Nigeria’s Archaeological Heritage: Resource Exploitation and Technology

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Abstract
People have exploited mineral resources for several reasons ranging from the production of metal and ceramic objects to stone and wooden tools. Indigenous extraction and use of mineral resources for production of general goods among others have continued unabated. In this article, archaeological and ethnographic data were used to identify extraction methods for some of these raw materials in the past, and thus, examine how failure to manage such resources has adversely affected technological and resource development in Nigeria.

Keywords
raw material sources, resource exploitation, resource extraction, stone, pottery, metal productions

Introduction
Archaeological studies in Nigeria have shown that its people, for millennia, exploited a wealth of mineral resources for the production of stone and metal tools and pottery. Traditional resource extraction and development continue into the 21st century. We argue that increased knowledge and understanding of this heritage can contribute to an alternative vision for resource extraction and development in Nigeria (see Figure 1).

Nigerian metal- and clay-working traditions extend back in time at least two and a half thousand years. For example, people of the Nok culture created distinctive terra cotta figurines more than 2,500 years ago and people at Igbo–Ukwu mined copper alloys in the ninth century AD (B. Fagg, 1990; Shaw, 1970), while the identification and exploitation of mineral resources such as tin ore on the Jos Plateau dates even earlier, to approximately 900 BC (B. Fagg, 1946; W. Fagg, 1952). In the 1970s, Shaw (1973) and Fraser (1975) reported the recovery of bronze or brass objects in the Tada, Jebba, and Giragi areas. Neaher (1976) has identified at least three centers of metal working in Igbo land—Awka in Anambra State, Eha Alumona in Nsukka, and Agulu Umana in Udi, Enugu State used bronze/brass and iron in their metal works. Still other studies have shown extensive exploitation of hematite ores for iron smelting in Nsukka areas such as Opi, Orba, Umundu, Nrobo, Lejja, and Obimo. In addition, archaeologists searching for the sources of the Igbo–Ukwu bronze have discovered early exploitation of lead and zinc at Enyigba Abakaliki and copper in the Benue trough (Chikwendu, Craddock, Farquar, Shaw, & Umeji, 1989; Chikwendu & Umeji, 1979; Craddock et al., 1997; Onwuejeogwu & Onwuejeogwu, 1977).

The legacy of ancient resource extraction continues in the present day. The archaeology of stone tool manufacture at the Ugwuele-Uturu Okigwe illustrates early and extensive exploitation of dolerite for the production of hand axes, cleavers, picks, and flake tools, whereas modern people continue to quarry this outcrop for road construction gravel. Similarly, people in Benin, Awka, Eha Alumona, Nsukka, Agulu Umana, and Udi continue to cast bronze and brass (Okpoko & Ibeanu, 1999).

Traditionally, stone tool production has been associated with hunter-gatherer and early agricultural societies. Archaeologists have long considered clay, and later metal technology, to coincide with the formation of agricultural societies with increased division of labor and intensified exchange of goods and services. More recently, social archaeologists have begun to highlight the roles that individual men and women played in shaping their material worlds through the use of such objects (Haaland, 1997). Mineral objects of all kinds play a major role in the development of states and kingdoms in Nigeria and elsewhere.

In this article, we attempt to use archaeological and ethnographic data to identify the source extraction methods for some of these raw materials in the past, and to examine how failure to manage such resources has adversely affected technological and resource development in Nigeria. We begin with a discussion of Nigeria’s archaeological heritage of three traditional resource types: stone, ceramic, and metal, especially iron. We include ethnographic examples illustrating the
persistence of these technologies in the recent past and present. We conclude with a discussion of some possible ramifications of Nigeria’s production heritage on the course of its current and future development (Figure 1).

**Raw Material Sources**

Humans have long made use of mineral resources—clay, metal, and stone—to manufacture tools. Such resources formed the raw material for hunting, farming, and other utilitarian implements, as well as symbolic objects imbued with social or ritual powers. Ultimately, the need for more efficient tools led to the exploitation of quality iron ores such as hematite for the production of iron implements.

**Stone Tool Production**

Stone artifacts have been produced in Nigeria since the Acheulian time (ca. 500,000-200,000 years; see Shaw, 1975). For instance, in the Nok valley, stone hand axes, cleavers, and picks were recovered from the sites of Mai-Idon Toro, Pingell, and Nok. Also in the forest zone of south-eastern Nigeria, a stone tool factory site was discovered in 1977 at Ugwuele-Uturu Okigwe (Andah & Derefaka 1983; Anozie, Chikwendu, & Umeji, 1978). However, the dating of Acheulian tools/sites in Nigeria has been trailed by controversies (Anozie, 1983; Clark, 1983; Allsworth-Jones, 1987; Okafor, 1989).

Furthermore, stone tools have continued to be used in many parts of Nigeria (plate 1). For example, Ibeau (2000) recently observed the use of a stone anvil and hammer by Ugwuogu blacksmiths in Uturu Okigwe. In addition, Okonkwo (2004) notes that in Sukur Kingdom, Adamawa State, 18th-century grinding stones, basins, and mortar hollows are still in use, thus demonstrating the persistence of the technical tradition (David & Sterner, 1989).

Some materials, such as obsidian (not readily available) lend themselves more easily to tool production than quartz/quartzite, so Nigerian hunter-gatherers have long visited remote quarries to gather quality raw materials for stone tool
making (Hodges, 1964). Such lithic resources are later recovered at archaeological sites outside the source areas. Stone tool technology, like all technologies, change over time. These changes may be a response to environmental shifts. As in many other parts of the world, stone tools in Nigeria can be divided into two broad categories: flake tools and ground or polished tools such as axes.

Flake tools, such as scrapers with limited working edge were mostly used for the processing of hides and fibers for use by humans. And perhaps, with increased and more effective demand on resource exploitation, man opted for more efficient and smoother cutting/digging tools—polished stone axes, which could be held with hand or hafted on wood—thereby expanding the scope of man’s subsistence base such as incipient farming activities. In Nigeria, most traditional agricultural tools seem to have taken cue from stone tools. For instance, the iron knives, hoes, axes, and picks have longer and sharper cutting edges compared with the hunter-gatherer’s digging sticks weighted with bored stones.

Clay—Pottery Production

The earliest evidence of pottery production in Nigeria dates to the fourth millennium BC in Rop Rockshelter (W. Fagg, 1972). To date, ceramic objects remain important in the economic and socio-cultural life of Nigerian peoples. Archaeological and ethnographic studies alike show Nigerians use traditional pottery for cooking and storage; they also play a prominent role in religious ceremonies and rituals. A variety of pottery traditions exist within Nigeria, including terra cotta discovered at Nok, and “potsherd pavements” found at Nok, Daima, and Ife archaeological sites. Nrobo potters of Nsukka area manufactured clay smoking pipes.

Despite the adverse impact of western colonialism on traditional art and craft, pottery has demonstrated some measure of resilience and adaptation (Fowowé, 2004; Ibeanu, 2000; Lloyd, 1953). For example, apart from the adaptation of pottery forms, such as ornamental wares, the demand for Ilorin black pots (Kashim, 2004) is still on the increase for use in socio-cultural practices in parts of Igbo land, such as title taking, traditional medicine, religious practices, and marriage.

In parts of Igbo land, traditional pots not only serve utilitarian functions but also ceremonial, ritual, and status symbols (Ibeanu, 1992, 2006). The above socio-cultural factors such as title taking, traditional medicine, marriages, and ritual practices help in no small way to continue to sustain the production of traditional pottery wares in parts of Nigeria. The Ilorin black pots were achieved as a result of the high technical skills of traditional potters.

The production process requires getting a bigger pot with perfectly round bottom as a mould. The mould is placed on the ground at a balanced position and clay lumps are put together gradually around the pot taking proper cognizance of even thickness and smoothness. (Kashim, 2004, p. 63)

After allowing the base to be a little bit hardened, the molding process continues on till the desired shape and size is achieved (plate 2). “Are” (a sharp edged smooth pebble) is used to make spiral decorations on the inner parts of the pot. The pottery wares are smoothened with coconut shells or leaves and fired in open fire. At a temperature of about 600 °C to 850 °C, the pots are removed from fire and dipped in a heap of saw dust, which impacts carbonized effect on the pots. Later, the hot pots are immersed in a big pot containing liquid extracted from tree barks and bean pods. The contact of the hot pottery wares with the black liquid produces a boiling effect on the surface of the pots giving it a black shining effect characteristic of Ilorin pots. This type of pot is still produced and used in Ilorin irrespective of the influx of imported wares (plate 3 & 4).

Iron and Metal Production

The utilization of iron in the production of tools and ornaments seems to have occurred prior to or simultaneously with other metal ores in Nigeria. Artifacts of iron and other metals were recovered from the same archaeological level for the first time at Daima site; thus, the transition from stone use to iron was documented in Daima dated between 5 AD and 6 AD (Connah, 1969). Unlike in northern Africa and Europe, which had distinct Iron and Bronze Ages, the earliest evidence so far for ore exploitation and smelting of iron and metal was dated 700 BC at Opi Nsukka and 500 BC in Taruga-Nok site, whereas the earliest date for bronze artifacts recovered in.
Nigeria is from Igbo–Ukwu sites dating to the 9th century AD (Okafor, 1993; Shaw, 1970). The ores used for smelting at these early sites were mined with simple tools or collected on the surface from eroded ore bearing deposits found in different parts of Nigeria.

Common ores for smelting at archaeological and contemporary ethnographic sites include hematite, limonite, magnetite, and hardpan occurring in bogs. For example, Sassoon (1964) also observes that in Sukur Kingdom, magnetite is the local source of ore for smelting. In Nsukka and Okigwe areas, hematite ores were smelted in the past. Umeji (1985) has observed that iron ores have traditionally been obtained along the Nsukka–Okigwe escarpment.

The type of ores for smelting depends on the availability and accessibility of the mineral resources in the environment where the iron smelters live and work. However, the relative ease of acquisition/abundance of iron ores explains why iron objects were more numerous than copper artifacts, and may also explain why iron smelting seem to have predated the smelting and production of copper artifacts in Nigeria.
Furnace/smelting. Smelting involves the reduction of iron/copper oxides (ores) to iron/metals. This is achieved by heating the ores with charcoal in an enclosed earthen chamber known as furnace. Three types of furnaces have been noted in parts of Nigeria: These include pit or bowl furnaces, dome furnaces, and shaft furnaces (plate 5a-c).

The iron smelting tradition of Nigeria exemplifies the Nigerian tradition of innovation; thus, the various types of smelting furnaces observed in parts of Nigeria seem to suggest improvement over time in smelting technique culminating with the slag-tapping shaft furnace at the time of colonial intervention. Besides, a lot of rituals are associated with the iron workers/workshops and in some places iron workers held very high social status in the society. In Ihube, Okigwe, Ogadazu (a small earthen pot) that is located inside a blacksmith workshop is used to administer oath to people. It is a general belief that the water in the Ogadazu ritual pot has the potency to cure some ailments such as skin disease and swollen leg (Ibeanu & Okpoko, 1994). Another important point is the bellows used in iron working, from fire to animal skin covered bellows to rubber and now motorized bellows as observed in some blacksmiths’ workshops. Also, pottery wares must have played significant roles in iron working given the quantity of potsherds in smelting sites.

The pit furnace is made up of a simple, clay-lined pit, two or more feet deep, and is the oldest furnace type noted in Nsukka and Abakaliki as well as in Taruga-Nok (Anozie, 1979; Tylecote, 1975). The dome furnace was an improvement on the earlier type because it has a superstructure with a small opening on top for recharging allowing faster attainment of higher temperature. Dome and pit furnaces alike employ bellows to raise the temperature, and both produce very heavy slag in Nsukka and Abakaliki areas, thereby indicating perhaps their low efficiency in iron extraction. Both require that slag be cooled with the iron bloom and then broken away and deposited on site, a process that leaves a distinctive archaeological signature. In the Yoruba village of Ola-Igbi, a dome furnace continued to be used into the late 19th and early 20th centuries (Bellamy, 1904).

The 5- to 6-feet-tall chimney-shaped shaft furnace is the most type of traditional furnace. Shaft furnaces feature a slag-tapping devise, which draws the melted slag in the furnace into a slag pit, and thus, creates an archaeological signature different from the other two.

Shaft furnaces continue to be employed in parts of Benue and by the Berom people, as well as those of Sukur Kingdom. They stand as an example of cultural resilience when smelting has gone into extinction in other parts of Nigeria. In Nigerian antiquity, smelted iron was either hammered or cast to produce tools and other objects. Casting techniques include the use of open molds, piece molds (for solid casting), cire perdue (lost wax), and false core (hollow casting).

Discussion and Conclusion

We have tried foreground early successful attempts by Nigerians of different ethnic groups to harness the mineral resources available to them. In so doing, they added value to
the raw materials and used the finished products to meet their own survival needs. The traditional skills and indigenous knowledge of Nigeria’s ethnic groups have been callously left to fossilize in the archaeological record, and are ignored in current attempts at economic planning. The Nigerian nation today is bereft of her past “golden Age” so long as our ancient heritage of resource extraction and production does not inform the present and future development of the country. For example, to what extent have we integrated our indigenous knowledge from different local industries to form the bedrock of our industrial development strategies?

It is not always correct to blame our development setbacks on western colonialism, especially if we are unable to appreciate our own past technological breakthroughs. For example, the analysis of the pig iron from the traditional smelting furnace at Ola-Igbi village in Yoruba showed that the iron produced there was actually steel iron with a very low carbon content of 1.6%, and the blacksmiths of the area were able to further refine the metal to reduce the carbon contents to 1%. The smiths considered this locally produced steel to be much stronger and more durable than the European imported iron. But by the time of W. Fagg’s (1952) visit, they were using imported iron, even though they considered it an inferior product (Bellamy, 1904).

Also, ethnographic studies in Agulu Umana in Udi, Enugu State, observed people’s creative skills in both iron smelting, blacksmithing, and casting. As a result, their blacksmiths were engaged by the colonial master in the iron foundry that produced the railway sleepers. Craddock and Picton (1986) noted the addition of lead to the Igbo–Ukwu copper alloys, which made possible the complex casting of the Igbo–Ukwu bronze artifacts. This mastery of the technical properties of copper alloys by the Igbo–Ukwu traditional metallurgists has not been seen anywhere else in the world.

No doubt, the European intervention adversely affected the continued development of traditional skills in mineral exploitations and other spheres of traditional technology in part by bringing techniques that would add more economic value to their investments returns. Successive Nigerian governments have since failed to take advantage of the abundant local skills for industrial development such as the colonial masters. For example, the local blacksmiths and other craftsmen were extensively used by the European colonialists in the iron foundry for the Nigeria railway sleepers as well as in the equipment and engine maintenance workshop at Ebute Metta. It is the policy somersaults of Nigerian government, which nipped such initiatives in the bud, that have since allowed the technological development to stagnate. Thus, Nigeria regretfully has remained a consumer rather than a hybridization of technologies.

**Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding**

The author(s) received no financial support for the research and/or authorship of this article.

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