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A Critical Assessment of the Problems and Prospects of Geoarchaeological Research Works In West Africa

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Abstract
The use of Geoarchaeology in archaeology and related disciplines research endeavour in West Africa is a welcomed development given the potentials but one which is frontally challenged by certain teething and bureaucratic problems in the area. These potentialities problems and promises of the discipline are critically assessed in this paper with a view to getting it right in the research activities in the region as is desired in the new millennium.

Introduction

Geoarchaeology – The application of the concept and techniques of geomorphology and sedimentary petrology among other earth sciences in environmental archaeological reconstruction and interpretation is a welcomed development in archaeological research. Archaeologists every-where have embraced this recent positive idea for its potentiality in their work. This is because such knowledge of the environmental setting of man is essential in fuller reconstruction of man and his cultures in time and space given the close man-land relationship. The contributions of this sub-discipline are particularly essential in the tropics including the West African sub-region, given the basic problem of preservation that has affected progress in research in the area.

The above situation notwithstanding, the state of geoarchaeology especially here in West Africa where it is said to be mostly needed, leaves much to be desired. Is there not much to be gained using the contributions of geoarchaeology, in archaeological research? What are the noticed evils attached to its application in such researches. In this paper, these issues are discussed with a view to knowing what should be done in marrying the sub-discipline's merits and limitations in archaeological research in West Africa.

The West African Environment

West Africa (the immediate western area of sub-Saharan Africa), lays between latitude 4˚N longitude 18˚E, and latitude $23^{1}/_{2}$ ˚N longitude 18˚E. The climate over the region is largely monsoonal in nature, it is basically controlled by the two wind systems namely South Westerly moisture – Laden monsoon, and the dry, North East Trade Winds (harmattan); and the shifts in the position of the intertropical discontinuity (ITD) (the meeting point of the two wind systems). One good delimitation of the West African sub-region based on the environment is that base on ecological vegetation zones. There are (beginning from the coast)

i. The coast and coastal lagoons (Swamp and Strand Lagoon margin vegetation)
ii. Lowland rain forest
iii. The savannas (a) Guinea (b) Sudan (c) Sahel
iv. Montane (undifferentiated)
v. Sahara (southern portion)

Sowunmi (1987:42), observed that the above zonation falls into belts that are roughly parallel with the equator. The vegetation zones are in *paripasu* with the different soils in the region; as they have their various fauna associates.

Another criterion of identification of the region of West Africa is the geology, together with the associated relief. Andah (1979:20), has done a good completion of this geomorphological index. Andah, also notes the principal landforms in the region as featureless plans; deeply weathered and lateralized land surfaces; and Isenberg landscapes; with many of the latter occurring within areas underlain by a basement complex of Pre-Cambrian or early Paleozoic gneiss and granite. Andah in the same vein observed that the rocks of the Pre-Cambrian are mainly metamorphic or igneous including a few old volcanic rocks, (marampa), magnetite quartzite of the Nimba mountains of the Guinea-Liberian frontier, and the auriferous conglomerates of the Tarkwaian in Ghana. The rocks are associated with metamorphosed sedimentaries that appear as quartzite, schists and phyllites and form linea, north south trending dominant in such areas as Ghana.

Palaezoic sediments extensively outcrop and are said to have been often important for human habitation in prehistoric times. According to Andah, the beds of greater human significance are the extensive sandstones of Ordovician and Denoman age found in Mauritania, Guinea, West and Southern Mali and Western Bokina Faso and Ghana (the Voltaian sandstones). He summarized that these sediments form a great discontinuous ring of sandstones plateaus (e.g. the Fouta Djallons and Bandiagara), in which bounding scarps humans have sometime sheltered as in Bandigara, as well as their springs which have stimulated human settlement through time.

West Africa is well drained. The most important rivers are Rivers Niger (one of the rivers in Africa) (Nzewunwa 1983:4), Benue, Senegal, Volta, Ogun, Kaduna, Anambra, New Calabar Ethiope, Imo and Cross rivers to mention but a few. There is Lake Chad at the northeast corner of Nigeria which has tributaries and the Yobe River flowing into it. The drainage system is such that flowing channels of streams, rivers, creeks empty into the Atlantic Ocean flanking the western and southern limits of the region especially in the areas of the Niger Delta in Nigeria and in Mali/Guinea area. The northern area of West Africa which is the southern portion of the Sahara with very limited moisture occurrence is basically without runoff.

Critical Assessment of the Potentials of Geoarchaeological Work in West Africa

Geoarchaeology: Precisely put stands for geologic studies in association with archaeology. In essence the environmental scientific earth studies entailing verse principles and techniques in both the field and laboratory now contribute to the anthropological research especially in the area of culture. The application of the contributions of prominent among the earth sciences, geomorphology, and sedimentary petrology to archaeological research is proper and in line with the desire more complete research parameters in archaeology. This approach is as a matter of fact neccessary in the tropics including West Africa, where archaeological research has different set backs mostly due to the traditional methods of the research and the tropical nature of the area.

Archaeology traditionally relies on the visual objects (finds) met in research processes; however, the West African terrain with acidic soil decays organic matters rapidly and thus leaves very limited materials; such that will aid palaeo-reconstruction. This is why in the region there has been no spectacular hominid finds except for very few ones such as the *T'Chadanthropus uxoris* from deposit in Chad (Andah 1982:53) the Eleru man found in very poor preservation state in Ondo state Nigeria (Shaw and Daniels 1984). These two finds are the oldest human fossil ever found with relatively young ages (Iwo Eleru man 11,000Bp) compared to those of East Africa of about 2 million years ago example (The Chadian man's age is controversial as it is not clear whether the fragments of jaw and Cranium recovered from the deposits belonged to an Australopithecine or early *Homo erectus*). All these are indications of how problematic it can be searching for such visual far-reaching datable hominid/human fossils. The Iwo Eleru man found was only a fortunate case as it was preserved in a micro-environment (in a calcareous sealed site of a rock shelter) in the rain forest of West Africa (Shaw and Daniels 1984:4).

Even correlatable parameters seem absent in West Africa, again attributive to the nature of the physical world. For instance, scarcity of lacustrine and other suitable deposits, particularly in marginal positions where small climatic changes have marked effects on the rest of the environment (Sownmi 1987:41), which would have served some purpose in the palaenvironmental research, is an indication of the gravity of the problem. This is coupled with problem of the high species diversity of especially plants which makes identification of their fossil specimens difficult, tedious, time-consuming and sometimes impossible. Some solace sometimes are obtain the areas of geology and palynology where the rocks and pollens (in acidic milieus) respectively are preserved.

These limitations of the nature of West Africa environment tend to cause researchers on the past environment to favour the geo- and the bio-archaeological (botanical) approaches given the availability of such remains (Tubosun 1995:5), at the expense of the others (e.g. the human paleontology). Hence Tubosun noted a sharp disparity in the amount of research work done in the north, south and east African sub-regions as against that of West Africa, attributing it to lack of depositional sequences that are well preserved in the latter.

However, given the main focus of contemporary theoretical orientation of archaeological research that consists of:

i. The reconstruction of climatic morphogenetic environment.
ii. The reconstruction of site development history.
iii. The determination of site specific human activities; and
iv. The interpretation of man-land relationship, West African archaeologists need not look far for solution but embrace such discipline as geoarchaeology. Besides the fact that this discipline has shown the potentiality of sediment analysis in many parts of the world where it has been used, it stands to backup the above theoretical orientation in archaeological research. Sedimentary petrology an aspect of geoarchaeology deals with sediment analysis, with a view to knowing the:

i. Nature of the parent material
ii. The distance and means of transport
iii. The nature of depositional environment and
iv. The post-depositional modifications.

The geoarchaeologist however, is essentially concerned with archaeological sediments (deposits that are directly and or indirectly related to past human activities). This can be organic or inorganic, totally, naturally or entirely anthropogenic. What matters though is that interpretation depends on an understanding of the sedimentation processes together with the degree relation to the times of operations.

The sediments in and on archaeological sites are no more discarded as dirt and immaterial but constitute valuable source of information on palaeoecological reconstruction. This information can be derived through detailed examination of the composition, texture, and the structure of the sediments. A direct relation to the site analysis and delimitation using obvious cultural materials and profiles reported Gordon (1978:331) is the quantification of humanly induced chemical residues in the soil. An example of such situation is bones from butchering and or burial places and metabolic by-products from former inhabitants of a site. This is possible in reconstructions given the fact that bones, as well as urine, and faeces result in high concentrations of phosphorus, nitrogen, potassium and calcium. If these attributes are anthropogenic, they can be used in recognizing activity areas or sites as well as in the interpretation of the processes involved in both the formation and the destruction of such archaeological site. Some of the elements (e.g. phosphorus can be analyzed to aid definition of stratigraphic levels in multi-component site as well as in outlining occupation areas mentioned earlier. Phosphorus analysis shows that it is a good indicator of human occupation because of its normal, high concentrations in archaeological sites (Gordon 1978). Apart from the analysis being easy, phosphorus concentrations remain fairly constant over long periods owing to its high leaching resistance. Laboratory identification of any biological remains and detailed studies of important indices such as particles size, free-ion oxide (amorphous and crystalline), PH, carbon content among others, can be used to illuminate and explain the relationship between changes in subsistence-settlement patterns, and even environmental change. The abundance of the data of this discipline adds to its potentiality in archaeological investigation.

With geoarchaeology, using such methods as in sedimentary petrology, stratigraphy becomes more meaningful and useful in the reconstruction of archaeological past. The former method of understanding archaeological stratigraphy simply for itself and or because of the artifact inclusions in it is not adequate in this regard. Stratigraphy should afford the archaeologist the cultural sequence and their placement in proper chronological framework. For the archaeologist to be successful in fuller coverage of the historical search, he should not only construct a time sequence but needs to interpret the natural and the anthropogenic agencies involved in the stratigraphic layering. This is because the archaeologist main intension in this regard, is observing the palaeoecology of man with a view to reconstructing as well as understanding his behaviour in the past. The geoarchaeologist thus takes the entire stratigraphy serious, ensuring proper study and interpretation of the various strata exposed in excavations.

However, there are some limitations in the use of sedimentological studies that demand that they are not used in isolation in palaeoanthropological analysis and interpretation. It is pertinent to add here that sediment analysis is only an indirect line of evidence. The use of some of the techniques and entities found in archaeological sites as highlighted above have as it were warned against complete reliance on them; thus, the need to be critical about their usages. For instance, although human occupation does result in significantly increased level of calcium, phosphorus, nitrogen and potassium as noted earlier, Gordon (1978:332) stated that these elements are not all effective gauges of human occupation. Calcium, he noted, normally present in moist soils as well as originating in bone apatite and excreta, and thus can be used as a general indicator of occupation. Similarly, only the meaningful comparisons for calcium can entail on-site and off-site sampling. Gordon also clarified that although such elements as carbon and potassium are no doubt, by-products of human occupation, that they are too ubiquitous for analytical significance.

The consideration could act like spanners in the wheels of progress of the discipline considering the various areas of sediments properties acquisition. These according to Gladfelter (1977:522) are:

i. from parent materials,
ii. during transport,
iii. as a product of the depositional micro-environment, and
iv. from *in situ* post depositional alteration.

Gladfelter again observed that only some of these properties are directly relevant to the period of human activity. The use of such data thus depend largely on the ability of the expert (geoarchaeologist) to differentiate

these inputs with respect to recognizing sedimentological conditions broadly contemporaneous with human activity. This reliance on his ability could mean reliance on his choice, thus biasness might be introduced if not properly corroborated with other direct lines of evidence such as those of actual biological remains.

In the field, the geoarchaeologist does description and recording of the various strata whether natural or cultural. When for instance, there is conformity in the strata or otherwise a good researcher should be able to know. Photographs of both coloured and black and white exposures are also used in recording the stratigraphy. He takes samples and carries out certain field techniques to ease excavation procedure stress such as the flotation separation technique. Illustrations are also done starting from the field by the expert.

The geomorphological consideration by a geoarchaeologist necessitates proper placement and compatibility of archaeological sites in palaeoecological context. Reconnaissance done in association with a geoarchaeologist will aid in determining the appropriate place in the site to initiate excavation. This judgment he makes vis-à-vis the landscape evolution history, together with the site-catchment analysis (Vita-Finzi and Higgs 1970). He thus is in a good position to relate an on-site be it of close (sealed) or open kind, to the off-site and even to the macro level of regional correlation. He, it is who knows where raw materials for instance for artifacts found in an excavation such as literites and rock types were sourced. Indeed geoarchaeology has great potentiality for archaeology.

However, whereas it is possible to describe a series of geological layers in strictly objective terms such as in terms of hardness, texture, crystallography among others, experts such as Tubosun had doubt that comparable means of describing an archaeological occupation layer and its relationships with adjacent strata, will ever be devised. Another limitation in the reliance on the use of geoarchaeological data is in the area of radioactive pediments (e.g. C14, K-Ar, thorium/Uranium and Uranium/ Lead) in archaeological studies. These elements have in broad sense, long half-life. Even for radiometric techniques which could be said to be exceptional in this limitation, spotty occurrence of datable materials, and unsatisfactory precision of most of its dates due to addition or lost of evidence (material) through time marks a major disadvantage in its use.

For a more reliable interpretation and reconstruction of palaeoanthropolopgical condition in relation to the environment, there is need to employ and articulate contributions from not only geoarchaeology but bio-archaeological ones especially palaeobotanical ones which are direct lines of evidence.

Problems/Inhibitions of Geoarchaeological Research In West Africa

The problems inhibiting geoarchaeological research in West Africa as have been noticed earlier in this paper are partly attributive to the tropical nature of the region. The irony of this is that this is the very rational behind the yearn for the discipline in the region. These problems having been exposed while looking at the West Africa sub-region's environment are highlighted below together with related ones.

The first and major problem facing geoarchaeological research in West Africa is that the sub-region being in the tropics (between Lat. 4˚N 18 E and Lat $23^{1}/_{2}$˚ N 18 E) has acidic soil which has poor preservation quality.

As such, there is the problem of incomplete nature of fossils record. Most part of both flora, and fauna, have not been fossilized and thus preserved as a result of their fragile nature, under rapid decomposition. When they are fossilized, they are only fragmentary (e.g. the Iwo Eleru man and the Chadian man) and thus difficult sometimes impossible to identify. (The identification of the two human fossil finds referred to above, have been controversial due to their poor preservation states). The West African terrain given the climatic situation has more of erosional landscapes rather than depositional ones. Such that materials are not in the main exposed to suitable depositional environment and subsequently preserved. This is why river basins and deltaic depositions are clamoured on to by palaeoenvironmental researchers. They are among the few focal points expected to yield stratigraphic information especially with regard to geomorphic and geomophorlogic processes. However, long distance accumulated deposits sometimes makes provenance of source of materials difficult e.g. in pollen and spores. Materials are deposited not in their primary context but actually re-deposited and may not therefore, be correlated appropriately.

There may be post-depositional changes on the sediment that could have altered the original characteristics such as colour of material deposited. Also shapes and sizes of clasts could have been altered. Gladfelter (1977:524), recorded that during aqueous transport, abrasion and corrosion progressively round a clast so that in contrast to alluvial pebbles, slope screes exhibit high angularity retained from mechanical comminution of local bedrock and/or limited transport.

There is also the problem of sufficient datable materials that makes it difficult to place environmental changes as well as material culture in the proper temporal context. There are for instance virtually no datable

volcanic materials as in East African sub-region, in West Africa. As such C 14 is mainly used in West Africa; but unfortunately, the laboratory is lacking in the region.

The above problems noted, culminate to the direct problems facing geoarchaeological research in the West African sub-region. These are that personnel in this field shy away from the region due mostly to lack of interest. The nature of the environment together with the absence of spectacular finds as to attract international aid in sponsorship as in the horn of Africa, East Africa and South Africa, where the discovery of spectacular finds has accorded them such benefit. A related problem to the above one, inhibiting geoarchaeological work in West Africa is that of lack of qualified specialists in the discipline. For instance, there are a few number of indigenous geoarchaeologist in the sub-region. This is worsened by the unavailability of texts in this field. The social environment also does not help matters in this respect. People's attentions (including those of the governments) are channeled towards other areas and thus leave such issues as the concerns of the discipline to float in isolation in the region.

Conclusion

In sum, geoarchaeology has a lot to offer in palaeo-reconstruction and interpretation. It should therefore, be encouraged, in archaeological works especially in West Africa. In fact, the geoarchaeologist should be involved in every level of archaeological investigation irrespective of the limitation observed in its application.

If the West Africans themselves should take work in this respect serious, spectacular finds may not be necessary to move forward in this endeavour. Help can come from within especially when there is a change of attitude with regard to looking inwards for solutions to problems within. Information articulated by geoarchaeologists in association with archaeologists will move from building hypotheses (about local human activity patterns in time and space) as well as correlation proposition, to positive constructive suggests, on development and nation building.

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