tumuli.

When comparing the pottery, we meet the 'enigmatic vessels' from Joal (Mauny, 1952) which do not occur in Casamanace. Certain decorative techniques, however, are shared with our Periods I and II, mainly braid impressions and wavy-line incisions. I was able to inspect the Joal collections at IFAN in 1965. Other notable differences cannot be disregarded, for the Joal pots, unlike our oldest ones, are slipped in red, are not shell-tempered, and have different shapes.

Limited archaeological information about the Gandoul middens south of Joal is available. Lafont (1938, p. 405) reports that the middens probably predate the tumuli, implying therefore that at least two periods are represented. In size, the Dionewar mound, being two kilometers long, is larger than any found in Joal, and certainly far larger than those of Casamanace. Yvetot (1949) describes other middens besides Lafont's in Gandoul, both authors mentioning pottery and bones. Since the pottery is not described, and I have not seen the material, there is nothing I can add about it.

In spite of the scanty archaeological data, Lafont's report contains an interesting ethnographic description of mollusk gathering among the modern Niominka Serer of the Gandoul area. This resemblance to modern Diola culture matches back to the first European accounts of Valentín Fernández (1951) that mention shell-tempered, red-slipped pottery similar to the pottery of our Period III in Casamanace.

Most famous among the Saloum sites is Bandiala, located ten to twenty kilometers southeast of Gandoul on Niombato island (see map in Mauny, 1961, fig. 35, p. 159) which has yielded elaborate pottery and attractive bronze ornaments. Here also the burial pottery from the tumuli appears to be more recent than the rest found in the midden fill.

Based primarily on the drawings and detailed notes I took of the IFAN collections made by Monod (1938 at Dioron Bondau, and referring to the Besser (1953) illustrations of the burial pottery, I offer ceramic comparisons as follows: (a) The Red Slipped Ware (Monod's category) and our Casamanace Period III ceramics share thin walls, crushed shell temper, red slip, decoration by incision and punctations, and a type of small pot with a lid. In general appearance, however, the Bandiala burial pottery is more skilfully made and fancier than the Casamanace utilitarian wares. (b) A second grouping by Monod ('fragments de poterie dont certains très épais') may be older than the Red Slipped Ware, if this is the pottery which makes up the midden fill. This ware shows little resemblance to my Periods I or II pottery since the 'gris tâillé' type, the techniques of roulette impressions, diamond-shaped incisions, red markings and branching incisions, are not present in Casamanace.

To summarize, the ceramic material from the Casamanace Period III looks like a poor reflection of the Bandiala burial pottery, reinforcing the hypothesis that contacts, probably for the purpose of exchanging rice for fish, first took place between nearby Gandoul and Casamanace during Period III. These contacts do not seem to have occurred in the preceding periods.
Conclusions

Investigations of several Lower Casamance shell middens in 1965-66 yielded the first cultural sequence for southern Senegal, spanning the period between 200 B.C. and A.D. 1600, and overlapping with early modern Diola material culture. By concentrating our excavation of seven sites in the delta within an area 22 km. by 6 km., I was certain of dealing with groups sharing the same culture, in continuous contact through the ages, undergoing similar adaptations to varying micro-environments.

I do not believe to have found the oldest occupations in the entire Lower Casamance. Quite the contrary, my oldest period (Period I, 200 B.C. to A.D. 200), found only in the Loudia Onclof sites, represents the ending, rather than the beginning, of a Neolithic expansion involving unknown peoples originating elsewhere. Pottery of this period shares decorative techniques, such as wavy-line incision, with Neolithic pottery of wide distribution, from cap Vert (Mauny, 1951) to southern Algeria (Hugot, 1963) and even beyond, to Central Africa (Arkell, 1962). Although we found no tools in Period I, prehistoric stone axes have been reported from the vicinity of Bignona, supposedly found in shell middens (Mauny, 1955).

For the following reasons I can safely suggest that the subsequent occupations (Periods II to IV) belonged to ancestors of the Diola: the findings fit well with historic and modern Diola practices and the sequence of pottery types Jinks clearly the ancient and the modern.

Further clues about their origins can be found in linguistics, which places the center of ancient Diola dispersion to the south, in coastal Portuguese Guinea (Sapir, 1969). Here the closest linguistic allies to the Diola are found, namely the Manjaku, a group living east of Bissau, and the Balante, a group to the northeast of Bissau just below the Rio Cacheu. They resemble the Diola closely in being wet rice cultivators and employing the unique hand-plow, the kayando. Thus the belief that the Diola as a group came from the east receives no linguistic support. Archaeologically it is also questionable since the practice of shellfish gathering, the shell-tempered pottery, and the presence of fish remains in Period II indicate a coastal rather than an inland eastern origin.

About 300 A.D. the Diola were exploiting the rich faunas of mangrove swamps and using both the fields and mangroves systematically searched for, though they should be in the future; cultivation of paddy fields would be very difficult because they have been continuously disturbed by cultivation and are closely guarded by their owners. Nonetheless, the location of the sites near low alluvial valleys where rice cultivation was most appropriate strongly indicates the existence of wet rice culture at the time. Unfortunately, however, our sequence is too recent in time to shed much light on the theory of an independent center of wet rice agriculture in West Africa as proposed by R. Portères (1950). He suggests that the Senegambia was a secondary center of Oxara glaberrima propagation, the primary center being somewhere near the Middle Niger in epochs going back several millennia before Christ.