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RETHINKING EARLY METALURGY
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Early Metallurgical Sites, created by Alice Chapman. Base map provided by ESRI.

Not so long ago we knew very little about ancient West African metallurgy. There were early iron dates in Nigeria (Taruga), and an early copper mine in Mauritania (Akjoujt). Iron technology was considered a simple import from Arabia, Egypt, or North Africa, and no interaction between iron and copper technology was imagined. But over the past four decades archaeologists, metallurgists, and historians have expanded our knowledge dramatically. There are now many sites with early dates. There is overlap between copper and iron technologies. And it is clear both metals became key features of complex

commerce systems. Both metals also became critical elements in practices of spiritual power, but that is for another paper. Here I want to survey sites for copper and iron that have received substantial research. This is preliminary. I leave out many places (such as work on the Dogon area by Anne Mayor and others) and I leave out gold. But what emerges is a robust entrepreneurship that played major roles in the bigger picture of trade and statecraft that is the history of Mande and their neighbors. In fact, to me at least the patterns of sites and dates now emerging suggest the infrastructure of knowledge acquisition we know as *jiridon* (the science of the trees) and *daliluw* (recopies for healing), an idea I will return to at the end.

(Niger iron & copper sites) Metal technology begins very early in Niger, perhaps the 13th century BCE for copper and the 11th century BCE for iron. Hamady Bocoum suggests it could be as early as the mid-second millennium BCE (2004:100-101). (Overview Map) But our focus here is further west. We will start in Mauritania, where Akjoujt copper mines date between 800 and 200 BCE, and Dhar Tichitt iron working may date between 800 and 400 BCE. After a brief reference to the Ghana Empire, we will move to the Middle Senegal Valley, where iron appears between 800 and 550 BCE, copper between 550 and 200 BCE, and iron production becomes enormous in the first millennium CE. Then we go to Kumbi Saleh, Awdughast (now Tegdaoust), and Nioro, to consider copper in the first millennium CE, including what may have been currency. Finally we visit the Middle Niger, where iron is early in the towns of Dia (mid first millennium BCE) and Jenne-Jeno (250 BCE), copper appears in the mid-first millennium CE, iron production becomes

nearly industrial at that time in the Méma, and beautiful brass figurines are deposited in a tomb to the north in the Lakes Region.

(Akjoujt map & mt.) Near Akjoujt in western Mauritania, Lambert first excavated several copper mines at La Grotte aux Chauves Souris (the bat caves). Later five more mining and production sites were found (Deme and McIntosh 2006:343; Lambert 1972 and 1983). This copper ore is rich in arsenic, making it distinctive, and also in iron, making it plausible that experimentation with iron technology could have transpired. The dates for this copper production range between 800 and 200 BCE. (Lambert photograph) The objects produced were cast, and then hammered into axes, jewelry, and several kinds of points for tools and weapons. (Lambert drawings) Thousands of these objects have been found, (Deme/McI map & Boudhida copper) across western Mauritania, Senegal, and the Dhar Tichitt culture area (Deme and McIntosh 2006:341; Vernet 1993:331, 356).

(Tichitt – Néma) In the Dhar Tichitt culture area rather large scale iron production may date to between 800 and 400 BCE at several Dhar Néma sites (Deme and McIntosh 2006:344; MacDonald *et al.* 2003: 76-78; and 2009; Togola 1996), (Deme/McI & Munson insert) Deme, McIntosh, and Vernet, think pastoralists brought Akjoujt copper objects to Dhar Tichitt. Isn't it possible that other kinds of people—perhaps metal technologists—were also traveling between Akjoujt and Tichitt? After all, the history of West Africa features travel, exploration and entrepreneurship, and it would not be surprising if enterprising metal workers were visiting and learning from each other.

Dhar Tichitt culture is important because its original excavator Patrick Munson presented a good argument for considering it to be early Soninke people, who moved south in response to climate change and Lybico-Berber incursions, and built the Ghana/Wagadu Empire (Munson 1980: 464-66). Remember Soninke traditions say the founder of Wagadu was Dinga, a travelling hero who invented iron smelting, and with his followers garnered much territory (McIntosh 1998: 259; Monteil 1953:369; SCOA 1984:113, 117). When Wagadu declined, the short lived Soso state was ruled by smiths who may also have originally been Soninke. All this suggests that Dhar Tichitt and its iron-working tradition may have sparked much West African history, and the advent of iron was politically powerful.

The early Middle Senegal Valley site of Walaldé also got copper from Akjoujt (Deme and McIntosh 2006: 317-47). (Walaldé map & metal) Walaldé shows a modest amount of iron and perhaps small scale smelting between 800 and 550 BCE. Then, between 550 and 200 BCE smelting became a much larger operation. Twenty-four heavily corroded iron objects have been recovered, with most of the site still to be excavated. One iron bracelet and two copper earrings were found in a burial dating to between 550 and 200 BCE, and another copper earring and two beads were found in the area. The copper has Akjoujt's chemical signature. It had been cast, then hammered and annealed, though it is not clear where this work took place. But at Walaldé, as at Dhar Néma, iron working dates seem to overlap substantially with Akjoujt copper working, making metallurgical experimentation plausible.

(MSV iron smelting) By the first millennium CE the Middle Senegal Valley featured large-scale iron production and high-quality copper-alloy artistry. In 2006 Deme and McIntosh (320) said 155 iron age sites had been surveyed. Four years later Hatté *et al.* (2010: 562) noted more than 400 related to iron production. Rows of smelting furnaces once stood along the river. McIntosh and Bocoum (2000:6) report that in just one area, near Silla and Rinjaw, there are up to 60,000. Who knows how many more there were.

(MSV Takrur) Thus it is not surprising that oral traditions say a group of blacksmiths called Jaa-Ogo (or Dia-Ogo) introduced and monopolized iron production in this large area, while founding a powerful dynasty that became the state of Takrur. Scholars date the state's inception to as early as the 4th century CE. By the time the Arab author al-Bakri was writing in the 11th century, Takrur may have rivaled Ghana in power, and one of its kings, War Jabi, had converted both Takrur and the nearby city-state of Silla to Islam. A century later al-Idrisi said Takrur was involved in the gold trade, and at some point after that, in the 12th or 13th century, a Soninke dynasty seems to have taken power (Becker and Bocoum 1998: 152; Bocoum 1990; Levtzion 1973: 27, 184; Levtzion and Hopkins 2000: 77-78, 107; Garenne-Marot *et al.* 1994: 46,56; McIntosh and Bocoum 2000: 3,4; Hunwick 2011: Brill Online).

(Jaa-Ogo origins 1) Scholars suggest the Jaa-Ogo blacksmith dynasty came from Syria, or Egypt, or the Namandiru region south of Fouta Toro and the Senegal River (Bocoum 1990: 162-65). (Jaa-Ogo origins 2) George Brooks (1993: 62-64) says they were quite possibly a

Soninke group originating in the Hodh region of Mauritanea, between Kumbi Saleh and Dhar Tichitt. He says their name means "masters of iron."

(map MSV Sincu Bara) The Middle Senegal Valley site of Sincu Bara (Sintiou Bara) has been tentatively suggested as the capital of Silla by Thilmans and Ravisé (1980), who began excavating there in 1973. The site is very large (67 hectors), with over 100 circular or oval areas of gravel and potsherds that range from 10 to 50 meters across. In 1991-92 Hamady Bocoum carried out more excavations and found one large oval to be a multi-function living area of long duration. (McIntosh and Bocoum 2000: 38) Even though only a small portion of Sincu Bara has been excavated, it is clear that widespread iron smelting existed (Sincu Bara Slag) from the site's first occupation. Between 388 and 894 CE both small and large furnaces were at work. One furnace had 28 kilograms of slag (the minerals left over from smelting) in the bottom, but only a few identifiable iron objects have been found: rings, bracelets, blades, broken tangs (for mounting iron to wood), and a lance point (McIntosh and Bocoum 2000: 28-33).

(Sincu Bara horse trappings ?) In one of the large Sincu Bara ovals (called area 356) Thilmans and Ravisé found a stunning treasure of eight kilograms of copper-alloy artifacts. They included large and small embossed disks, ornate bells of various sizes, end-looped bars, a decorative head piece, and hundreds of tiny rings or cylinders (viroles), many of which were in a pot with a small ingot and fragments and droplets of

additional metal. The disks, bells and end-looped bars may have been ornate horse trappings.

It is not clear whether these copper-based objects were made at Sincu Bara or imported, but the techniques employed included casting, hot-metal hammering, annealing, riveting, soldering, and repoussé. Unlike the 13th-14th century gold and silver jewelry found at Rao to the west, no filigree work has been found at Sincu Bara. Many objects were bimetallic, such as iron disks with brass embellishment, or two end-looped brass bars joined by an iron rod. (Sincu Bara Bimetallic) One arched tubular iron piece was carefully fitted over with brass that was riveted in place. Garenne-Marot hypothesizes that such bimetallic work was created either to conserve valuable brass or add aesthetic character by color contrast, and notes in general that iron-brass combinations were well executed and sophisticated (Garenne-Marot *et al.* 1994; and Garenne-Marot 1996).

Four categories of copper were found at Sincu Bara: brass (which is copper and zinc), leaded brass, pure copper, and alloys of copper with zinc and silver, or with zinc and tin. This metal appears in relative abundance, around 800-900 CE. Its source is uncertain. The Akjoujt mines do not seem to have been active at this time. But the Sincu Bara brass is similar in its metallurgical makeup to what was being imported in large quantities from the north, (Map Ma'den Ijafên) such as that found at Ma'den Ijafên, where a wrecked trade caravan with 2085 brass ingots has been dated to circa 1030-1280 CE (Garenne-Marot *et al.* 1994:57-9). Garenne-Marot *et al.* argue that Sincu Bara brass composition did not

resemble the brass being worked at Audaghust/Tegdaoust, a nearby major trade center and site of highly sophisticated and extensive metal working, that was linked to and sometimes part of the Ghana Empire. They note (56) that al-Bakri said the city-state of Silla was competing with Ghana in the gold trade, and there were separate itineraries for northern merchants trading with Audaghust and those trading with Takrur and Silla. However, elsewhere Garenne-Marot (1996) says Audaghust maintained a special link with the Middle Senegal Valley, while McIntosh and Bocoum (2000: 36) argue that the chemical compositions of Sincu Bara and Tegdaoust metals are more similar to each other than to anywhere else in West or North Africa. This suggests complex trade relations.

(tiny copper cylinders Sincu Bara) The hundreds of tiny metal cylinders found at Sincu Bara are a mystery. Garenne-Marot (1995: 49) says they could have been strung on a cord, making one wonder if they were jewelry, or perhaps even currency.

(2-headed curved copper wires Kumbi Saleh) Copper currency seems to appear at two other important sites. Excavating at Kumbi Saleh in 1949-51, Mauny and Thomassey (1951, 1956) discovered huge numbers, everywhere they looked, of little copper wires 30-40mm long, slightly curved, flattened in the middle, with thick, rounded ends. While copper dates to the 9th century at Kumbi, these double-headed wires seem not to appear until the 11th century, although that could be wrong because most were not subjected to dating procedures. The wires continued to be used until the late 14th or early 15th century, like Kumbi Saleh itself, beyond the decline of the Ghana Empire. Mauny considered

these unique wires to be currency and so does Garenne-Marot (2009: 2-7). (Kumbi Saleh Iron) As an aside, many iron objects were also found by Thomassey and Mauny (1951, 1956), including big headed and flat headed nails, bracelets, chains, rings, hoes, sickles, knives, hammers, pincers, arrowheads, lances, and a lovely scissors.

(map Awdaghost/Tegdaoust) The tiny, two-headed copper wires were also found at Awdaghost, but thus far they have not been dated. Awdaghost/Tegdaoust was a major trade entrepôt and artisan center joined to Ghana/Wagadu. A separate part of town housed metal workshops, where ingot-molds, 16 copper-alloy ingots, and three large smelting furnaces were found. Evidence from 12 years of excavations by several archaeologists, combined with Arabic written sources, suggests that both copper and brass were imported from North Africa, and re-melted with lead and locally-smelted copper, perhaps from Akjoujt or Nioro Mali, to help reduce the cost of the North African metal or manipulate its color before sending it south in trade. Small metal workshops have also been found in Awdaghost living quarters, and in one a spectacular set of jewelry and five gold bars was unearthed. That jewelry included (cast ornate ring) two very ornate rings cast to resemble filigree (Garenne-Marot 1996: 529-30; Roberts 1970: 490) McDougall (1985: 11) makes an interesting point about the Awdaghost metal work, saying its style and technique relates to the sahel and savannah, not the desert. Its relationship to Kumbi Saleh, Dhar Tichitt, and the Senegal Valley requires more research.

During the 1st and 2nd millennia CE copper-based metals become an enormous part of the trans-Saharan trade. Eugenia Herbert (1984: 113) says its importance runs like a leitmotif through virtually all the written sources".

But some Sub-Saharan copper was mined as well. To the east in Niger it was mined at Takadda/Azelik in the 1300's (Levztion and Hopkins 2000:302). (Map of Nioro near Siracoro) To the west on the Mali-Mauritania border, nine copper sites at Nioro-Siracoro were worked in the past, and one, Boullé Kadié, shows extensive surface mining. The 14th century Arabic writer al-'Umari learned from Mansa Musa's retinue in Cairo that the Mali Emperor had a copper mine at a town called Zkra (or Dkra) from which ingots were brought to the Mali capital and then sold for two thirds their weight in gold. Mauny thought this royal mine was at Nioro, which Herbert says was the only copper source within the Mali Empire at that time. She says the name Dkra might actually be Diara, a town about 5 miles from Siracoro near Mauritania. She also suggests Diara is a derivative of three words (dyakule, dyakwalle, and dyakwale) that mean "copper" in Sarakolle and Azer (Herbert 1984:17-18; Levtzion and Hopkins 2000:272, 413).

(Dia, Akumbu, Boulel, Jenne-Jeno) Now we move to the Middle Niger, another major iron production zone. Bedaux, MacDonald, Person, Polet, Sanogo, Schmidt, and Sidibé (2001: 843) note that iron metallurgy was being practiced by the middle of the 1st millennium BCE at Dia, and from then forward the scale of production seems to have expanded tremendously. Iron working appears in Jenne-Jeno's earliest phases, 250 BCE,

but much iron ore was imported, or partially smelted and imported. Roderick McIntosh (2005:147-8) speculates it may have come from the Bénédougou region around San, while Dia or the Méma would also be possibilities. LeViolette (1987: 161, 173) notes that while many of the sites around Jenne have large accumulations of iron slag, iron ingots were still imported, up to the 20th century, made by Miniyanka smelters from around San and Koutiala.

Térêba Togola (1996: 92-107) says iron was smelted on a near-industrial scale in the Méma region north of the Niger. In just the western quadrant 15 iron-production sites have been found. The site of Boulel had at least 100 smelting furnaces and enormous amounts of slag. The large site of Akumbu also featured much smelting that dates between 548 and 1401 CE, along with strong evidence of long distance and trans-Saharan trade. Imported goods included cowrie shells and copper objects, which date to between the 8th and fourteenth centuries, although two copper bracelets were found in a burial between 342 and 442 CE (106-7). In the southern Méma Randi Haaland documented more industrial-scale iron production.

(map of Ghana, Mali) The Méma had power, perhaps fueled by its iron. Togola notes the major site of Akumbu is often linked to the rise of the Ghana Empire, and Méma was the most structured polity in the Mande world when ancient Wagadu fell. Sunjata is said to have travelled to its court via camel caravan, and lived there many years establishing himself as a great military leader. Ibn Battuta (1352-53) noted the importance of the "Mima road" trade route. Both Soninke and Maninka oral traditions emphasize the Méma's

importance to the political development of the Wagadu and Mali Empires. And Arab texts and local chronicles refer to numerous trade routes through the region (Togola 1996: 92.95-6).

Copper alloys were imported to the Middle Niger and copper alloy objects seem to have represented prestige, status, and possibly the powers of esoteric knowledge and sorcery. McIntosh (2005:147, 157) notes copper's appearance at Jenne-Jeno in the 5th century CE, imported from the north. (map Lakes District Middle Niger) In the Lakes Region north of the Méma, Desplagnes excavated two famous tumuli at Koï Gourrey (Killi) and El Oualadji, in 1901 and 1904, when archaeology was like treasure hunting.

Desplagnes dug a trench across the Killi mound, and at the center found 20 to 25 entangled bodies together with numerous copper alloy objects, especially bracelets, anklets, and beads. (Killi croc. Lizard, bird) But there were also three beautiful little figurines: a crocodile, lizard, and long-beaked bird, each about 4 inches long (or tall).

The excavation produced no dates, but area oral traditions place the burial before 1326 CE. (Garenne-Marot and Mille 2007: 160). The bird and crocodile have a high zinc content (31% and 27%, respectively, by weight) (163), which aligns in general with the high zinc content of brass imported from the north (for example, the Ma'den Ijafên caravan brass had a zinc content of 20% by weight). Garenne-Marot and Mille examined the literature on 184 Islamic brass ornaments dating from the 11th to the 14th centuries CE, and found they too

had a high zinc content, but had been made by hammering hot brass, whereas the Killi pieces were cast in a mold, no doubt south of the Sahara. (165)

(El Ouladji drawings) The better-excavated El Ouladji tumulus contained its own lovely copper-alloy objects. An inner chamber held two bodies, one with iron objects and the other with copper ornaments—bracelets, rings, and beads. The mound's exterior surface was pitted with ash-filled depressions, and the largest one contained burned horse bones and what appear to be such ornamental trappings as bells, plaques, and harness parts. Two disk-shaped ornaments were particularly elaborate. (160) A date of 1030-1220 CE was acquired from a 1984 carbon sample. Garenne-Marot and Mille liken the site to the 11th century al-Bakri description of a Ghana emperor's tumulus burial.

Garenne-Marot and Mille also wonder (168) why copper was so highly valued, as Arabic sources indicate. They suggest protective qualities while noting the possible ritual character of the three animal figurines. (Garenne-Marot, Robion, and Mille, 2003). Kassim Kone (2011) notes that in the Mande world iron (*nègè fin*) is more generally used for tools of material need, while copper (*nsira*) is more generally used for ornaments and amulets. (Lobi & Senufo Divination pieces and Amulets) The use of copper alloy objects in divination and as amulets is widespread in West Africa, and includes such people as Dogon, Bobo, Bwa, Gurunsi, Lobi, Mossi, Nuna, Nunuma, Winiama, Senufo, and Frafra. We also know that one of Samori's smiths (a Kante clan member named Syagha-Bori) made a set of copper alloy divination pieces for his leader, who used soothsaying as part

of his military strategy (Herbert 1984: 262; Person 1967). Could the little Lakes Region figurines also have served this purpose?

In 1975 I was lucky enough to view the Mande holdings of the Royal Museum for Central Africa in Tervuren, where I encountered a very small and quite exquisite copper alloy pendant shaped just like a miniature Kòmò horn (buru). No date was given in the museum documentation, and its actual origins were unknown (simply listed as diggings from the Jenne-Mopti region). This of course is a far too common story, but the fact is there may have been many miniature copper alloy objects like this horn and the little animals form the Lakes Region. Could these be early versions of what we now consider amuletic and divinatory figures? If archaeologists had found the little horn, think what we might learn about the antiquity and distribution of power association like Kòmò, and about the ancient relationships between political and spiritual power. Clearly an enormous hole in our literature lurks here, and there has got to be a way to try and fill it.

(the summary slide) To summarize the materials presented here, according to the archaeological record as we presently understand it, copper and iron technologies may have begun at roughly the same time, but then took divergent courses. Iron was widely plentiful and its smelting and production into tools and weapons reached industrial proportions in several areas by the first millennium CE. It was an instrumental part of complex commerce networks across the Sahel and Savannah, and both archaeology and oral traditions suggest strong links to political power. Had our focus here been different we would have seen strong links to the powers of medicine and sorcery as well. Copper became scarce, and by the 1st millennium CE was a major import item from the north, often in the form of brass. Its sub-Saharan artisans re-melted it, sometimes changing its

chemical composition, and shaped it into an array of precious and perhaps spiritually powerful artifacts. There is obviously much more to know, such as the details of copper smiths and blacksmiths interrelationships. We know experimentation was involved in these technologies' development, but how did it begin?

The debate about beginnings has percolated through the archaeological, historical, and metallurgy literature for decades. Egypt, the Arabian Peninsula, North Africa, and even Spain have all been candidates for the source of Sub-Saharan metal technology, as has independent invention (Stanley 2005 is the most detailed presentation of all the data). As new information comes out interpretations understandably shift, and it is not clear there will ever be a definitive explanation. But the pattern of dates and sites that we now have suggests a most interesting possibility for how the early days unfolded. At least among Mande learning metalwork involves lengthy apprenticeship and, according to oral tradition, it has been steeped in monopoly-producing endogamy for far more than a thousand years. Learning from masters is also how Mande people have acquired knowledge of the science of the trees (*jiridon*), and the recipes (*daliluw*) for healing, fixing things, and taking sorcery-charged action in the world. Garnering this knowledge has long involved travel to learn from the masters that have the recipes one wants. And seekers are quite willing to journey great distances, as far as their funds and dedication will take them. I wonder if this kind of entrepreneurial travel in quest of useful knowledge might have occurred between Dhar Tichitt, Akjoujt, and the Middle Senegal, for example, and been an instrumental element of metal technology's early development in western West Africa.

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